

**Improving the Exercise Behaviour of Pregnant Women in Thailand:
A Mixed Methods Feasibility Study**



Sirikanok Klankhajhon

A thesis submitted in partial fulfilment of the requirement of the degree of Doctor of
Philosophy to School of Health Sciences, University of East Anglia

September 2018

This copy of the thesis has been supplied on condition that anyone who consults it is understood to recognise that its copyright rests with the author and that use of any information derived there from must be in accordance with current UK Copyright Law.

In addition, any quotation or extract must include full attribution.

Table of contents

Contents	Page
ABSTRACT	1
ACKNOWLEDGEMENTS	2
CHAPTER 1 - INTRODUCTION	3
1.1 General overview of the thesis	3
1.2 Background information	6
1.2.1 General information about Thailand	6
1.2.2 General information about Nakhon Sawan province, Thailand	9
1.2.3 General information about the Health Promoting Hospital, 3 rd Regional Health Centre, Nakhon Sawan, Thailand	10
1.3 Western influences on health in Thailand	13
1.4 Structure of the thesis	14
CHAPTER 2 - LITERATURE REVIEW	16
2.1 The scoping review process	16
2.2 Obesity and overweight	19
2.2.1 Incidence and prevalence of obesity and overweight	21
2.2.2 Causes of obesity and overweight	24
2.2.3 Consequences of obesity and overweight	25
2.3 Exercise	27
2.3.1 Definition of exercise	27
2.3.2 Benefits of exercise during pregnancy	28
2.3.2.1 Physical aspect	28
2.3.2.2 Psychological aspect	35
2.3.2.3 Social aspect	35
2.3.2.4 Life course of offspring outcomes	36
2.3.3 Recommendation for exercise during pregnancy	38
2.3.3.1 Intensity of exercise during pregnancy	39
2.3.3.2 Contraindication for exercise during pregnancy	40

Table of contents (continued)

Contents	Page
2.3.3.3 Types of exercise during pregnancy	40
2.3.4 Exercise behaviour of pregnant women	42
2.4 Exercise in pregnancy in Thailand	44
CHAPTER 3 - REVIEW OF BARRIERS AND FACILITATORS TO EXERCISE IN PREGNANCY	48
3.1 Review questions	49
3.2 A literature search	49
3.3 Study selection and quality assessment of studies	52
3.4 Data extraction and analysis	52
3.5 Findings	53
3.5.1 Barriers to exercise during pregnancy	61
3.5.2 Facilitators to exercise during pregnancy	68
3.6 Summary and report of the findings	73
3.7 Justification for conducting this study	74
CHAPTER 4 - METHODOLOGY AND METHODS	76
4.1 Part 1: Methodology	77
4.1.1 Research philosophy	77
4.1.2 Rationale for the use of mixed methods	79
4.2 Part 2: Methods	80
4.2.1 Population and sample	81
4.2.2 Phase 1: Workshops	82
4.2.2.1 Collaboration between healthcare professionals (HCPs) and clients	82
4.2.2.2 Sample and recruitment for the workshops	84
4.2.2.3 Process of the workshops	86
4.2.2.4 Data collection and analysis of the workshops	89
4.2.3 Phase 2: Feasibility study	90
4.2.3.1 Exercise intervention	93

Table of contents (continued)

Contents	Page
4.2.3.1.1 Sample and recruitment for the exercise intervention	97
4.2.3.1.2 Data collection and analysis of the exercise intervention	98
4.2.3.1.3 Statistical analyses	101
4.2.3.2 Qualitative component	102
4.2.3.2.1 Sample and recruitment for the qualitative component	103
4.2.3.2.2 Data collection of the qualitative component	106
4.2.3.2.3 Data analysis of the qualitative component	107
4.2.4 Data analysis in the mixed methods design	109
4.2.5 Setting	111
4.2.6 Language translation	111
4.2.7 Study rigour	113
4.2.8 Ethical approval process	119
CHAPTER 5 - FINDINGS FROM THE WORKSHOPS	122
5.1 Background of the workshops	122
5.2 Process of the workshops	124
5.3 Findings from the workshops	125
5.3.1 Integration of the exercise programme	125
5.3.2 Techniques for motivating exercise	129
5.3.3 Group exercise network	133
5.3.4 Follow-up to continue exercise	135
5.4 Brief summary: protocol of exercise programme for pregnant Thai women	136
5.5 Reflexivity from the workshops	137

Table of contents (continued)

Contents	Page
CHAPTER 6 - RESULTS OF THE FEASIBILITY STUDY	140
6.1 Exercise intervention	140
6.1.1 Recruitment process	141
6.1.2 Demographic characteristics of the sample	144
6.1.3 Preliminary effects of the exercise intervention	146
6.1.4 Feasibility and acceptability of the exercise intervention	156
6.2 Qualitative component	160
6.2.1 Results of interviews with pregnant women	160
6.2.2 Results of focus group with healthcare professionals (HCPs)	181
CHAPTER 7 - DISCUSSION	193
7.1 Feasibility for conducting a larger trial with the exercise programme	193
7.2 Acceptability of the exercise programme	196
7.3 Trending of the exercise in pregnancy in Thailand as a ‘modern mum’	205
7.4 Workshops for designing the exercise programme	213
7.5 Reflexivity of the researcher	218
7.6 Strengths and limitations of the study	221
CHAPTER 8 - CONCLUSION	224
8.1 Contribution to knowledge	226
8.2 Recommendations for future research	228
8.3 Recommendations for healthcare policy	229
8.4 Recommendations for practice	229
8.5 Recommendations for education	231
8.6 Dissemination	233
REFERENCES	234

Table of contents (continued)

Contents	Page
APPENDIX	271
APPENDIX A: The flowchart of the study	271
APPENDIX B: The prescription of exercise during pregnancy	273
APPENDIX C: The project information for the physiotherapist	275
APPENDIX D: Prompt sheet for reception nurse	276
APPENDIX E: The Screening question for recruitment pregnant women in the workshops	277
APPENDIX F: Prompt sheet for secretary of the human resource meeting	279
APPENDIX G: The Screening question for recruitment healthcare professionals in the workshops	280
APPENDIX H: Protocol for recording and reporting adverse events	281
APPENDIX I: The Screening question for recruitment pregnant women in the intervention	283
APPENDIX J: The baseline data questionnaire	285
APPENDIX K: The outcomes questionnaire (1 st Follow up)	288
APPENDIX L: The outcomes questionnaire (2 nd Follow up)	291
APPENDIX M: Self-assessment and analysis of stress from mother and child health handbook, Thailand	292
APPENDIX N: The exercise checklist/ The exercise diary	293
APPENDIX O: The process of accessing medical records	296
APPENDIX P: The Screening question for recruitment pregnant women in telephone interviews	297
APPENDIX Q: Question guide for pregnant women: telephone interviews	298
APPENDIX R: Question guide for healthcare professionals: focus group	300
APPENDIX S: Participant information sheet	302
APPENDIX T: Consent form	319
APPENDIX U: Posters and leaflets for advertisement	323
APPENDIX V: The permission letters for the study	326
APPENDIX W: Protocol of exercise programme for pregnant Thai women	335

Table of contents (continued)

Contents	Page
APPENDIX X: Poster and leaflet for the exercise intervention	337
APPENDIX Y: The schedule of the exercise programme	339
APPENDIX Z: Baseline characteristics of the excluded participants in the study	340
APPENDIX AA: CONSORT 2010 checklist of information to include when reporting a pilot or feasibility trial	341
APPENDIX AB: The checklist of quality assessment of studies	344

Lists of Figures

Contents	Page
Figure 1.1: Birth rate of Thailand	7
Figure 1.2: Map of Thailand and Nakhon Sawan province	10
Figure 2.1: Mapping of the scoping review	17
Figure 2.2: Maternal mortality by cause 2012-2014	23
Figure 3.1: The review of barriers and facilitators to exercise during pregnancy	51
Figure 4.1: Multiphase study design	81
Figure 4.2: Process of developing an exercise programme	87
Figure 4.3: Design of the feasibility study	91
Figure 4.4: The timeline of the feasibility study	91
Figure 4.5: Process of the feasibility RCT study	94
Figure 4.6: Reporting usual care and the exercise intervention	96
Figure 4.7: Process of thematic analysis	108
Figure 4.8: Process of data analysis in the multiphase mixed methods design	111
Figure 4.9: The language translation process	113
Figure 6.1: Flow diagram of the feasibility RCT study	143
Figure 6.2: The timeline for recording pulse rate of the participants	154
Figure 6.3: The number of women in each exercise class	157

Lists of Tables

Contents	Page
Table 2.1: BMI classification between international and Asian criteria	21
Table 2.2: Recommendation range of weight gain during pregnancy	30
Table 3.1: Descriptive study characteristics from 21 studies	54
Table 3.2: Barriers to exercise during pregnancy from 21 studies	65
Table 3.3: Facilitators to exercise during pregnancy from 18 studies	71
Table 4.1: Purposive sampling frame for HCPs in the workshops	86
Table 4.2: Outcomes measures for the feasibility study	92
Table 4.3: Details of instruments for the exercise intervention	100
Table 4.4: Purposive sampling frame for pregnant women in the qualitative component	104
Table 4.5: Summary of recruitment and consent process for the whole study	105
Table 5.1: Demographic characteristics of the participants in the workshops	123
Table 6.1: Demographic characteristics at 16-18 weeks of gestation	145
Table 6.2: Total gestational weight gain in the control and intervention groups	149
Table 6.3: Baby birth weight in the control and intervention groups	149
Table 6.4: Total physical activity in the control and intervention groups	151
Table 6.5: Pregnancy outcomes: blood pressure and stress score	153
Table 6.6: Pulse rate of participants in the intervention group	155
Table 6.7: Demographic characteristics of pregnant women in the interviews	161
Table 6.8: Themes and sub-themes from interviews with pregnant women	162
Table 6.9: Demographic characteristics of HCPs in the focus group	182
Table 6.10: Themes and sub-themes from focus group with HCPs	183

Lists of Abbreviations

Abbreviation	Stands for
ACOG	The American College of Obstetricians and Gynecologists
ACSM	The American College of Sports Medicine
AE	Adverse event
ANC	Antenatal care
BMI	Body Mass Index
CDC	The Centers for Disease Control and Prevention
CIA	The Central Intelligence Agency
DPA	The Data Protection Act
DoH	Department of Health
EDD	Expected Date of Delivery
G	Gravida is the number of pregnancy
GA	Gestational age
GDM	Gestational diabetes mellitus
GHO	The Global Health Observatory
GPAQ	The Global Physical Activity Questionnaire
HCP	Healthcare professional
HRA	The Health Research Authority
IOM	The Institute of Medicine
L	Living children
MoPH	The Ministry of Public Health
NCD	Non-communicable disease
NHDPC	The National Health Development Plan Committee
NIDA	The National Institute of Development Administration
NFE	The Non-formal and Informal Education
NSAE	Non-serious adverse event
NSO	The National Statistical Office
O&O	Obesity and Overweight
P	Para or parity is the number of births of viable offspring
PA	Physical activity
PIH	Pregnancy-induced hypertension

Lists of Abbreviations (continued)

Abbreviation	Stands for
QoL	Quality of life
RCOG	The Royal College of Obstetricians and Gynaecologists
RCT	Randomised Controlled Trial
SAE	Serious adverse event
UEA	University of East Anglia
UK	United Kingdom
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USDHHS	The United States Department of Health and Human Services
WHO	The World Health Organization
WPRO	Western Pacific Region

ABSTRACT

Obesity and overweight (O&O) is a serious global health problem. The prevalence of O&O worldwide is an increasing cause of non-communicable diseases (NCDs). Exercise during pregnancy can increase physical fitness, decrease risk of cardiovascular diseases and control gestational weight gain (GWG). Currently, antenatal care clinics in Thailand do not have routine exercise programmes for pregnant women. The objectives are to determine the acceptability of an exercise programme based on Thai Government guidance for exercise in pregnancy, to assess preliminary effects and explore the experiences of participants engaged in an exercise programme and their healthcare professionals' (HCPs) opinions of the programme.

A total of 61 women between 12-16 weeks gestation participated in the mixed methods feasibility randomised controlled trial (RCT). They were randomly allocated to the exercise intervention (n = 31) or control group (n = 30) over 10 weeks. Baseline measures were collected before intervention and preliminary effects data after completion of intervention and two weeks after expected date of delivery. Ten women were interviewed and four HCPs attended a focus group at two weeks after the intervention's completion.

Analysis of Covariance (ANCOVA) showed the exercise group had lower GWG than control group after controlling for maternal age, pre-pregnancy body mass index (BMI), gestational age, and baby birth weight ($p < .001$). The study indicated significant increases over time in physical activity after controlling for maternal age, and pre-pregnancy BMI ($p < .001$). Thematic analysis of the qualitative interviews, identified four themes: exercise is easier than I think, I want to become a modern mum, doubts and concerns at the beginning, and I get active and keep up with exercise until childbirth. The exercise programme was acceptable to women. The study demonstrated feasibility of conducting a larger RCT with an intervention to improve exercise behaviour in pregnant women.

ACKNOWLEDGEMENTS

PhD is a long journey and a huge part of my life. I have learned a lot and really gained valuable experiences and knowledge while learning throughout this study. This thesis has become a success with precious supports from all of significant people during my PhD journey. I am highly indebted to Naresuan University, Phitsanulok, Thailand for providing opportunity and financial support in PhD study at University of East Anglia (UEA), Norwich, United Kingdom (UK). I would like to express my grateful thanks to School of Health Sciences, Faculty of Medicine and Health Sciences, UEA, for providing necessary information and facilities during the study. It is my great pleasure to express my sincere gratitude and appreciation to my primary supervisors: Professor Dr.Kenda Crozier for her expertise, encouragement, and guidance throughout the process of PhD study in the UK. I also would like to acknowledge my deepest thanks and gratitude to Professor Francine Cheater and Dr.Jan McAllister for their kind support and useful advice. I would like to express my special thanks to Professor Rosalynd Jowett, Head of School, School of Health Sciences, Faculty of Medicine and Health Sciences, UEA for giving me the chance to continue PhD study.

I would like to express my deepest gratitude and sincere appreciation to Associate Professor Dr.Poonsuk Hingkanont for her support and encouragement in both PhD study in the UK and fieldwork in Thailand. I also would like to express my special thanks to Assistant Professor Dr.Kanokwan Srisupornkornkool (physiotherapist) for kind support as a consultant in this research. I am really thankful to my Dean and all my colleagues at the Faculty of Nursing, Naresuan University, and the Director and all staff at the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan for their insightful advice and kind support. I am grateful to Dr.Janet Ramjeet, Dr.Choosak Yuennan and his wife for their kind support and helpful suggestions.Last of all, I am highly indebted to my parents, family members, and my friends especially my husband for all their kind support during the study in the UK.

CHAPTER 1

INTRODUCTION

This chapter provides an outline of the thesis, an overview of Thai society, the setting for the study, and structure of the thesis including an outline of the chapters. This thesis focuses on an exercise intervention to improve exercise behaviour in pregnancy as an approach to improve health outcomes of pregnant women. Exercise during pregnancy can assist in controlling gestational weight gain and reduce risk of complications during pregnancy. This study aimed to determine how an exercise programme can effectively be incorporated into the antenatal care of pregnant women in one healthcare service setting in Thailand. Evidence from this research could provide direction for future research, nursing education and healthcare practice in healthcare in Thailand.

1.1 General overview of the thesis

Before I became a full time PhD student at the Health Science School, Faculty of Health Science, University of East Anglia. I worked as a nurse and midwife at the maternal and newborn department at Maewong Hospital (District Hospital), Nakhon Sawan, Thailand for eight years from 2001 until 2009. I worked in the antenatal care clinic, labour room, and postpartum care. Then, I moved to Phitsanulok province. I was a nursing instructor in maternal and newborn nursing at the Faculty of Nursing, Naresuan University, Phitsanulok, Thailand for five years from 2009 until 2014. The Faculty of Nursing works in partnership with the Thai Ministry of Public Health (MoPH), several hospitals and healthcare centres across the lower North region of Thailand. Although I was employed as a nursing instructor, I continued to work within practice areas of maternal and newborn nursing, supervising nursing students at the antenatal clinic, labour room, and postpartum ward including the

primary healthcare centre. My professional experience made me aware of health promotion in pregnant women, which is associated with health outcomes of the next generation.

Obesity and overweight (O&O) is a serious global health problem. The Global Health Observatory (GHO) report indicated that the prevalence of global O&O is increasing continuously (World Health Organization (WHO), 2015) including in Thailand (Aekplakorn & Mo-Suwan, 2009, Ministry of Public Health (MoPH), Thailand, 2010). Obesity has direct and indirect impacts on physical and mental health, particularly in terms of high to extremely high risk of non-communicable diseases (NCDs) depending on level of obesity (Davies et al, 2010; Mahmood & Arulkumaran, 2013; Özdemir, 2015). NCDs are also known for leading to chronic illness composed of four main types: cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes mellitus (WHO, 2015). In pregnant women, obesity and overweight may impact on maternal health and offspring outcomes, including both medical and obstetrical complications. Moreover, being obese is associated with next generation obesity (Poobalan et al, 2009; Keeley, Gunning & Denison, 2011; Centers for Disease Control and Prevention (CDC), 2012; Marchi et al, 2015), thereby compounding this public health issue for future generations.

The evidence strongly supports the benefits of regular exercise during pregnancy, which increases physical fitness. Several studies show that exercise is associated with a decrease in the risk of NCDs and obstetrical complications, control of gestational weight gain, reduction in antenatal depression symptoms, reduced rates of macrosomia (a birth weight more than 4,000 grams) and reduced risk of the overweight offspring (Prather, Spitznagle & Hunt, 2012; Siebel, Carey & Kingwell, 2012; Millard et al, 2013; Makinde, Adeyemo & Ogundele, 2014; Seneviratne et al, 2014). Generally, guidelines recommend that low risk pregnant women without any contraindications should conduct moderate exercise of at least 30 minutes of accumulated exercise a day for at least 3 days a week (American

College of Sports Medicine (ACSM), 2014; American College of Obstetricians and Gynecologists (ACOG), 2015). In Thailand, the policy promotes exercise during pregnancy for all antenatal care units (National Economic and Social Development Board, Thailand, 2011; National Health Development Plan Committee (NHDPC), Thailand, 2011; Department of Health, Thailand, 2014). International and national organisations recommended performing regular exercise during pregnancy. The levels of exercise behaviour during pregnancy have declined worldwide from 1986 to 2009 (Gaston & Cramp, 2011), and are generally lower than in the pre-pregnancy period worldwide, including in Thailand (Utsahawararat, 1999; Gaston & Cramp, 2011; Currie et al, 2013).

Antenatal care clinics (ANC) in Thailand do not have routine exercise programmes for pregnant women (MoPH, Thailand, 2012). Generally, prenatal education classes are led by one nurse who teaches a range of subjects during pregnancy including exercise (3rd Regional Health Centre, Thailand, 2011). Research studies indicate that pregnant women may receive insufficient information and that current practice may be ineffective for motivating their intention to engage in exercise during pregnancy for numerous reasons (Bauer, Broman & Pivarnik, 2010; Jones, Housman & McAleese, 2010; Krans & Chang, 2012; Melton et al, 2013). These reasons challenged me to consider how best to incorporate this knowledge into the practice setting.

The overall aim of the study was to determine the preliminary effects, feasibility and acceptability of an exercise programme based on the Thai Government guidance for exercise in pregnancy in a feasibility randomised controlled trial (RCT). The objectives of the study were to:

1. Design an exercise programme for pregnant Thai women in collaboration with pregnant women and HCPs;

2. Determine the feasibility of the RCT as well as the feasibility and acceptability of the exercise programme while assessing the programme's preliminary effects; and
3. Explore the experiences of participants engaged in the exercise programme during pregnancy and their healthcare professionals' opinions of the exercise programme.

1.2 Background information

The background information is divided into sections relating to three levels of the setting: general information about Thailand; Nakhon Sawan province, Thailand; and the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand.

1.2.1 General information about Thailand

General information about Thailand is explained in terms of the geography, population, socio-economics, and education of Thailand.

- **Geographical information**

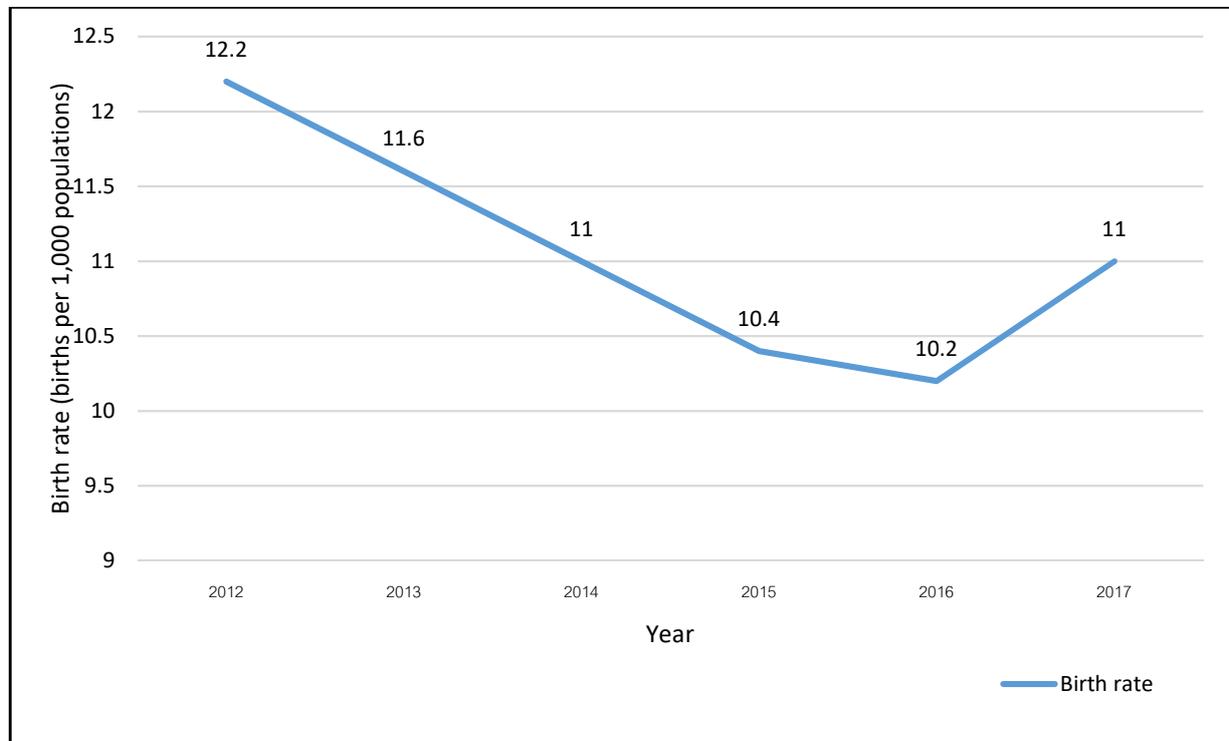
Thailand is located in South-East Asia. It shares a border with the Union of Myanmar, Lao People's Democratic Republic, Kingdom of Cambodia and Malaysia from the North to South. Thailand covers an area of 513,119 km², and is subdivided into 77 provinces and six regions: Central, Eastern, Western, Northern, North-eastern, and Southern regions (National Statistical Office (NSO), Thailand, 2011).

- **Population**

Thailand's population is approximately 63.9 million, including 75% Thai, 14% Chinese, 3% Malaysian, and various minorities of hill tribes. Buddhism is an official religion, followed by 93% of the total population, 5.4% of the population are Muslim and 0.9% are Catholic (NSO, Thailand, 2011; World Bank, 2014). The birth rate of Thailand between 2012 and 2017 is shown in Figure 1.1. The birth rate slightly decreased from 12.2 to 10.2 births per 1,000 populations during between 2012 and 2016. The birth rate in 2017 slightly increased

from 2016 approximately 11 births per 1,000 populations (The Strategy and Planning Division, Ministry of Public Health (MoPH), Thailand, 2016; 2017).

Figure 1.1: Birth rate of Thailand



(The Strategy and Planning Division, Ministry of Public Health (MoPH), 2016; 2017)

- **Socio-economics and culture**

Thailand, as a new economy, is classified as a lower middle income developing country (World Bank, 2014). Most of the population work in the agricultural sector. Thailand is the world's top rice exporter accounting for 36% of the global market. The average monthly income per household rose from 17,787 to 21,157 Baht (approximately from 400 GBP to 480 GBP) between 2006 and 2015 (NSO, Thailand, 2011; 2012; 2016). The Thai culture is unique as it is associated with Thai traditional culture and religions.

Many communities in Thailand are traditionally made up of extended families that comprise husband, wife, their parents, grandparents, or sibling and their children in both urban and rural areas. Recently, the size of family has been changed from extended to nuclear

family due to social and economic changes such as urbanisation. A nuclear family includes husband, wife and their children (The National Institute of Development Administration (NIDA), Thailand, 2010; NSO, Thailand, 2011). Although, the family size in Thailand has been dramatically changed, most Thai families have close relationships with one another, especially when family members have significant life events such as pregnancy and birth, changing job or sickness (Jones, 2003; NIDA, Thailand, 2010; Powell, Amsbary & Hickson, 2014). Thai culture places significant emphasis on respect for the family, especially elders in the family such as grandparents and parents (Punyapiroje & Morrison, 2007; NIDA, Thailand, 2010; NSO, Thailand, 2011; Pimpa, 2012; Powell, Amsbary & Hickson, 2014). The traditional beliefs of family members influence health behaviour of women during pregnancy and after birth (Liamputtong et al, 2005; Chinnawong, 2007; Dornan et al, 2015).

Liamputtong, et al (2005) studied the traditional beliefs and practice of women about pregnancy and childbirth in the Northern part of Thailand. Women explained their behaviour during pregnancy and childbirth is based on their traditional beliefs and that of family members. For example, women had traditional belief that pregnant women should keep working during pregnancy for easy childbirth. When pregnant women keep their routine of working, they have energy to push their babies out during the delivery. However, pregnant women avoid rigorous activities or too much heavy work during pregnancy because they fear danger to the baby. For some women, heavy work is unavoidable, particularly on the farm due to low family income (Liamputtong et al, 2005). Dornan, et al (2015) found the Thai culture with family and elders also influences breastfeeding behaviour of women in Northern Thailand (Dornan et al, 2015).

- **Education**

The Thai government provides 12 years of education for all citizens. Compulsory education in Thailand takes six years to complete to primary school level. The school system provided by the government includes kindergarten, primary, lower secondary, upper secondary school and vocational colleges. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (2013), the global adult literacy rate, evaluated for the population aged 15 years and older, increased from 76% to 86% between 1995 and 2015, whereas 12% of adults who live in South and West Asia are illiterate (UNESCO, 2013). In Thailand, the rate of adult literacy was 96.7%, with the same proportions of males and females (NSO, Thailand, 2011; 2012; 2016; CIA, 2015).

1.2.2 General information about Nakhon Sawan Province, Thailand

Nakhon Sawan is in the lower North region of Thailand. The map of Thailand and Nakhon Sawan province is shown in Figure 1.2 (Source: <http://www.mapofthailand.org/>). Nakhon Sawan province is 239 kilometres from Bangkok and covers an area of 9,598 km². It is subdivided into 15 districts, 130 sub-districts and 1,377 villages. The total population is 1.1 million, 80% of whom live in rural areas. Of the total population, 67% work in the agricultural sector and 65% were educated only to primary school level (Nakhon Sawan provincial statistical office, Thailand, 2014; 2017).

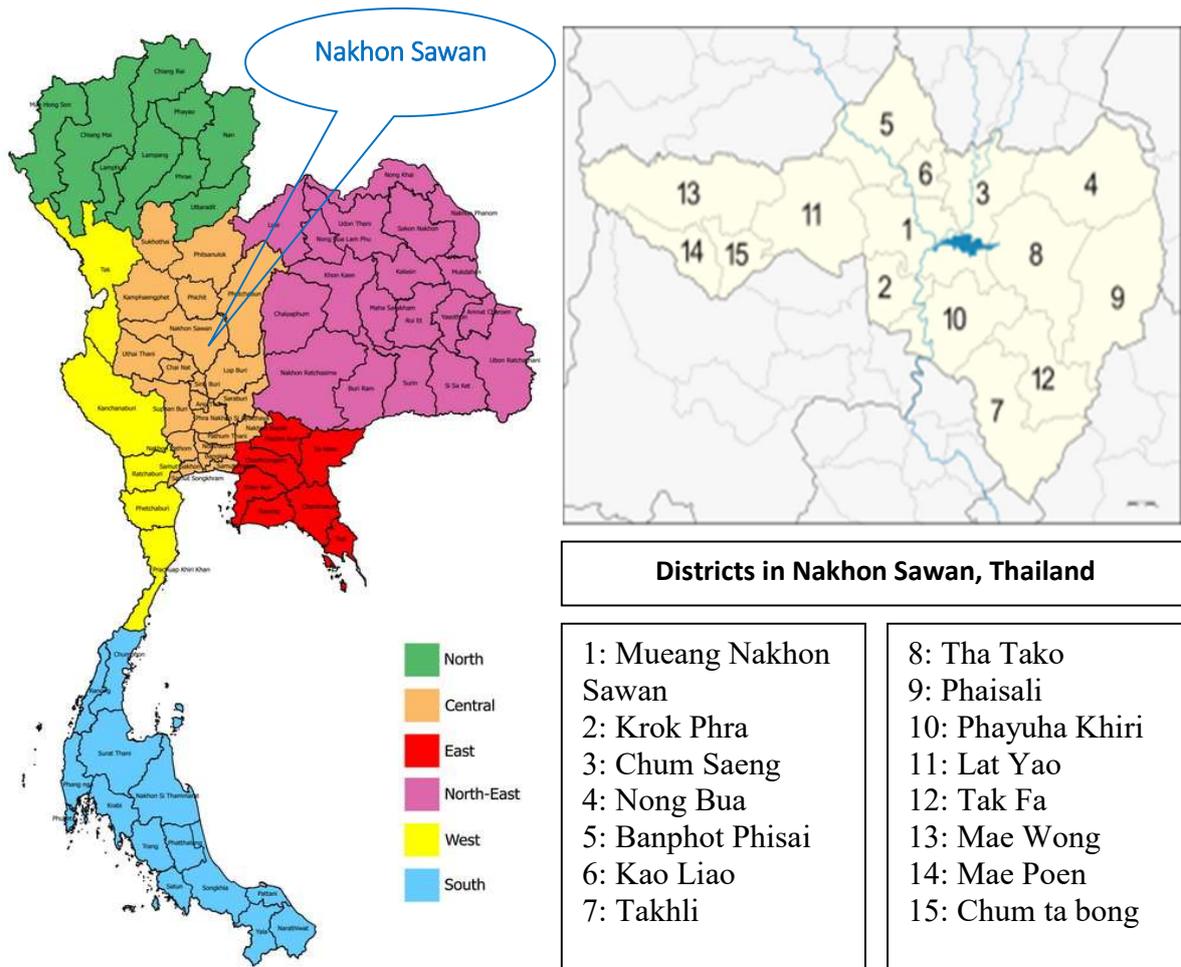


Figure 1.2: Map of Thailand and Nakhon Sawan province

1.2.3 General information about the Health Promoting Hospital,

3rd Regional Health Centre, Nakhon Sawan, Thailand

The 3rd Regional Health Centre, Nakhon Sawan, Thailand is located in an urban area: Mueang Nakhon Sawan district, Nakhon Sawan province. This Regional Health Centre covers five provinces in the lower North and upper Central region of Thailand: Pichit, Uthaitхани, Kamphaeng Phet, Chainat, and Nakhon Sawan. The Health Promoting Hospital is a sub-service of the 3rd Regional Health Centre which integrates research into routine work (R2R) for the purpose of developing the healthcare system and driving the learning organisation (3rd Regional Health Centre, Thailand, 2011; MoPH, Thailand, 2012).

The hospital serves the whole population of the area, providing a healthcare service and acting as a health learning centre for research, teaching, and clinical services for healthcare clients and professionals, including building a supportive environment and linking the community to the health system. The hospital provides a full range of health promoting services such as family planning, maternity services, children services, a check-up centre, occupational health, dental care and applied Thai traditional medicine (3rd Regional Health Centre, Thailand, 2011).

The antenatal care clinic is a part of the hospital service that offers antenatal care Monday to Friday, 8.00 am. - 4.00 pm. The clinic is staffed by eight nurses/midwives, two medical doctors, one obstetrics/gynaecology specialist, one healthcare educator, four public health workers, and twelve healthcare community volunteers (3rd Regional Health Centre, Thailand, 2016). Approximately 50 women attend this ANC daily and 200 newly pregnant women attend this ANC monthly (3rd Regional Health Centre, Thailand, 2011). Approximately 10 % of all pregnant women during 2014 and 2015 were classified as having a high risk pregnancy, such as hypertensive disorders during pregnancy and cardiovascular disease (3rd Regional Health Centre, Thailand, 2015). High risk pregnant women should have antenatal appointments every two weeks throughout pregnancy. All low risk pregnant women should have at least five antenatal care visits: an initial booking appointment before 12 weeks of gestation; then at the following points of pregnancy 20, 26, 32, and 38 weeks of gestation until childbirth which normally occurs between 40 and 41 weeks of gestation.

In the first ANC visit at \leq 12 weeks of gestation, which takes about three hours, women are given a general physical examination by nurses/midwives. Their weight, height and blood pressure are checked, and a urine sample is requested and checked for protein, sugar, and asymptomatic bacteria by multiple dipstick. Then they are offered a range of blood tests for haemoglobin (Hb), Haematocrit (Hct), Osmotic Fragility (OF) and

Dichlorophenol Indophenol Precipitation (DCIP) for Thalassaemia screening test, Venereal Disease Research Laboratory test (VDRL) for syphilis, HIV test, blood group, Rh typing, and Hepatitis B surface antigen (HbsAg). Doctors check lung, heart sound, pelvic examination, and ultrasound scan for expected date of delivery and multiple pregnancies, nurses/midwives give the first dose of tetanus toxoid vaccine, vitamin supplements (folic, iron, and iodine), advise and provide contact numbers in case of emergency with abnormalities.

In the second visit at 20 weeks of gestation, which takes about two hours, doctors do an ultrasound scan to check the physical fetal development for possible abnormalities and placenta position. Nurses/midwives give the second dose of tetanus toxoid vaccine (at least one month after the first dose of vaccine) and vitamin supplements (calcium, iron, and iodine).

In the third visit at 26 weeks of gestation, which takes an hour, pregnant women are examined for anaemia, oedema and given vitamin supplements (calcium, iron, and iodine) by nurses/midwives. At the fourth visit at 32 weeks of gestation, which takes about two hours, women take blood tests for Hb/Hct, VDRL, HIV test and then they are provided with vitamin supplements (calcium, iron, and iodine) by nurses/midwives. Doctors do an ultrasound scan for fetal position and growth, placenta position, as well as amniotic fluid measurements to detect polyhydramnios or oligohydramnios associated with impaired fetal growth.

In the fifth visit at 38 weeks of gestation, which takes about two hours, doctors do an ultrasound scan for fetal position and possible abnormalities. Nurses/midwives give advice on visiting the hospital if delivery does not occur at 40 weeks of gestation. In addition, women are weighed, urinalysis is performed for protein (risk of pre-eclampsia) and glucose (risk of diabetes), blood pressure, and abdominal examination for fundal height, and fetal heart sound in every ANC visit. Pregnant women receive blood results and post-test counselling on blood results by nurses/ midwives, which takes an hour at 12-16 and 30-34 weeks of gestation.

All low-risk pregnant women are provided with four prenatal education classes 1) dental care, health in pregnancy, and medication when they reach 12-16 weeks of gestation; 2) exercise and massage during pregnancy, including physical and emotional care at 16-28 weeks of gestation; 3) nutrition and fetal development at 20-32 weeks of gestation; and 4) preparation for childbirth and breastfeeding beyond 32 weeks of gestation. Each class takes approximately 40 to 60 minutes. Nurses/midwives teach pregnant women individually at 26-28 weeks of gestation how to count fetal movements for the prevention of stillbirths (3rd Regional Health Centre, Thailand, 2011; MoPH, Thailand, 2012).

1.3 Western influences on health in Thailand

Western culture has an important influence over the Thai society and culture in many perspectives; one of them is health. Thai society has recently become more urbanised, which affects values and lifestyles, including health behaviour (Craven & Hawks, 2006; Lee, Yach, & Kamradt-Scott, 2011; Chaipraditkul, 2013). That is, physical inactivity and unhealthy eating have become a common behaviour. Physical inactivity is associated with urbanisation, caused by increased income, modern home appliances, and car ownership (L-Y Lim et al, 2009). Eating behaviour has changed from local to junk food as the latter looks modern and convenient (Hawks et al, 2004; Jitnarin et al, 2011; Chaipraditkul, 2013).

According to Thai health reports, urban living and changes in socio-economy are related to a surging obesity rate in Thailand, resulting in a health-risk transition from communicable to non-communicable diseases (L-Y Lim et al, 2009; Teerawattananon & Luz, 2017). Meanwhile, beauty values in Thailand have been influenced by the West and reinforced by celebrities. Desire for beauty and perfect body shape are a common attitude among women, resulting in increased use of beauty and a perfect body shape products (slimming aids and meal replacements) as well as cosmetic surgery (Montgomery et al, 2012).

In the wake of globalisation, English language and higher education including fashion, music, and technology, as conveyed in social media and by celebrities, are more influential in the modern Thai society (Baker & Phongpaichit, 2017). These factors impact on views and thus changes the way the people of Thailand work and live. For example, most people communicate with each other through chat applications or social media, such as Facebook, or Twitter. As a result of modernisation, there have been societal changes worldwide (Leventon & Gluckman, 2013; Rhein, 2016) including Thailand (Baker & Phongpaichit, 2017).

1.4 Structure of the thesis

This thesis is divided into eight chapters. The first chapter comprises an introduction and background information on the setting. This study consists of two reviews of literature, in chapters two and three respectively. Chapter two contains a scoping review about obesity and overweight in pregnant women, exercise in pregnancy, and recommendations for exercise in pregnancy in the Thai context. Next, Chapter three provides an in-depth narrative review of barriers and facilitators to exercise during pregnancy that leads to better insights into exercise in pregnant women and clarifies ideas about the development of an exercise intervention. Chapter four consists of the methodology and describes the multiphase mixed methods applied in this study. Chapter five reports the findings from the workshops, protocol of the exercise programme for Thai pregnant women and personal reflection on the workshops. Chapter six contains the results of the feasibility randomised controlled trial, including preliminary effects, acceptability and feasibility of the exercise programme. The findings from qualitative interviews with pregnant women who participated in the exercise programme and focus group with HCPs who participated in the workshops for designing the exercise programme are also reported in this chapter. Chapter seven comprises the discussion on how the findings from the workshops and the feasibility study fit within the existing body

of knowledge including strengths and limitations of this study. The last chapter provides the conclusion of the study, contribution of knowledge, personal reflection on the study based on the research process, and recommendations for practice, education and future research.

CHAPTER 2

LITERATURE REVIEW

This chapter describes a scoping review about obesity and overweight in pregnant women, including perspectives of exercise in pregnant women with relevance to the current situation in Thailand. This review has addressed the existing knowledge and identified a literature gap on improving the exercise behaviour of pregnant women in Thailand while clarifying the research aims and questions. The review is presented in three main sections. The first aims to address health problems for obese and overweight women related to pregnancy. The second section reviews the importance or otherwise of exercise during pregnancy, and recommendations for exercise during pregnancy. The last topic addresses the current situation of exercise for pregnant women in Thailand.

2.1 The scoping review process

The scoping review is used to answer broader review questions and is a narrative integration of the relevant research evidence to identify gaps in knowledge underpinning a research area (Arksey & O'Malley, 2005; Armstrong et al, 2011; Peterson et al, 2017). The Arksey and O'Malley methodological framework was applied in this review covering the scope of overweight and obesity as well as exercise in pregnancy. The mapping of the scoping review is shown in Figure 2.1. The process involved six stages: identifying the research question, identifying the relevant studies, selecting the relevant studies, charting the data, collecting summarising and reporting the results, and consulting (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010; Halas et al, 2014; Peters et al, 2015).

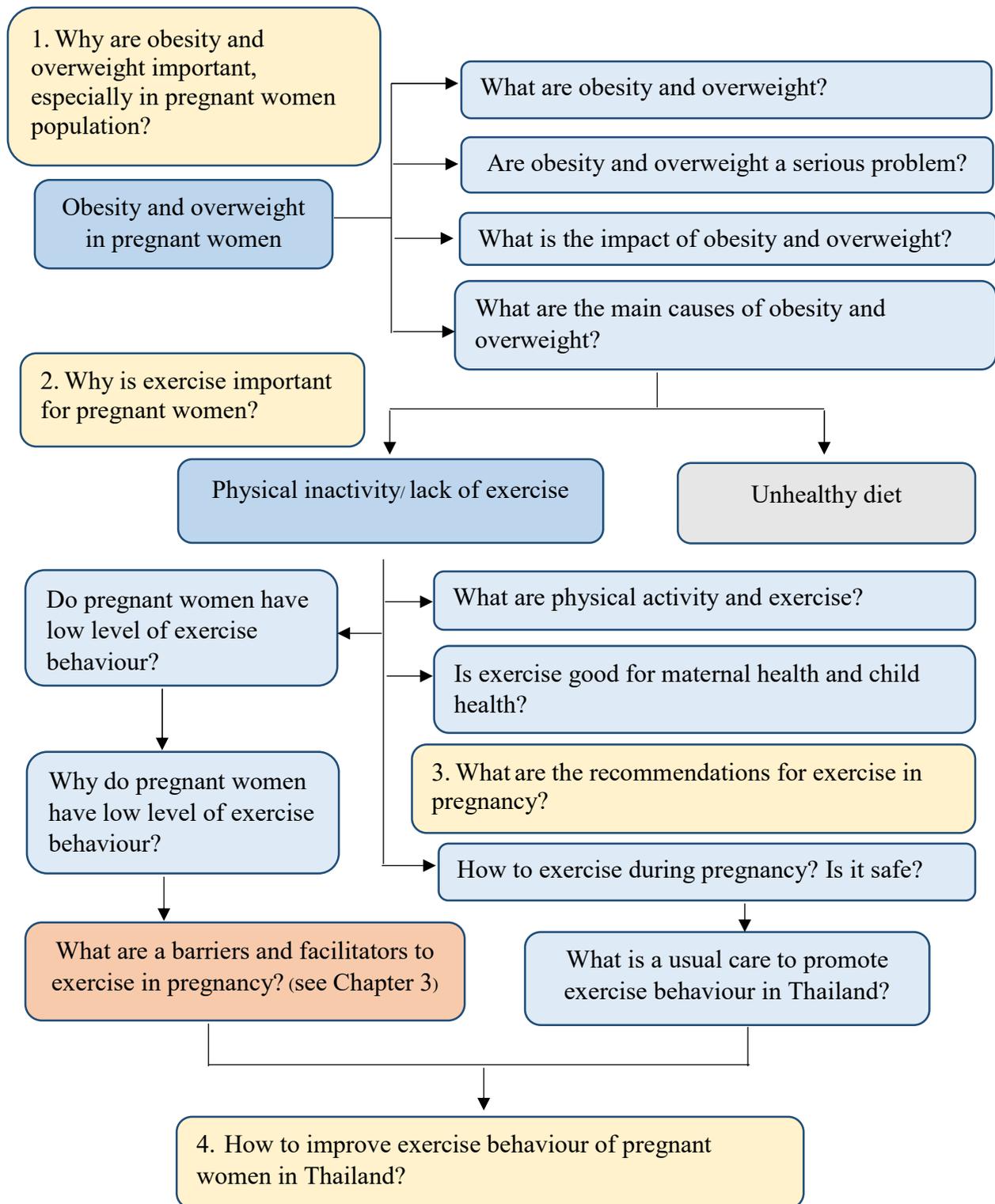


Figure 2.1: Mapping of the scoping review

In the first stage, obesity and overweight in pregnant women are identified as a guide of the scope for enquiry because it is a serious issue in Thailand. This issue thus makes for the

rationale of the study which is attempting to find relevant evidence. The study aims to comprehensively examine the scope for improving exercise behaviour of pregnant women that links to positive maternal and child outcomes. The main questions of this literature review guiding the scoping review are as follows:

1. Why are obesity and overweight important, especially in pregnant women?
2. Why is exercise important for pregnant women?
3. What are the recommendations for exercise in pregnancy?
4. How to improve the exercise behaviour of pregnant women in Thailand?

Then, the review focuses on exercise during pregnancy. It aims to address questions arising from the review in order to find the answer and to identify the gaps in knowledge on exercise in pregnancy. The criteria, databases to search, search strategy, key terms, and limitations were decided for the scoping review. The inclusion criteria were applied to review articles as follows: published in English language, full-text articles, human subjects, and pregnant women as a target population. The review articles included qualitative and quantitative studies, systematic reviews, meta-analyses, scoping reviews, narrative reviews, critical reviews, best practices and critical reviews.

A literature search was undertaken on six electronic databases provided by University of East Anglia (UEA) Library Search: Medline (EBSCO), EMBASE, CINAHL, PsycINFO, and PubMed Central (PMC), including additional search from EthOS (e-theses online service) from database until January 2018. The search was performed in December 2014 and updated in February 2018. The search strategy comprised three concepts: overweight/obesity; exercise/physical activity; and pregnancy. For each concept, key words and MeSH terms were combined with the 'OR' operator and the results were combined with the 'AND' operator.

After identifying the relevant studies, the study selection process was applied to decision making based on the quantity and quality of the studies, inclusion and exclusion criteria, study design, and key findings by a researcher. The titles of articles were reviewed based on the inclusion and exclusion criteria indicating a target population, language, and scope of the study. Then, the selection process included reviews of abstracts and full-text articles under supervision of the supervisors. In this scoping review, the quality assessment of the articles were assessed by using the assessment tool from the Critical Appraisal Skills Programme (CASP) (CASP, 2017). Data were extracted from the studies using a data sheet about the study's author and year, study design, sample size and characteristics, data collection, and key findings. The findings from present study are summarised in accordance with the questions of this review. At each stage of the scoping review supervisors were consulted.

In addition, barriers and facilitators to exercise in pregnant women emerged from the initial scoping review of literature on overweight and obesity as well as exercise in pregnancy. These barriers and facilitators are found to play a key role for enhancing a better understanding of exercise behaviour of pregnant women, and thereby being used to design the exercise programme for pregnant women. Therefore, details of a review of barriers and facilitators to exercise in pregnant women is separately explained in Chapter three.

2.2 Obesity and overweight

Obesity and overweight (O&O) are defined as excessive fat accumulation or abnormal fat that impacts on health (The World Health Organization (WHO), 2014, WHO, 2015). The international criterion of overweight is body mass index (BMI) which is range between 25 and 29.9 kg/m² (WHO, 2014). For international criterion, WHO defines obesity as the BMI equal to 30 kg/m² or higher. This is further divided into three classifications associated with increasing health complications: obese class I: BMI range between 30-34.9

kg/m²; obese class II: BMI range between 35-39.9 kg/m²; and obese class III: BMI \geq 40 kg/m² (WHO, 2014; Doyle, 2014). On the other hand, the cut-off point for overweight is BMI \geq 23 kg/m² and obesity is BMI \geq 27.5 kg/m² in Asia (WHO expert consultation, 2004). Asian people generally have higher body fat than Whites with the same BMI (He et al, 2013; Wang et al, 1994), although the mean BMI of Asians is lower than that of Whites (Carpenter et al, 2013; He et al, 2013).

Several studies indicate that health problems such as cardiovascular diseases, diabetes, hypertension, dyslipidaemia, and albuminuria in Chinese populations (in Hong Kong and Singapore) are associated with lower BMI than Western countries (WHO, Western Pacific Region (WPRO), 2000; Zhou, 2002; WHO expert consultation, 2004; Wee et al, 2008, Tang et al, 2012). This suggests that the prevalence of O&O may be underestimated as the measurement of the prevalence and trend of O&O by solely relying on BMI classification, following the international criteria and definitions of WHO (Carpenter et al, 2013; He et al, 2013; WHO, 2014). Therefore, the Asian criteria are used in this study, drawing on the evidence of the cut-off point analyses linked to health risk factors, morbidities, mortality, cultures, socioeconomic status and nutrition transitions in the Thai context (WHO, WPRO, 2000; WHO expert consultation, 2004; Isaranurug, Mo-suwan, & Choprapawon, 2007; The Ministry of Public Health (MoPH), Thailand, 2010; Liabsuetrakul, 2011; Saereporncharenkul, 2011; Sunsaneevithayakul, 2014). However, the Ministry of Public Health, Thailand recommends both international and Asian criteria of BMI classification for Thai research (MoPH, Thailand, 2010), depending on the nature of their cases or purposes. The BMI classification between International and Asian criteria is shown in Table 2.1 (Developed from WHO expert consultation, 2004).

Table 2.1: BMI Classification between international and Asian criteria

Classification	BMI (kg/m ²)		Risk of developing health problems
	International criteria	Asian criteria	
Underweight	< 18.5	< 18.5	Low
Normal weight	18.5-24.9	18.5-22.9	Average
Overweight	25.0-29.9	23.0-27.4	Increased
Obese Class I	30.0-34.9	27.5-29.9	Moderate
Obese Class II	35-39.9	≥ 30	Severe
Obese Class III	≥ 40	-	Extremely severe

(Developed from WHO expert consultation, 2004)

2.2.1 Incidence and prevalence of obesity and overweight

The prevalence of global O&O combined has risen continuously by 27.5% for adults and 47.1% for children between 1980 and 2013 (WHO, 2014; Ng et al, 2014; WHO, 2015). The Global Health Observatory (GHO) reported that there were more than half a billion obese and overweight adults aged over 20 years old in 2008 (Stevens et al, 2012; WHO, 2014). In the same year, the global prevalence of O&O among adults in the Americas was the highest, with around 62% for overweight and 22% for obesity (WHO, 2014; Ogden et al, 2014). The lowest obesity rates were in South East Asia, where the average was around 14% for overweight and 3% for obesity (WHO, 2014). By 2014, more than 600 million (13%) adults aged 18 years and older were obese and over 1.9 billion (39%) were overweight worldwide (WHO, 2015). Women had higher rates of O&O than men, particularly in Africa, the Eastern Mediterranean and South-East Asia (Stevens et al, 2012; WHO, 2014). This report indicated that a significant proportion of obese pregnant women is likely to be overweight or obese before pregnancy.

As for maternal O&O, the trend is increasing continuously in both pre-pregnancy overweight or obesity, and excessive weight gain during pregnancy (Doyle, 2014; Sullivan,

2014). Globally, the prevalence of women at reproductive age and the number of pregnant women have increased dramatically since the mid 20th century (Stevens et al, 2012). In the UK, the prevalence of maternal obesity almost doubled from 10% in 1990 to 19% in 2000 (Frankie, 2012; Public Health England, 2013). The rate of maternal mortality with obesity was around 30% to 22% of all maternal deaths from 2000 to 2002 and from 2003 to 2005 respectively. Around one-fifth of them showed no recorded BMI (Public Health England, 2013). This means that there might be some maternal obesity hidden among them.

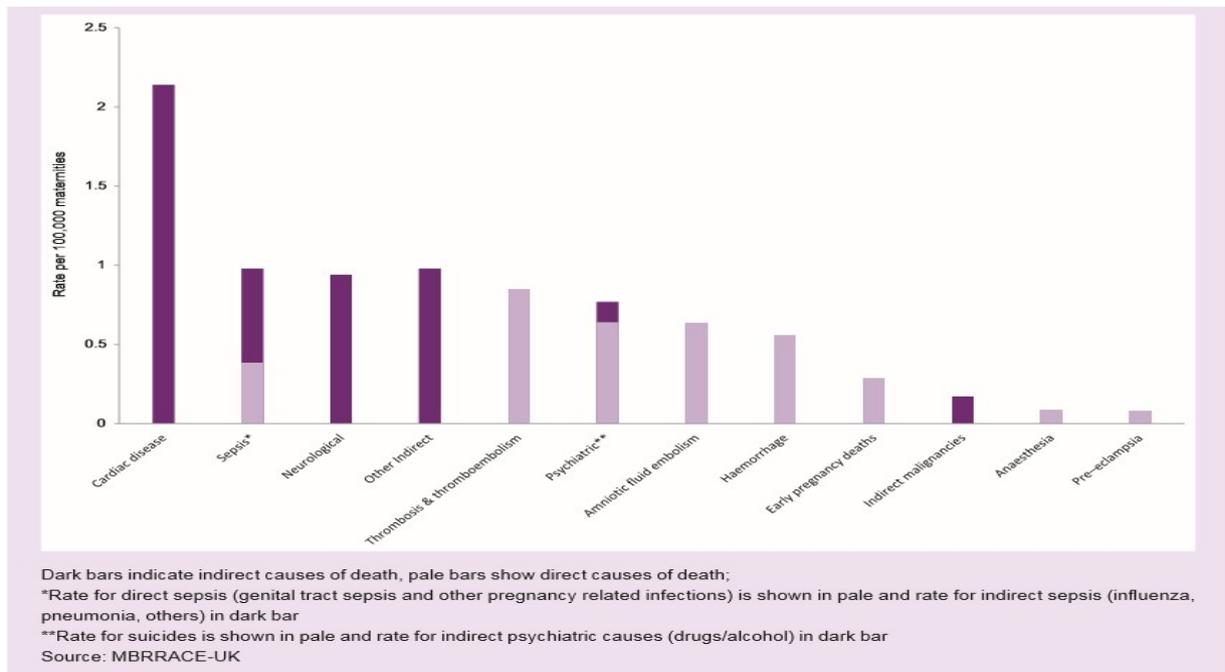
In Thailand, the prevalence of O&O among adults aged over 15 years old is the second-highest in South East Asia (after Malaysia). O&O almost doubled in this age group from 1991 to 2009, from 18% to 36% for overweight and 4% to 9% for obesity (Aekplakorn & Mo-Suwan, 2009; MoPH, Thailand, 2010). Females had a higher rate of O&O than males (Thai Health Working Group, 2011). The prevalence of O&O rose up to 39.7% for women and 32.1% for men in 2013 (Ng et al, 2014). From the statistics, the prevalence of obesity aged over 20 years is continuously increasing up to 11.8% and 4.9% for females and males respectively (World Health Statistics, 2014). However, the prevalence of maternal O&O has not been reported so far in Thailand, but the estimated prevalence may increase following the trends of reproductive age women.

The estimated prevalence of Thai maternal overweight and obesity may increase following the trends of women in the general population. In terms of health, obesity has direct and indirect social, psychological, and physical consequences, particularly high to extremely high risk of non-communicable diseases (NCDs), which depends on the level of obesity (Davies et al, 2010; Mahmood & Arulkumaran, 2013; Özdemir, 2015). NCDs, is composed of four main types: cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes mellitus (WHO, 2015). Being overweight also increases the risk of developing

health problems, especially NCDs (Davies et al, 2010; Gatineau & Mathrani, 2011; Mahmood & Arulkumaran, 2013).

Therefore, the rate of maternal mortality with obesity may be higher than what is shown in the statistics. The most common direct cause of maternal death in the UK is heart disease. More than half of maternal death from heart diseases was related to overweight and obesity between 2003 and 2005 (Public Health England, 2013). The report is associated with the MBRRACE-UK confidential enquiry reports. Cardiac disease was the largest cause of indirect maternal deaths in 2012-2014 (rate 2.18 per 100,000 maternities). These data illustrate overview of the causes of maternal mortality in the UK. The causes of maternal deaths are presented in Figure 2.2 (Knight et al, 2016). Increasing age of pregnant women was indicated as one of the risk factors for maternal death (McCall, Nair, & Knight, 2016). However, these data could not completely indicate that causes of maternal death related to overweight and obesity.

Figure 2.2: Maternal mortality by cause 2012-2014



(Data from the MBRRACE-UK confidential enquiry reports: Knight, Nair, Tuffnell, Kenyon, Shakespeare, Brocklehurst, Kurinczuk, (Eds.) on behalf of MBRRACE-UK., 2016)

2.2.2 Causes of obesity and overweight

Causes of O&O are associated with several factors. Many studies suggest risk factors, including health status, health behaviour and environment. The health status refers to congenital anomalies, chronic illness, disability and heredity that impact on diseases, overeating behaviour, barriers to physical activity and exercise (Williams, 2012). The main cause of O&O is unhealthy behaviour (Leddy, Power & Schulkin, 2008; Davies et al, 2010; Squibb, 2014; Doyle, 2014). For example, a lack of exercise, inappropriate diet, and sedentary lifestyle often increase the risk of overweight/obesity and corresponding health problems (Davies et al, 2010). 'Environment' includes public health policy, health care service and community barriers to exercise and healthy diet, such as insufficient knowledge and services from healthcare providers, inappropriate community beliefs and uncertainty about public health policy. Globalisation also plays a key role in making changes in Asian societies (Huynen, Martens & Hilderink, 2005; Osman, Subhani & Hasan, 2013). It impacts on health behaviour and lifestyle that shift to over eating pattern, sedentary behaviour and low exercise (Uusitalo, Pietinen & Puska, 2002; Mendez & Popkin, 2004).

Among pregnant women, maternal O&O may be caused by economic, technological, and lifestyle changes that result in unhealthy behaviours: a lack of exercise and physical activity (PA), and inappropriate diet (Leddy, Power & Schulkin, 2008; Davies et al, 2010; Squibb, 2014). May et al (2013) found that both exercising and non-exercising pregnant women changed their behaviour in a healthier way when compared to non-pregnant ones, particularly in nutrition, during pregnancy (May et al, 2013). For pregnant women, there are two classifications of obesity problems: pre-pregnancy overweight or obesity, and excessive weight gain during pregnancy (Davies et al, 2010; Squibb, 2014). Pre-pregnancy overweight or obesity often indicates causes from the long term inappropriate lifestyles (Krans & Chang, 2012; Marshall, Bland & Melton, 2013). Excessive weight gain in pregnant women can be a

result of inadequate knowledge and antenatal care, and beliefs (Squibb, 2014; Stirrat & Reynolds, 2014) that lead to inappropriate healthy behaviour (Sunsaneevithayakul et al, 2014; Özdemir, 2015).

2.2.3 Consequences of obesity and overweight

Research has shown that O&O can lead to health problems in all age groups (Frankie, 2012; Gatineau & Mathrani, 2011). According to WHO (2013), O&O have physical, psychological and social consequences. Physical impacts include such complications as coronary heart disease, stroke, hypertensive disorder, a range of cancers (endothelium, breast and colon), dyslipidemia, osteoarthritis, and liver and gallbladder disease (The Centers for Disease Control and Prevention (CDC), 2012; WHO, 2013). Psychological aspects are associated with social status, which leads to an increasing rate of depression and anxiety, low quality of life (QoL) and self-esteem, inadequate interpersonal relationships, and body image dissatisfaction (Sporis, Badric & Miljkovic, 2014; WHO, 2013). In a prospective cohort study with 5,522 pregnant women, overweight and obese women who had high socio-economic status (household income > 45,000 GBP per year) had a significantly increased risk of antenatal depression. The antenatal depression may be result of their body image dissatisfaction (Molyneaux et al, 2016).

Maternal O&O tend to have negative impacts on maternal and child outcomes in terms of both medical and obstetrical complications such as miscarriages, pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), shoulder dystocia, an increasing rate of emergency caesarean section, fetal distress, stillbirth, perinatal asphyxia, preterm birth, and greater risks of developing cardiovascular diseases, and metabolic syndrome in later life (Davies et al, 2010; Garber & Chiasson, 2013; Huisman et al, 2013; Birdsong et al, 2014; Squibb, 2014; Stirrat & Reynolds, 2014; Sunsaneevithayakul et al, 2014; Özdemir, 2015). Furthermore, O&O also have socio-economic implications e.g. high costs of medical

care, a lack of labour (lack of employee), loss of benefits, and undermining community/national development (caused by low quality human resources) (CDC, 2012). Women with maternal O&O have a longer hospital stay than normal pre-pregnancy BMI and normal gestational weight gain because they have maternal complications during pregnancy, labour and postpartum period such as abnormal delivery, and postpartum haemorrhage (Heslehurst et al, 2008; Mamun et al, 2011). They also have higher frequency of hospital admissions than women with normal weight (Crane et al, 2013; Denison et al, 2014).

O&O in pregnant women also have psychological and socio-economic consequences such as depression, anxiety, stress, an increasing rate of caesarean section and higher costs of medical care (Poobalan et al, 2008; Keeley, Gunning & Denison, 2011; CDC, 2012). Montgomery et al (2012) found that male partners often have negative perceptions when their female partners experience perinatal excessive weight gain, perceived to be caused by inappropriate eating behaviour and exercise habits. Such a perception is linked to stress, anxiety, and depression in both partners and future divorce (Montgomery et al, 2012). This has raised an important but often ignored issue. While healthcare research generally considers the psychological impacts of the physiological and biological effects of O&O, they seem to disregard the wider contextual factors surrounding patients such as marital or relationship issues linked to illness. In addition, maternal O&O also affect the next generation's obesity and child morbidity and mortality (Papachatzi et al, 2013; Stadlander, 2014; Sullivan, 2014; Özdemir, 2015). As Tie et al (2014) pointed out, excessive gestational weight gain is significantly related to the higher risk of childhood O&O, drawing on a meta-analysis of twelve retrospective and prospective cohort studies (Tie et al, 2014).

O&O is a crucial global health issue. As a result of unhealthy behaviour, it is rising continuously. Most people lack exercise and physical activity (PA), accompanied by unhealthy diet (Engberg et al, 2012; May et al, 2013; Özdemir, 2015). This problem affects

all age groups, especially pregnant women. This means that it has impacts on mothers and their offspring. There is convincing evidence that exercise during pregnancy can decrease the risk of non-communicable diseases (NCDs) and health problems for both mothers and offspring (Poobalan et al, 2008; Keeley, Gunning & Denison, 2011; CDC, 2012; Tennant, 2014). Hence, exercise promotion plays a strategic role in solving the O&O problem.

2.3 Exercise

Many studies demonstrate that exercise positively impacts on physical and mental health (CDC, 2012; Dhurup, 2012; WHO, 2014). It can reduce the risk of non-communicable diseases (NCDs) such as coronary heart disease, diabetes mellitus, hypertension and depression (WHO, 2014). It also improves physical health as well as psychological well-being while playing an important role in the prevention and treatment for medical conditions (CDC, 2012; Dhurup, 2012; WHO, 2014).

2.3.1 Definition of exercise

Exercise is a subcategory of physical activity. Physical activity is defined as “any bodily movement produced by skeletal muscles that result in energy expenditure” (Caspersen, Powell & Christenson, 1985, p.126) which covers numerous activities of daily living such as activities for working, household working, child-care, playing, gardening, leisure-time activity/recreational activity, and stair climbing (WHO, 2014). While exercise is the leisure time physical activity, exercise refers to “planned, structured, repetitive and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective” (Caspersen, Powell & Christenson, 1985, p.128; WHO, 2014). Exercise is categorised into two types: non-weight bearing, and weight bearing exercise. Brisk walking, jogging, stationary cycling, water aerobic exercise, swimming, or a myriad of other recreational activities are examples of exercise (Caspersen, Powell & Christenson, 1985; WHO, 2014).

2.3.2 Benefits of exercise during pregnancy

Exercise during pregnancy is related to potential maternal and offspring's physical, psychological and social health aspects as described below.

2.3.2.1 Physical aspects

2.3.2.1.1 Reducing risk of Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus (GDM) is associated with several maternal and fetal health problems such as an increasing rate of perinatal morbidity and mortality, the increasing risk of type 2 diabetes mellitus after childbirth and high obstetrics delivery rate (Ceysens, Rouiller & Boulvain, 2006; Mudd et al, 2013). Risk of GDM is related to several factors such as overweight, obesity, physical inactivity or sedentary lifestyle, advanced maternal age, family history of diabetes mellitus and excessive weight gain during pregnancy (Han, Middleton & Crowther, 2012). An increase in insulin resistance from the placenta during the second trimester of pregnancy (Ouzounian & Elkayam, 2012; Yanamandra & Chandraharan, 2012) may cause gestational diabetes resulting in macrosomia, dystocia in labour, and increasing risk of caesarean section (Han, Middleton & Crowther, 2012; Ouzounian & Elkayam, 2012; Yanamandra & Chandraharan, 2012). Exercise enhances insulin sensitivity and improves glycogen storage in muscle and liver that would help reduce insulin resistance (Horak & Osman, 2012; Barakat et al, 2014). Moreover, exercise during pregnancy prevents gestational diabetes from both normal BMI and over (Artal, Toole & White, 2003; Royal College of Obstetricians & Gynaecologists (RCOG), 2006). In addition, recreational moderate and vigorous PA (MVPA) before and during pregnancy can reduce the risk of developing GDM in women with normal pre-pregnancy BMI. Deierlein, Siega-Riz & Evenson (2012) found that any metabolic equivalent (MET) hour/week of leisure time physical activity in pregnant women with normal BMI was associated with 48% lower risk of hyperglycemia than those who self-reported none. Maternal hyperglycemia followed the

guidelines by Carpenter and Coustan (1985) that glucose challenge test cut off at 130 mg/dl and over. The data were collected from 1,437 pregnant women from 2001 and 2005. However, as most of the sample was Whites (71.6%), their results may not be generalisable to other groups such as Asians and Blacks (Deierlein, Siega-Riz & Evenson, 2012).

2.3.2.1.2 Weight management

O&O impact on pregnant women through several complications such as pre-eclampsia, hypertensive disorder, impaired glucose tolerance, gestational diabetes mellitus, infection, dystocia in labour and the increasing rate of caesarean section (C/S) including perinatal death, congenital anomalies and macrosomia (Furber et al, 2013; Muktabhant et al, 2012). The recommendation for gestational weight gain between international and Asian criteria is displayed in Table 2.2 (Adapted from: The Institute of Medicine (IOM), 2009 and the American College of Obstetricians and Gynecologists (ACOG), 2013). The revised international recommendations were provided from the Institute of Medicine (IOM) for appropriate total gestational weight gain by BMI. The new guidelines of IOM based on the cut-off points for the BMI categories of WHO and included the new evidence of specific relatively narrow range of recommendation for weight gain for obese women (Rasmussen & Yaktine, 2009; American College of Obstetricians and Gynecologists (ACOG), 2013). The new IOM guideline focuses on both total weight gain and rate of weight gain week by week, recommended for implementation in several countries (Siega-Riz, Deierlein & Stuebe, 2010). In Thailand, the national guidelines are drawn from IOM and the cut-off points of overweight and obesity in adults whereas some other studies are based on Asian criteria (Isaranurug, Mo-suwan, & Choprapawon, 2007; Saereporncharenkul, 2011; Sunsaneevithayakul, 2014). This very much depends on how those researchers considered advantages/disadvantages, including their research objectives, questions and assumptions.

Table 2.2: Recommendation range of weight gain during pregnancy

Pre-pregnancy BMI (kg/m ²)		Recommendation range of total weight (Kilograms (kg))	Rates of weight gain in second and third trimester (kg/week)
International criteria	Asian Criteria		
BMI < 18.5	BMI < 18.5	12.5-18.0	0.51 (0.44-0.58)
BMI 18.5-24.9	BMI 18.5-22.9	11.5-16.0	0.42 (0.35-0.50)
BMI 25.0-29.9	BMI 23.0-29.9	7.0-11.5	0.28 (0.23-0.33)
BMI > 30	BMI > 30	5.0-9.0	0.22 (0.17-0.27)

(Adapted from: The Institute of Medicine (IOM), 2009 and the American College of Obstetricians and Gynecologists (ACOG), 2013)

Regular exercise such as walking, cycling, and resistance training assist in efficiently controlling standards of maternal gestational weight gain based on pre-pregnancy BMI (Sui, Grivell & Dodd, 2012). It prevents and reduces excessive weight gain in O&O women from the baseline pre-pregnancy weight (Makinde, Adeyemo & Ogundele, 2014; Seneviratne et al, 2014). This is because adipose tissue or fat is converted to muscle and energy (Barakat et al, 2014). Some studies found that moderate intensity exercise assisted women to control gestational weight gain in both healthy, underweight, and overweight pregnant women (Brown & Avery, 2012; Jones, Housman & McAleese, 2010), including women who had excessive gestational weight gain during pregnancy (Mudd et al, 2013). As reported in a cohort study of urban Chinese pregnant women, sedentary women had higher average gestational weight gain than active ones during the second and third trimesters (Jiang et al, 2012). Moreover, some studies confirmed that a combination of intervention between nutrition and exercise programmes increases the success management rate of excessive weight gain in obese pregnant women (Martin, Duxbury & Soltani, 2014; Mottola, 2013; Sagedal et al, 2013).

2.3.2.1.3 Reducing risk of hypertensive disorders

Hypertensive disorders during pregnancy such as pre-eclampsia, chronic and gestational hypertension are associated with several maternal complications such as eclampsia, coronary heart disease, acute renal failure, gestational diabetes, abruption placenta, and intrauterine growth restriction (IUGR). This also results in offspring complications such as preterm birth, birth asphyxia and respiratory distress syndrome (Meher & Duley, 2006). Exercise reduces blood pressure, levels of stress, and anxiety that may cause gestational hypertension and pre-eclampsia (Horak & Osmam, 2012).

The mechanism of regular exercise during pregnancy decreases arterial stiffness that leads to cardiovascular disorders such as pregnancy-induced hypertension and myocardial ischemia in low risk pregnant women (Kawabata et al, 2012). A case control comparison between recreational PA and the risk of pre-eclampsia among 201 women with pre-eclampsia and 383 normotensive pregnant women revealed that pregnant women who engaged in regular PA during the first 20 weeks of pregnancy and during the year before pregnancy had lower risk of pre-eclampsia than those with sedentary lifestyle (Sorensen et al, 2003).

In addition, the effect of 12 week of aerobic exercise training on women with a history of pre-eclampsia included a decrease in blood pressure and the lower risk of cardiovascular diseases, as recorded from arterial pressure and biochemical parameters such as cholesterol, triglycerides and fasting blood glucose. This case control study was conducted with 24 women who had previous pre-eclampsia history and 20 control women of similar characteristics (Scholten et al, 2014). With some limitations, the participants received a follow-up evaluation of 6-12 months after delivery. The recovery period of pre-eclampsia was within 6 months (Mikami et al, 2014). Hence, the levels of blood pressure and risk of cardiovascular diseases in women may return to normal within the recovery period after delivery.

2.3.2.1.4 Improvement in musculoskeletal fitness

Pregnant women experience abdominal wall stretch because their enlarged uterus reduces the strength of abdominal wall. The enlarged abdomen shifts the balance of the body (forward) with more lordosis, causing back/low back pain (Yanamandra & Chandraharan, 2012). Ligament and fascia around the pelvic frame have more flexion because the progesterone hormone generates the alteration of pelvic joint and bone, which can be easily injured (Martens et al, 2006). PA during pregnancy improves physical fitness, body balance, and posture as well as maintains physical and muscular strength, including increasing lean muscle mass and bone density (Kramer, 2003; Prather, Spitznagle & Hunt, 2012). Prather, Spitznagle & Hunt (2012) compared non-exercising and exercising pregnant women by ultrasound for bone density mass and found that pregnant women who exercised at least ten hours per week experience significantly lower loss of bone mass density than those who did not exercise (Prather, Spitznagle & Hunt, 2012). Exercise can increase or maintain physical strength, body balance, and good posture (Kramer, 2003).

Moreover, some studies confirmed that physical inactivity and/or sedentary lifestyle during pregnancy leads to loss of muscular and cardiovascular fitness and increases incidence and severity of back/low back pain (Kordi et al, 2013; RCOG, 2006). Pregnant women exercising at least three times a week have been found with less low back pain, pelvic girdle pain and leg pain than pregnant women who exercised less than three times a week at third trimester (thirty-two weeks of gestational age) (Field, 2011; Gjestland et al, 2012). The prevalence and intensity of low back pain and pelvic girdle pain has been found to be reduced by exercise, including moderate intensity aerobic exercises and different types of exercises such as treadmills, brisk walking, stationary cycling, swimming and water-gymnastics (Keder & Naim-Shuchana, 2014; Kihlstrand et al, 1999). Aquatic activity offers many benefits during pregnancy because water lessens pressure on joints for pregnant women. Water thus

helps reduce pressure on the uterus and pelvis, which improves joint flexibility during pregnancy (Stan, 2014).

From the meta-analysis of eleven randomised controlled trials, pregnant women with or without low back pain or pelvic girdle pain were recruited for this meta-analysis (n = 2,347 women). Exercise interventions, which included water gymnastics, sitting pelvic tilt exercise, energy expenditure exercises, strengthening exercises for abdominal, hamstrings and spinal muscles, low impact gymnastics and strengthening exercises or a combination of at least three of aerobic, strengthening, stretching and relaxation, flexibility and endurance, resistance exercises, pelvic floor muscle training or balance exercises, reduced the risk of low back pain and prevented sick leave, caused by low back pain or lumbopelvic pain in pregnancy. The duration of the intervention ranged from 8 to 24 weeks. There was no statically significant effect on pelvic girdle pain or lumbopelvic pain in pregnant women. (Shiri, Coggon & Falah-Hassani, 2018).

2.3.2.1.5 Reducing discomfort during pregnancy

Physiological and psychological alteration during pregnancy impacts on pregnant women, especially discomfort such as nausea, headache, morning sickness, fatigue, constipation, varicose veins and swollen extremities (Ireland, 2006; Yanamandra & Chandraharan, 2012). Some studies have demonstrated that PA and/or exercise reduce these common discomforts during pregnancy (Stan, 2014; Fieril et al, 2014; Tiran, 2014), as reflected in increased QoL and wellness scores (Hawkins et al, 2014; Prather, Spitznagle & Hunt, 2012). Furthermore, exercise tends to decrease severity of nausea and fatigue symptoms as a result of physical, psychological and social changes during pregnancy (Shivakumar et al, 2011; Tiran, 2014). Exercise and dietary interventions during pregnancy have been found to prevent and reduce constipation symptoms during pregnancy and the

postpartum period (Derbyshire et al, 2006; Trottier, Erebara & Bozzo, 2012), including decreasing the risk of haemorrhoids during pregnancy (Avsar & Keskin, 2010).

2.3.2.1.6 Labour outcomes

Pregnant women engaged in exercise were found to better manage pain during labour process, and experience reduced pain during first and second stages of labour, including a decreased risk of childbirth complications and a higher rate of vaginal birth (Barakat et al, 2014; Kader & Naim-Shuchana, 2014; Magann et al, 2002). Studies on PA during pregnancy have supported the reduced incidence of caesarean section, which often occurs with both sedentary and inactive pregnant women. (Melzer et al, 2010). Some studies found that exercise and yoga programmes help reduce the perception of labour pain and increase the tolerance of such a pain (Field, 2011; Field et al, 2012; Horak & Osmam, 2012). Moreover, a study advocates that moderate intensity of exercise during pregnancy reduces the risk of preterm delivery with pre-pregnancy BMI at least 24 kg/m² and over (Guendelman et al, 2013). This cut-off BMI is associated with nearly overweight and over. In other words, moderate exercise could prevent preterm birth in O&O pregnant women.

2.3.2.1.7 Long-term outcomes

Long-term benefits of exercise include protection against the effects of coronary heart disease, and the reduced risk for osteoporosis, diabetes mellitus and hypertension (Hay-Smith, 2013; Horak & Osmam, 2012). Clapp's (2008) studied long-term outcomes of women who regularly exercised during pregnancy by comparing the outcomes in two groups: women who had regularly exercised before pregnancy until one year after delivery, and those who had stopped exercise before twelve weeks of gestation until delivery. The study found that pregnant women who participated in a weight-bearing exercise programme during pregnancy and six months after delivery were found with lower risk of cardiovascular diseases, when measured at 18-20 years after the index pregnancy. Clapp's (2008) study also discovered that

resting heart rate, blood pressure and cholesterol of continuous exercise group were significantly lower than non-exercise one during pregnancy. However, a main limitation of the above-mentioned work was a small sample size of 39 participants in both groups, which were inadequate for generalizability. Moreover, it is problematic to prove the long-term benefits of exercise on cardiovascular function. Cardiovascular diseases have more related factors such as dietary behaviour and lifestyle, but Clapp's (2008) study did not control such related factors. This means that exercise during pregnancy may be only one of the factors reducing the risk of cardiovascular diseases (Clapp, 2008).

2.3.2.2 Psychological aspects

Regular PA and exercise in pregnant women enhances self-esteem, improves body image, self-confidence, sense of control and psychological well-being while reducing stress, anxiety, depression and insomnia symptoms (Field, 2011; Fieril et al, 2014; Prather, Spitznagle & Hunt, 2012; Shivakumar et al, 2011). It also improves stress response and relaxation (Field, 2011). Yoga enhances vagal activity with numerous hormonal and physiological impacts (e.g. reducing cortisol and substance P and increasing serotonin) that reduce blood pressure and heart rate. Pregnant women who engaged in PA had lower scores on anxiety and depression symptoms compared to those who did not perform significant PA (Horak & Osmam, 2012). In addition, some studies indicate that taking part in an exercise programme during pregnancy can boost emotional states such as vigour, energy level, enjoyment and euphoria, reducing negative affective states such as anger, tension, confusion, fatigue and depression (Guszkowska et al, 2013; Guszkowska, Langwald & Sempolska, 2013).

2.3.2.3 Social aspects

Pregnant women engaged in exercise programmes may have more opportunities to meet new people, friends, and families (Gaston, Cramp & Prapavessis, 2012), which might

lead to networking and collaboration between groups of pregnant women. Some studies found that exercising pregnant women developed closer relationships with families as well as social relationships compared to inactive pregnant women because the former received supportive influences from social models such as family members, friends, and colleagues (Connolly, Feltz & Pivarnik, 2014; Haakstad et al, 2009); this also may indirectly reduce stress, anxiety, and depression during pregnancy. Several studies support the notion that pregnant women with high levels of social support have low levels of stress, anxiety and depression, and high level of self-efficacy (Jenkins et al, 2006). These results have positive effects on mothers and offspring both directly and indirectly (Adachi-Mejia et al, 2010; Evenson et al, 2009).

2.3.2.4 Life course of offspring outcomes

2.3.2.4.1 Fetal outcomes

PA has a significant role in improving the viability of the placenta and placental functional capacity, increasing amniotic fluid level and endothelium dependent vasodilation. These results prevent fetal distress and the risk of pre-eclampsia (Prather, Spitznagle & Hunt, 2012), and improve overall fetal growth (Melzer et al, 2010).

2.3.2.4.2 Infancy outcomes

Regular moderate intensity exercise during pregnancy is found to produce appropriate birth weight (Doustan et al, 2012), especially for infants born from overweight and obese mothers (Prather, Spitznagle & Hunt, 2012; Seneviratne et al, 2014). Some studies indicate that neonates born from exercising mothers had lower birth weight ($\geq 2,500$ grams) than those of non-exercising, overweight, obese and gestational diabetes mothers (Artal & Toole, 2003; Tomic et al, 2013). Exercise during pregnancy reduces the rate of macrosomia because mechanisms of PA affect insulin sensitivity, adipose tissue, endocrine regulation and muscle mass (Siebel, Carey & Kingwell, 2012).

2.3.2.4.3 Childhood/adolescence outcomes

Research on long-term effects of exercise during pregnancy suggests that maternal exercise reduces the risk of developing later overweight, obesity and cardio-metabolic complications on the next generation (Siebel, Carey & Kingwell, 2012). Moreover, some studies have reported that offspring of exercising mothers have improved neurodevelopmental outcomes at five years old than those of non-exercising mothers (Prather, Spitznagle & Hunt, 2012; Siebel, Carey & Kingwell, 2012). A cohort study about PA during pregnancy and offspring's cardiovascular risk factors has confirmed that maternal PA during pregnancy is associated with lower BMI, waist circumference, glucose and insulin of offspring at fifteen years old, including an increase in PA at fourteen years old, when compared to those born of inactive mothers, (Millard et al, 2013).

2.3.2.4.4 Adulthood outcomes

A few studies of long-term effects of PA during pregnancy argue that adult offspring (aged twenty years old and above) born from exercising mothers have shown lower positive markers of metabolic syndrome (MS) such as BMI, high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, triglycerides, leptin level and fasting blood sugar (FBS), and blood pressure (BP) than non-exercising mothers. This is confirmed by previous studies showing a connection between exercising mothers and positive benefits for children and teenage offspring (Boyd et al, 2013; Millard et al, 2013). Danielsen et al. (2013) also reported that leisure-time PA during pregnancy is a significant negative marker of metabolic syndrome (MS) in young adult offspring, which causes high blood pressure, low level of HDL cholesterol and triglycerides (Danielsen et al, 2013). Furthermore, Rooney, Mathiason & Schauburger (2011) studied 777 obese mothers and their offspring from infancy to adulthood. This birth cohort study found that maternal obesity was significantly associated with offspring obesity in childhood (ages 4–5 years), adolescence (ages 9–14 years), and

early adulthood (ages 19–20 years). Offspring delivered from pre-pregnancy obese mothers accounted for 52% of obesity in childhood, 62% in adolescence and 44% in early adulthood. (Rooney, Mathiason & Schauburger, 2011).

2.3.3 Recommendations for exercise during pregnancy

The World Health Organization (WHO) recommends for adults aged 18-64 years that they should engage at least 150 minutes of moderate intensity physical activity, or at least 75 minutes of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous intensity physical activity per week (WHO, 2010). Recommendations for exercise during pregnancy have multiple international guidelines based on research evidence of the mothers and offspring benefits, including expert consensus (Evenson et al, 2013; Smith & Campbell, 2013). The American College of Obstetricians and Gynecologists (2002) recommends that healthy pregnant women should engage an accumulated 30 minutes or more of moderate exercise a day on most days of the week (ACOG, 2002; Artal & Toole, 2003). An updated version recommends that healthy pregnant women should take moderate intensity exercise at least 20-30 minutes a day on most or all days of the week (ACOG, 2015). The United States Department of Health and Human Services (USDHHS) recommends that healthy pregnant and postpartum women should engage at least 150 minutes of moderate intensity aerobic activity per week (USDHHS, 2008).

The Royal College of Obstetricians and Gynaecologists (RCOG) recommends for previously inactive women or those starting exercise during pregnancy that women should begin moderate intensity exercise no more than 15 minutes at least three times a week and progress up to 30 minutes four times a week (RCOG, 2006). The American College of Sports Medicine (ACSM) recommends that women with morning sickness in the first trimester should initially perform at least 10 minutes of moderate intensity exercise during pregnancy, progressing to up to 30 minutes a session, at least three times a week (ACSM, 2014).

2.3.3.1 Intensity of exercise during pregnancy

The intensity should be a moderate level of exercise as measured by multiple methods. Firstly, RCOG (2006) recommends the talk test, whereby the exercising pregnant woman should be able to communicate (in light conversation) during exercise. This is considered to constitute moderate-level exercise (ACOG, 2002; RCOG, 2006; ACOG, 2015). This method is the simplest measurement of intensity of exercise that pregnant women of all backgrounds can easily remember and apply in their exercise regimens. Secondly, the Borg rating scale is used to measure perceived exertion during exercise. The guidelines recommend twelve to fourteen perceived exertions for moderate exercise (this is generally regarded as somewhat hard) (RCOG, 2006; ACOG, 2015). During the exercise activity, the number that best describes the level of perceived exertion on the Borg rating scale is chosen based on the question “how hard you feel like your body is working?” (Nascimento, Surita & Cecatti, 2012; Evenson et al, 2014). Midwives must clearly explain the meaning of the scale and measurement process for perceived exertion.

Thirdly, moderate intensity of exercise is an energy requirement of three to six metabolic equivalent tasks (METs) (Zavorsky & Longo, 2011). The METs depend on such factors as types and duration of exercise (Cohen, Plourde & Koski, 2010), which are quite difficult to calculate in usual care service. Midwives must clearly explain types and time of exercise for pregnant women. Next, the ACSM recommends the target heart rate (THR) based on a range of age and BMI for measuring intensity of exercise (ACSM, 2014). Moderate intensity for pregnant women should meet 60-90% of maximum heart rate. This method is quite a good measurement because it considers individual factors of pregnant women such as age and BMI. Pregnant women will be able to measure their heart rate either manually or with equipment after education from midwives. Finally, oxygen consumption can be used to measure maximum oxygen uptake. Pregnant women should meet 50-85% of

maximum oxygen uptake (Artal & Toole, 2003; Prather, Spitznagle & Hunt, 2012). This method is clearly a difficult application for pregnant women in the real world because it requires expertise and specific equipment.

2.3.3.2 Contraindication for exercise during pregnancy

ACSM recommends that healthcare professionals (HCPs) should screen for contraindications before pregnant women engaged in exercise (Artal & Toole, 2003; ACSM, 2014; ACOG, 2015) and be aware of any warning signs during exercise such as vaginal bleeding, dizziness and preterm labour. Risks for exercise should be advised such as falls, muscle injuries and accidents (ACOG, 2002; Artal & Toole, 2003; ACSM, 2014; ACOG, 2015). The Society of Obstetricians and Gynaecologists of Canada (SOGC) and the Canadian Society for Exercise Physiology (CSEP) recommend Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy) as a screening tool for exercise during pregnancy (Davies et al, 2003). For high-risk pregnancy including existing medical conditions such as chronic hypertensive disorder, diabetes mellitus, and morbid obesity more detailed information from a physician or midwife is needed before engaging exercise (Artal & Toole, 2003; Evenson et al, 2014; ACSM, 2014).

2.3.3.3 Types of exercise during pregnancy

Aerobic exercise, both weight-bearing and non-weight bearing, such as walking, running, jogging, stationary cycling, swimming, aquatic activities, low-impact aerobics, prenatal yoga, muscular workouts, and racquet sports are recommended in pregnancy to maintain physical fitness, improve cardiovascular circulation, and decrease risk of NCDs and control gestational weight gain (RCOG, 2006; ACSM, 2014; Stan, 2014; ACOG, 2015). Exercise has been found to be beneficial and safe for both women and their offspring (RCOG, 2006; Charlesworth et al, 2011; Nascimento, Surita & Cecatti, 2012; Prather, Spitznagle & Hunt, 2012; Bredin et al, 2013; ACSM, 2014; ACOG, 2015; Suputtitada, 2015).

However, unsafe activities and contact sports should be contraindicated because these exercises increase the risk of falling, abdominal trauma, and injury to connective muscle tissues (RCOG, 2006; ACOG, 2015; Suputtitada, 2015). Exercise in supine position should be avoided during the second trimester of pregnancy in order to hypotension and Valsalva manoeuvre in pregnancy (Nascimento, Surita & Cecatti, 2012; Evenson et al, 2014; Suputtitada, 2015).

In Thailand, recommendations of exercise during pregnancy follow the ACOG guidelines endorsed by empirical evidence appropriate in the Thai context (Suputtitada, 2015) for the promotion of mother and child health (The National Economic and Social Development Board, Thailand, 2011; The National Health Development Plan Committee (NHDPC), Thailand, 2011). The Department of Health, Thailand developed the implementation of an action plan for all antenatal care units about promoting exercise during pregnancy (Department of Health (DoH), Thailand, 2014). The Physical Power for Health Division adapted steps and types of exercise which are suitable in the Thai context (Suputtitada, 2015). Generally, nurses and midwives should screen contraindications to exercise during pregnancy by an individual exercise checklist and women should be made aware of any warning signs during exercise based on the ACOG guidelines (3rd Regional Health Promoting Centre, Thailand, 2011; Suputtitada, 2015).

Hence, women in low risk pregnancy should perform at least 30 minutes of moderate exercise at least three times a week and progress up to a maximum of five times a week (3rd Regional Health Promoting Centre, Thailand, 2011; Suputtitada, 2015). Pregnant women who are starting exercise or suffering morning sickness in the first trimester should begin moderate exercise from a minimum of 10 minutes three times a week and progress up to a maximum of approximately 30 minutes per session four times a week (Davies et al, 2003; RCOG, 2006; ACSM, 2014).

2.3.4 Exercise behaviour of pregnant women

The worldwide level of exercise among all age groups is low in both developed and developing countries (CDC, 2014; The National Heart Foundation of Australia, 2015; WHO, 2015). Globally, 25% of adults aged twenty and above do not get adequate PA while more than 80% of adolescents have insufficient PA (WHO, 2015). In the UK, one-third of adults perform moderate intensity of exercise at least once a week for 30 minutes (Health and Social Care Information Centre, UK, 2014). In the US, half of the national population participate in regular exercise, but less than 5% of adults perform regular exercise for 30 minutes each day (The President's Council on Fitness, Sports and Nutrition, US, 2015). Walking is the most popular form of exercise in the US, being cited as regular PA by 30% of people (US Bureau of Labor Statistics, 2008). In Thailand, a quarter of the overall population aged over 18 years old participate in regular exercise at least three times a week for 30 minutes at moderate to vigorous intensity, comprising 'sports' followed by walking (The National Statistical Office, Thailand (NSO), 2012). The lower rate of sport or exercise activities is associated with advanced age, as in the UK (The NHS Information Centre, Lifestyles Statistics, UK, 2011; NSO, 2012). Sports is the most common exercise (34.7%) followed by walking (20%) aerobic exercises such as dancing, yoga, fitness, and cycling (NSO, 2012; NSO, 2015).

For pregnant women, nearly one-third of women in the US met the American College of Obstetricians and Gynecologists (ACOG) guidelines for exercise during pregnancy (Mudd et al, 2009). Only 8.4% of pregnant women remained active all three trimesters of pregnancy. The proportion of women who met the ACOG guidelines for exercise during pregnancy (≥ 150 minutes of moderate intensity exercise per week) was lower: 7.2%, 7.6% and 4.7% in the first, second and third trimester, respectively (Nascimento et al, 2014). 11.1% of pregnant urban Chinese women met the ACOG guidelines (Zhang et al, 2014).

Pregnant women typically had a lower level of exercise than they did during their pre-pregnancy life (Borodulin et al, 2008; Hegaard et al, 2011; Gaston & Cramp, 2011; Engberg et al, 2012; Currie et al, 2013; Nascimento et al, 2014). The overall physical activity level of women decreased between the second and the third trimester of pregnancy for both hour per week and MET hour per week ($p < .001$) (Borodulin et al, 2008). Nulliparous women also decreased the intensity and time spent on exercise during pregnancy than pre-pregnancy period ($p < .001$). The proportion of women who participated in competitive sports and moderate-to-heavy activity decreased over the three trimesters of pregnancy. The proportion of women with sedentary behaviour also increased from 6% in pre-pregnancy period to 29% during pregnancy (Hegaard et al, 2011).

A review of exercise patterns during pregnancy from 1986 to 2009 revealed that levels of PA during pregnancy declined (Gaston & Cramp, 2011). Engberg et al (2012) reviewed 34 studies about life events and change in leisure time physical activity and concluded that exercise during pregnancy declined from pre-pregnancy to after delivery due to avoiding any harm for their offspring, and changing the type of physical activity (Engberg et al, 2012). Most pregnant women decrease exercise and occupational activities, but increase household activities (Blum, Beaudoin & Caton-Lemos, 2004; Treuth, Butte & Puyau, 2005). Walking is the most common exercise during pregnancy, followed by swimming and antenatal exercise as reported by 9,889 women who participated in the AVON Longitudinal Study of Parents and Children (ALSPAC) in Bristol, AVON Southwest, England (Liu et al, 2011). The statistics of physical activity or exercise in Thai pregnant women are not currently reported, but the proportion of women who exercise during pregnancy may be lower than pre-pregnancy, as estimated by the global trend.

However, it is possible that the statistics of exercise during pregnancy may be under or overestimated. This could be a result of the methods of data collection that vary and

depend on questions, guidelines of exercise, and types of research. For instance, some studies collected data of exercise that accumulated minutes per week. Other collected data that checked the minutes per time and times per week. Several other collected the data by interview, self-report or health volunteers' checklists (Borodulin et al, 2008; Mudd et al, 2009; Hegaard et al, 2011; Liu et al, 2011; Gaston & Cramp, 2011; Engberg et al, 2012; Currie et al, 2013; Zhang et al, 2014; Nascimento et al, 2015). These affect the quality and quantity of data which may not show the actual level of exercise during pregnancy. Although exercise during pregnancy provides many benefits for mothers and offspring, the overall exercise level during pregnancy in both developed and developing countries is still declining. There might be some other significant factors affecting the exercise behaviour during pregnancy.

2.4 Exercise in pregnancy in Thailand

As part of usual care in Thailand, HCPs spend approximately 15-20 minutes on general health advice during pregnancy, which includes brief advice on topics of working, physical activity, and exercise for all low risk pregnant women in the second or third appointment at an antenatal care clinic. Advice about exercise is provided only once at 16-28 weeks of gestation. This takes approximately 30 minutes in a prenatal education class facilitated by nurse educators as part of usual care at an antenatal care clinic (3rd Regional Health Centre, Thailand, 2011; MoPH, 2012). Several issues have emerged as limitations to exercise behaviour in pregnancy for Thai pregnant women.

Firstly, there is limited coverage on exercise during pregnancy in the mother and child health handbook. The handbook consists of general advice during pregnancy, some of which includes physical activity and exercise during pregnancy (MoPH, 2012). Secondly, pregnant women may experience fatigue from a long wait during antenatal care service, which generally takes around three to four hours (Sanklaleak, Boromtanarat & Tiautchasuwan,

2014). Thirdly, the antenatal care clinics in Thailand do not have a routine exercise programme during pregnancy (3rd Regional Health Centre, Thailand, 2011). Thus, HCPs may lack feedback about pregnant women's exercise behaviour and knowledge that would be useful for improving specific information and promoting exercise individually.

Lastly, the prenatal education class usually has a nurse or midwife who teaches many sessions about how to care for oneself during pregnancy, including exercise. This nurse or midwife cannot give in-depth advice due to limited time and resources. In addition, HCPs in an antenatal care clinic have a range of responsibilities for promoting health behaviour such as physical examination, counselling for screening, well-being advice, and management of common symptoms during pregnancy (MoPH, 2013).

In light of the above, it is likely that typical antenatal care clinic in Thailand is unable to deliver efficient exercise support to improve exercise behaviour in pregnant women, which may result in low level of exercise behaviour in pregnant women (Piravej & Saksirinukul, 2001; Currie et al, 2013). This scoping review has identified the benefits of exercise in pregnancy clearly and therefore it is necessary to understand what motivates or prevents women from engaging with exercise while being pregnant before considering how to design a study to meet the recommendations of the Royal Thai Government.

- **An exercise programme for pregnant women**

An educational programme of exercise for pregnant women may play an important role in antenatal care, which consequently creates challenges for HCPs in promoting the level of exercise behaviour for the benefits of mothers and offspring. For this reason, the integration of the exercise programme into the usual antenatal care clinic is introduced so as to deliver better services, including an increase in exercise level of pregnant women in the long term.

In Thailand, there is a small number of studies about exercise programmes for pregnant women. Several studies established a programme based on self-efficacy (Bandura, 1997) and social support (House, 1981) models. Results of these studies explained the effects of programmes on the self perception of self-efficacy and social support, which can lead to increased levels of exercise (Mornsang, 2009; Parnkasem, 2013). These studies may not provide sufficient evidence to enhance exercise behaviour because of their small sample sizes and a lack of some significant factors of barriers and facilitators to exercise in pregnancy. It is noticeable that there was no integration of the exercise programmes into the usual antenatal care clinic.

Currie, et al (2013), in reviewing strategies for improving the declining rate of physical activity during pregnancy found that the duration of exercise intervention for changing behaviour should be at least four weeks (Currie, et al, 2013). According to several behavioural change theories: Pender's Health Promotion model, Transtheoretical model (TTM), and Planned Behaviour, the model process intervention consists of two phases: the short-term (three months or less), and the long-term (over three months) (Supavitipatana et al, 2012; Gaston et al, 2013; Pantaewan & Prasittivatechakod, 2014). Therefore, the appropriate duration of intervention for enhancing the exercise level may be somewhere between ten to twelve weeks. As pointed out by Kramer & McDonald (2006), an exercise programme processing an intervention for at least ten weeks generated short-term benefits for mothers and offspring such as body fitness, control body weight gain, muscle strength and a decreasing rate of macrosomia (Kramer & McDonald, 2006).

The appropriate gestational period for engaging in the exercise programme varies in evidence, guidelines and policies (Cioffi et al, 2010; Mornsang, 2009; Supavitipatana et al, 2012; Gaston et al, 2013; Parnkasem, 2013). In the first trimester of pregnancy, mothers face great changes: physical, psychological and social. They feel uncertain and vulnerable

(Yanamandra & Chandraharan, 2012). Cioffi et al (2010) suggested the second trimester period (≥ 20 weeks of gestation) as appropriate stage for engagement in exercise during pregnancy. Firstly, mothers have more emotional stability that results from the level of hormone, physical, psychological and social changes. Secondly, discomfort caused by pregnancy in the first trimester such as morning sickness and fatigues is generally relieved. Finally, mothers in the second trimester develop maternal role attainment to enter motherhood, develop maternal and fetal relationships by changing health behaviour to take care of the baby (Mercer, 2004; Yanamandra & Chandraharan, 2012).

In addition, healthy pregnant women can continue moderate intensity of exercise regularly until childbirth (Cioffi et al, 2010) following the recommendations of exercise in pregnancy (RCOG, 2006; ACSM, 2014; ACOG, 2015) due to benefits of exercise in the third trimester and birth process such as a relief in low back pain and an increase in tolerance of pain during labour (Field, 2011; Horak & Osmam, 2012; Kordi et al, 2013). Therefore, the exercise programme should be begin in the second trimester of pregnancy and continue into the third trimester until childbirth. Based on a scoping review, it is clear that obesity and overweight in pregnant women affect maternal health and child outcomes, including increased risks of NCDs and the next generation obesity. In response to this problem, regular exercise during pregnancy can increase physical fitness, decrease risk of cardiovascular diseases and control gestational weight gain, including reducing antenatal depression. However, according to the statistics, the levels of exercise behaviour during pregnancy are low and even lower in the pre-pregnancy and postnatal periods, which is occurring in Thailand as well. To gain better insights into barriers and facilitators to exercise in pregnant women an in-depth narrative review is presented in Chapter Three. These findings from the narrative review are of particular relevance to designing the exercise programme for pregnant women and were used in the co-design workshops with women and HCPs.

CHAPTER 3

REVIEW OF BARRIERS AND FACILITATORS TO EXERCISE IN PREGNANCY

Subsequent to Chapter Two, this chapter describes an in-depth narrative review as an analysis of papers that address the existing knowledge and present perspectives on barriers and facilitators to exercise in pregnant women, including justification for conducting this study (Noble & Smith, 2018). The barriers and facilitators to exercise in pregnancy were identified from a broad scoping review on overweight and obesity, the importance of exercise and the subsequent exercise recommendations for pregnant women. The review of barriers and facilitators to exercise in pregnancy has promoted a better understanding about exercise behaviour of pregnant women. It helped clarify and link the research aims and questions, and contributed evidence to the design phase of the study to ensure that the exercise programme would include evidence based facilitators to maximise engagement.

Barriers and facilitators to exercise in pregnant women

This in-depth analysis of papers was carried out to identify evidence from both qualitative and quantitative approaches on the topic of barriers and facilitators to exercise in pregnant women in different contexts and countries worldwide. The review is reported in five sections: 1) review questions, 2) literature search, 3) study selection and quality assessment of studies, 4) data extraction and analysis, and 5) summary and report of finding. Each stage of this review were proceeded under supervision of the supervisors for making clear a purpose and checking accuracy of each process as a consultation.

Physical activity (PA) and exercise behaviour during pregnancy are dependent on several intrinsic and extrinsic factors, including characteristics of pregnant women, their socio-economic status and levels of social support. Several studies indicate significant points

that are either barriers or facilitators (Evenson et al, 2009; Leiferman et al, 2011). A barrier is defined as something or someone that may be imagined or real which consists of perceptions concerning the unavailability, inconvenience, expense, difficulty, or time-consuming nature of a particular action (Pender, 2002). It also addresses a negative association with a regular leisure-time PA or exercise (Adachi-Mejia et al, 2010).

A facilitator is defined as someone or something which helps, contributes, guides, and aids the process (Pierce, Cheesebrow & Braun, 2000). The roles of facilitators include a coordinator, catalyst, observer, climate setter, communicator, enabler, and learning coach, depending on situations and conditions (Shephard, 2014). For a clear comparison, this study has divided barriers and facilitators into three dimensions: intrapersonal, interpersonal and environmental.

3.1 Review questions

The main review question asks: what are barriers and facilitators to exercise in pregnancy?

3.2 A literature search

A literature search was undertaken on six electronic databases provided by University of East Anglia (UEA) Library Search: Medline (EBSCO), EMBASE, CINAHL, PsycINFO, and PubMed Central (PMC), including additional search from EthOS (e-theses online service) from database inception in 2005 and January 2018. The searches were performed in March 2015 and updated in February 2018. The search strategy comprised three concepts: barriers and facilitators; exercise/physical activity; and pregnancy. For each concept, key words and MeSH terms were combined with the 'OR' operator and the results were combined with the 'AND' operator. For example, a comprehensive search strategy was developed combining the following keywords: [(barriers OR obstacles OR challenges) AND (exercise OR physical activity OR fitness) AND (pregnancy OR pregnant OR prenatal OR

antenatal OR maternal OR perinatal)], and [(facilitators OR motivators OR enablers) AND (exercise OR physical activity OR fitness) AND (pregnancy OR pregnant OR prenatal OR antenatal OR maternal OR perinatal)].

Inclusion criteria included: (1) qualitative and quantitative studies, (2) full-text articles published in peer-reviewed journals, and (3) full theses. Studies were excluded if they focused on high-risk pregnant women, defined as pregnant women with conditions, complications, and diseases during pregnancy such as hypertensive disorders, cardiovascular diseases, gestation diabetes mellitus (GDM), overweight and obesity and severe anaemia. In addition, studies were excluded if they are published in non-English language and if the results showed that there was no available access to the full-text article. The search strategy for the review of barriers and facilitators to exercise during pregnancy is presented in Figure 3.1 based on the PRISMA statement, 2009 (Moher, Liberati, Tetzlaff, Altman, the PRISMA Group, 2009).

There were 2,245 articles in total from the search. After duplicates were removed, the remaining 1,034 articles were screened by considering the title, then abstract. After the title and abstract screening, 103 articles were eligible for the review. Following the full text review, 73 articles were excluded: 68 did not meet the inclusion and exclusion criteria while full papers could not be found in five studies. Six literature and systematic review studies were excluded because the outcomes found in these studies were secondary information. Two articles were excluded because they were non-English language. In total, 21 studies reported in 22 articles were included in the review: eight studies (reported in nine articles) with a quantitative design, 12 studies with a qualitative design, and the other with a mixed-methods design.

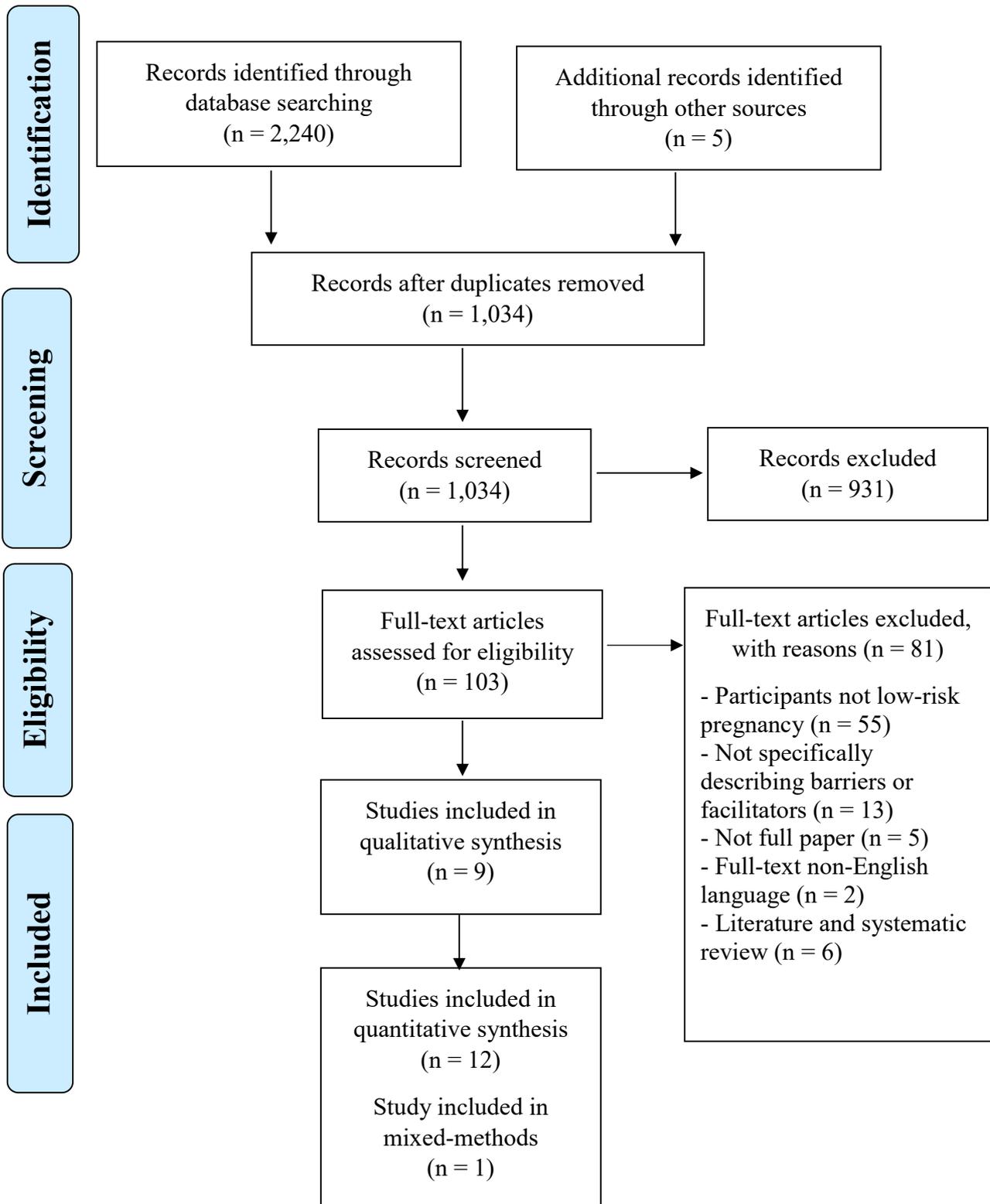


Figure 3.1: The review of barriers and facilitators to exercise during pregnancy

3.3 Study selection and quality assessment of studies

The review included two types of the study: quantitative and qualitative. Quantitative studies were assessed, according to a checklist specifically designed for the evaluation of descriptive/cross-sectional study. The checklist is comprised of 11 items covering study design, methods, sample size, accuracy of measurement, data collection, analysis, result and validity (Albert Einstein College of Medicine of Yeshiva University, New York, 2002). Qualitative studies were assessed using the assessment tool from the Critical Appraisal Skills Programme (CASP). The checklist is comprised of 10 items covering study design, data collection, analysis, result and validity (CASP, 2017). The studies were evaluated in accordance with the criteria of quality, credibility and accuracy. The content of the studies was checked using the appropriate CASP tools and quality evaluated according to the criteria. The papers were assessed and graded for quality and accuracy with all selected studies meeting a grade of satisfactory (see Appendix AB). No study was excluded based on the useful data.

3.4 Data extraction and analysis

Data were extracted from the included articles using a data sheet comprising the study's author and year, country of research, study design, sample size and characteristics, data collection, and key findings. Qualitative studies were analysed using an inductive approach and then categorised into themes and sub-themes (Thomas, 2006). For quantitative studies, the data were analysed using the socio-ecological model by categorising findings into themes. Findings were summarised and grouped under the categories: intrapersonal, interpersonal, and environmental barriers and facilitators to exercise during pregnancy for qualitative analysis (Golden & Earp, 2012).

3.5 Findings

Twenty- two articles comprising quantitative and qualitative studies, were included in this review. A summary of the studies is shown in Table 3.1. The included studies were published between 2009 and 2017. Data came from 11 different countries; most studies were conducted in the United States of America (USA) (n=9), followed by Australia (n=3), Canada (n=3), Norway (n=1), Brazil (n=1), Portugal (n=1), Sweden (n=1), South Africa (n=1), Netherlands (n=1), and only two studies from Eastern countries China (n=1), and Hong Kong (n=1). Number of participants in the included studies ranged from nine to 1,535 participants. These studies included low risk pregnant women representing a range of age groups, parity, body mass index, education, race/ethnicity, and socioeconomic backgrounds.

Regarding data collection, data in the quantitative research were collected through open-ended questions in two studies, closed questionnaires in ten studies, and barrier and facilitator scale in only one study. Data collection methods used in the qualitative research included focus groups in five studies, face-to-face interviews in three studies, and a combination between face-to-face and telephone interviews in only one study. Telephone interviews and open-ended questions via a face-to-face questionnaire were used in the mixed methods study.

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
¹ Marquez et al. (2009)	USA	Qualitative	n=20, pregnant Latina and non-Latina White women at < 28 weeks of gestation	Three focus groups: two groups of pregnant Latina women (n=13), one group of non-Latina White women (n=7)	Satisfactory
² Cioffi et al. (2010)	Australia	Qualitative	n=19, pregnant women at all trimesters (first, second, and third)	19 women participated in face-to-face interviews, 16 women participated in the individual interviews and remained in a small group interview	Satisfactory
³ Leiferman et al. (2011)	USA	Qualitative	n=25, pregnant women between 17-40 weeks of gestation	Individual and paired interviews with the interview guide (consisted of 12 questions that assessed interpersonal beliefs, motivating factors and supports, and barriers. Each interview took an average of 40 minutes to complete	Satisfactory
⁴ Krans & Chang (2011)	USA	Qualitative	n=34, African American, low income pregnant women at all trimesters (first, second, and third)	Six focus groups with three to four participants in each group. Focus groups were led by one of two moderators using open-ended and semi-structured questions	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
⁵ Krans & Chang (2012)	USA	Qualitative	n=34, African American, low income pregnant women at all trimesters (the same population as that of Krans & Chang, 2011)	Six focus groups with two to eight participants in each group	Satisfactory
⁶ Bennett et al. (2013)	Canada	Qualitative	n=9, pregnant women between 10 and 39 weeks of gestation	Individual interviews for a total 18 semi-structured interviews.	Satisfactory
			Semi-structured interviews: seven women with face-to-face interviews, and two women with telephone interviews at two different times: (1) 10-35 weeks, and (2) 31-39 weeks of gestation		
⁷ Groth & Morrison-Beedy (2013)	USA	Qualitative	n=26, African American, low-income pregnant women at all trimesters. 60% of the women were in the first 20 weeks of pregnancy	Three focus groups with seven to ten participants in each group with an interview question guide	Satisfactory
⁹ Fieril et al. (2014)	Sweden	Qualitative	n=17, pregnant women between 15 and 35 weeks of gestation who did regular highly repetitive resistance training (once or twice a week for 5 weeks or longer)	Semi-structured, face-to-face interviews after the completion of the intervention study of the efficacy of a resistance training programme during pregnancies from 2006 to 2009	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
¹⁰ Muzigaba, Kolbe-Alexander & Wong (2014)	South Africa	Qualitative	n=34, pregnant women from low socioeconomic communities at all trimesters	Five focus groups with six to eight participants in each group with a stratified random selection	Satisfactory
¹¹ Duncombe et al. (2009)	Australia	Quantitative	Total of 158 pregnant women: n=158 at 16-23 weeks of gestation, n=152 at 24-31 weeks of gestation, and n=144 at 32-38 weeks of gestation completed all data	Mailed questionnaire with closed questions at: 16-23 weeks of gestation, 24-31 weeks of gestation, and 32-38 weeks of gestation.	Satisfactory
			*n=158 at 16-23 weeks of gestation, n=153 at 24-31 weeks of gestation, and n=143 at 32-38 weeks of gestation completed data about reasons for participating and not participating in exercise.		
¹² Haakstad et al. (2009)	Norway	Quantitative (Cross-sectional design)	Total of 467 healthy pregnant women	A questionnaire with closed questions, self-administered at home between 32 and 36 weeks of gestation.	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
¹³ Cramps & Bray (2009)	Canada	Quantitative	Total of 160 pregnant women completed questionnaires at 18, 24, 30, 36 weeks of gestation	Online questionnaire via e-mail with both open-ended and closed questions at: 18 (T1), 24 (T2), 30 (T3), 36 (T4) weeks of gestation (T1, n=59; T2, n=86; T3, n=97; T4, n=106)	Satisfactory
¹⁴ Evenson & Bradley (2010)	USA	Quantitative	1,306 pregnant women at 27-30 weeks of gestation	Phone interviews with closed questions at 17-22 weeks of gestation and medical records for personal characteristics; phone interviews at 27-30 weeks of gestation for physical activity advice from health professionals, and self-administered questionnaires at 24-29 weeks of gestation for exercise before and during pregnancy and beliefs about exercise	Satisfactory
¹⁵ Ribeiro & Milanez (2011)	Brazil	Quantitative (Descriptive study)	Total 161 pregnant women at 32 weeks of gestation	Structured questionnaire used for individual interviews with pregnant women at 32 weeks of gestation	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
⁸ Marshall, Bland & Melton (2013)	Southeast USA	Qualitative (Descriptive design)	88 healthy pregnant women living in rural communities at all trimesters	A self-administered questionnaire, open-ended questions asking, “What is stopping you?” related to perceived barriers to regular exercise	Satisfactory
			*Rural = outside Census Places with a population <25,000 and within an area designated as nonmetro based on definitions of the Federal Office of Management and Budget (United States Department of Agriculture, 2010)		
¹⁶ Melton et al. (2013)	USA	Quantitative (Cross-sectional study)	88 pregnant women in a rural south-eastern region of the United States	A self-administered questionnaire with closed questions on exercise self-efficacy, perceived benefits of exercise, and awareness of safety precautions	Satisfactory
¹⁷ Da Costa & Ireland (2013)	Canada	Quantitative	82 healthy pregnant women at the first trimester (13 mean weeks of gestation)	A self-administered questionnaire with a scale assessing exercise benefits/barriers, self-efficacy for exercise, and social support for exercise	Satisfactory
¹⁸ Santos et al. (2014)	Portugal	Quantitative (Prospective study)	133 pregnant women: 102 and 97 women completed. The final sample consisted of 82 women who participated in both trimesters	A self-administered questionnaire with closed questions and free-response section; data were collected in two stages: (1) at 10-12 weeks of gestation (baseline), (2) at 20-22 weeks of gestation (the time of second ultrasound)	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
¹⁹ Guelfi et al. (2015)	China and Australia	Quantitative	Pregnant women at 18-26 weeks of gestation, n=240 in China, n=215 in Australia	A self-administered questionnaire with closed questions while waiting for their antenatal appointments.	Satisfactory
			n=227 China, n=186 Australia completed participant characteristics		
²⁰ Put, Chuang & Chan (2015)	Hong Kong	Quantitative (Prospective cohort study)	261 pregnant women completed the questionnaire in both trimesters (first and second)	A self-administered questionnaire with closed questions and face-to-face at the antenatal clinic, Hong Kong	Satisfactory
			*534 pregnant women completed the questionnaire at the first trimester; 261 pregnant women completed the questionnaire at the second trimester (24-28 weeks of gestation).		Satisfactory
²¹ Merckx et al. (2017)	Netherlands	Quantitative	n=455 healthy pregnant women of all gestational ages	A secondary analysis of a cross-sectional survey. Data were collected through a closed questionnaire	Satisfactory

Table 3.1: Descriptive study characteristics from 21 studies (reported in 22 articles) (Continued)

Author(s)/year	Country	Study design	Sample size and characteristics	Data collection	Quality assessment
²² Evenson et al. (2009)	USA	Quantitative (qualitative included)	1,535 pregnant women at 27-30 weeks of gestation for survey, 58 pregnant women in focus group (group specific to race/ethnicity	(1) Telephone interviews, face-to-face questionnaire with open-ended questions at the first prenatal visit for survey (2) 13 focus groups with pregnant women between 20 and 37 weeks of gestation	Satisfactory
= Hispanic, Non-Hispanic African American, or Non-Hispanic Whites)					

3.5.1 Barriers to exercise during pregnancy

Barriers to exercise during pregnancy were reported in 21 studies (reported in 22 articles). A summary of barriers to exercise during pregnancy from 21 studies (reported in 22 articles) is shown in Table 3.2. In this study, the barrier is divided into three categories: intrapersonal, interpersonal, and environmental. Firstly, intrapersonal categories include two sub-categories: health and non-health related intrapersonal barriers. Secondly, interpersonal barriers focus on a lack of advice, information, and social support. Lastly, environmental barriers are weather, resources/accesses and policies for exercise during pregnancy.

- **Intrapersonal barriers**

Intrapersonal barriers are the most frequently cited in all of the studies. Health-related intrapersonal barriers are found to mainly reduce the level of regular exercise or leisure time PA during pregnancy. According to Leiferman et al (2011), common health-related intrapersonal barriers comprise tiredness, dizziness, palpitations, lack of sleep, shortness of breath, musculoskeletal problems, and discomfort during pregnancy (Leiferman et al, 2011; Marshall, Bland & Melton, 2013), including complications during pregnancy and pre-pregnancy such as previous history of miscarriages, threatened abortion, irregular contraction, and premature labour (Evenson et al, 2009).

Physical limitations that occur with stages of pregnancy cover all periods of pregnancy (first, second and third trimesters) (Krans & Chang, 2011). In the first trimester, this includes nausea and vomiting or hyperemesis gravidarum, fatigue and dizziness. During the second and third trimesters, back pain and pelvic pain can be a barrier to PA (Cramp & Bray, 2009). In their study of perceived barriers to PA, Evenson et al (2009) found that 52% of 1,535 participants experienced health-related barriers including tiredness, shortness of breath, and musculoskeletal problems, including the fear of harming the fetus and feeling ill (Fieril et al, 2014). Moreover, pregnant women with a depressed mood during pregnancy

perceive low self-efficacy and high barriers that inhibit positive exercise behaviour (Da Costa & Ireland, 2013).

Non-health-related intrapersonal barriers are important causes for the decreased rate of regular exercise and leisure time PA during pregnancy (Leiferman et al, 2011), especially among rural and low-income pregnant women (Krans & Chang, 2012; Melton et al, 2013). Busyness or a lack of time is the principal and most prevalent reason given for inactive leisure time PA. Several studies indicate that non-health-related intrapersonal barriers comprise low motivation, dislike of exercise, a lack of interest, a lack of knowledge and skills about PA or exercise, ethnicity/race belief and low self-efficacy (Evenson et al, 2009; Leiferman et al, 2011; Krans & Chang, 2012; Marshall, Bland & Melton, 2013; Santos et al, 2014). Household tasks, family responsibilities, employment, long work days, being busy at work, and child caring were cited by pregnant women as reasons for their lack of time for exercise (Cramp & Bray, 2009; Krans & Chang, 2011; Krans & Chang, 2012). In addition, low income and rural pregnant women are more concerned about financial problems than exercise. As a result of low levels of household income, they are deprived of time and enjoyment of exercise (Krans & Chang, 2012).

- **Interpersonal barriers**

Interpersonal barriers are affected by a lack of advice and information from healthcare professionals (HCPs) and lack of social support. Such a lack is significantly associated with inadequate and inaccurate knowledge about types, duration, intensity, benefits and risks of exercise during pregnancy (Krans & Chang, 2011; Melton et al, 2013). Women are found to misunderstand the effects of exercise during pregnancy related to preterm labour, low birth weight, and neonatal abnormalities. Women who had not got advice about exercise from health professionals is associated with decreased regular exercise in the third trimester of gestation. It illustrated the consistency of antenatal exercise information received from health

professionals is statistically significant (Haakstad et al, 2009). Hispanic women in the USA received conflicting advice on PA by their family members healthcare teams (for instance, some of them recalled doctors advising them “don’t do too much movement” without explanation); and thereby generally tended to follow their mothers’ advice because it was delivered with greater rationale and certainty (Evenson et al, 2009).

A lack of social support is defined as a lack of motivation or encouragement from a spouse/ husband, friends and family. Several studies reported that low level of exercise significantly correlated with pregnant women who perceived low level of emotional wellbeing and self-esteem support from a significant person such as a husband, friend, family member or partner (Evenson et al, 2009) including lack of social role models on exercise (Haakstad et al, 2009; Krans & Chang, 2011). They also experienced severe levels of nausea and fatigue and higher levels of stress and anxiety (Evenson et al, 2009).

Moreover, interpersonal barriers should be considered with such specific subgroups of pregnant women as cultures and ethnicities, minority groups, teenage pregnancy, rural mothers, and low-income women because these groups have seriously changed marital status, social role and economic status. Most of them perceive a lower level of social support than those who attain a high socioeconomic status and are well-prepared for pregnancy (Krans & Chang, 2012; Marshall, Bland & Melton, 2013). First-generation immigrant Hispanic mothers in the USA with a high BMI described interpersonal relationship problems when they went outside without their family members. They felt lonely because of language and transportation barriers to PA (Evenson et al, 2009).

- **Environmental barriers**

Environmental barriers significantly impact on pregnant women engagement in exercise during pregnancy (Evenson et al, 2009). These barriers include weather, a lack of resources/accesses, and policies (Evenson et al, 2009; Leiferman et al, 2011; Santos et al,

2014). Pregnant women have low levels of regular exercise because they perceive a lack of facilities of PA and high cost of accessing resources (Leiferman et al, 2011). In Portugal Government policy also contributes to a decrease in the level of exercise during pregnancy, caused by costly of leisure physical activity (Santos et al, 2014), a lack of PA guidelines, and facilitators for PA promotion including inconvenience of accessing services which are also insufficient in North Carolina, USA (Evenson et al, 2009). Winter in Europe and North America negatively affects PA due to inclement weather factors (Leiferman et al, 2011). On the other hand, it can be inferred that in the extreme heat in tropical countries (including Thailand) may also become a hindrance to PA during pregnancy. It impacts on body temperature regulation and results in imbalance between heat production and heat loss (Martens et al, 2006; Yanamandra & Chandraharan, 2012). A summary of barriers to exercise during pregnancy from 21 studies (reported in 22 articles) is shown in Table 3.2.

Table 3.2: Barriers to exercise during pregnancy from 21 studies (reported in 22 articles)

Level	Sub-level	Descriptive barriers reported in the studies	Reference number of studies
Intrapersonal	1. Health-related	Physical and psychological changes during pregnancy including body changes, discomfort related to pregnancy, physical limitations/restrictions, tiredness, low energy dictate activity, feeling restricted, fatigue, dizziness, palpitations, musculoskeletal problems such as pelvic pain, breast tenderness, sore knees, pressure from the uterus, back pain, or soreness, irregular contractions, less time due to longer sleep, shortness of breath, and sickness. Concern with pregnancy complications (Avoiding complications and harm to baby, caused by risks during pregnancy such as miscarriage, premature labour), and other medical conditions	Marquez et al. (2009); Cioffi et al. (2010), Leiferman et al. (2011); Krans & Chang (2011); Bennett et al. (2013); Groth & Morrison-Beedy (2013); Marshall, Bland & Melton (2013); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Duncombe et al. (2009); Haakstad et al. (2009); Cramps & Bray (2009); Ribeiro & Milanez (2011); Melton et al. (2013); Da Costa & Ireland (2013); Santos et al. (2014); Guelfi et al. (2015); Put, Chuang & Chan (2015); Merckx et al. (2017); Evenson et al. (2009)
	2. Non-health related	Individual's knowledge, perceptions, attitudes, beliefs, responsibilities and commitments such as lack of time or busyness, work, excuse, childcare, housework, lack of energy or laziness, lack of motivation, lack of enjoyment, inadequate or inaccurate knowledge, misperceptions and concerns about exercise and safety during pregnancy,	Marquez et al. (2009); Cioffi et al. (2010); Leiferman et al. (2011); Krans & Chang (2011); Krans & Chang (2012); Bennett et al. (2013); Groth & Morrison-Beedy (2013); Marshall, Bland & Melton (2013); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong

Table 3.2: Barriers to exercise during pregnancy from 21 studies (reported in 22 articles) (continued)

Level	Sub-level	Descriptive barriers reported in the studies	Reference number of studies
Intrapersonal	2. Non-health related	African American cultural influences, cost, dislike for exercise, concern for the baby, no wish for over-exercise, low self-efficacy, low self-confidence, anxiety regarding the fetus/harmful to the fetus or the pregnancy, unsureness of exercise safety, lack of interest, negative experience with exercise, no history of habit of activity or exercise, discomfort in exercise.	(2014); Duncombe et al. (2009); Haakstad et al. (2009); Cramps & Bray (2009); Evenson & Bradley (2010); Ribeiro & Milanez (2011); Melton et al. (2013); Da Costa & Ireland (2013); Santos et al. (2014); Guelfi et al. (2015); Put, Chuang & Chan (2015); Merkx et al. (2017); Evenson et al. (2009)
Interpersonal	1. Lack of advice and information	Lack of role model, lack of informational support/advice from healthcare workers, lack of healthcare providers, guidance, and counselling.	Marquez et al. (2009); Leiferman et al. (2011); Krans & Chang (2011); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Haakstad et al. (2009); Ribeiro & Milanez (2011); Marshall, Bland & Melton (2013); Melton et al. (2013); Put, Chuang & Chan (2015); Merkx et al. (2017); Evenson et al. (2009)
	2. Lack of social support	Lack of social network and support systems with specific relationships such as friends and family members, lack of social norms, lack of emotional and informational support, African American cultural	Leiferman et al. (2011); Krans & Chang (2011); Muzigaba, Kolbe-Alexander & Wong (2014); Haakstad et al. (2009); Cramps & Bray (2009); Da Costa & Ireland (2013);

Table 3.2: Barriers to exercise during pregnancy from 21 studies (reported in 22 articles) (continued)

Level	Sub-level	Descriptive barriers reported in the studies	Reference number of studies
Interpersonal	2. Lack of social support	influences, lack of external motivation, conflicting advice between family members and others, values on their family members and cultural aspects of advice, attitudes to avoid harmful exercise, isolation from other people (feeling isolated, caused by language and transportation in Hispanic women (not having friends), having no one to exercise with, exercise habits of parents/siblings during childhood	Santos et al. (2014); Put, Chuang & Chan (2015); Merckx et al. (2017); Evenson et al. (2009)
Environmental	1. Weather	Adverse weather such as too cold, too hot, bad weather, seasons of the year	Marquez et al. (2009); Leiferman et al. (2011); Cramps & Bray (2009); Evenson et al. (2009)
	2. Lack of resources/access	Lack of accessibility to trails, parks, lack of transportation, financial constraints including household income below the poverty level, lack of facilities in neighbourhood, safety, and resources, minimal public resources for recreation and physical activity, not enough recreational facilities, lack of available exercise options	Marquez et al. (2009); Cioffi et al. (2010); Leiferman et al. (2011); Krans & Chang (2011); Muzigaba, Kolbe-Alexander & Wong (2014); Haakstad et al. (2009); Cramps & Bray (2009); Da Costa & Ireland (2013); Santos et al. (2014); Evenson et al. (2009)
	3. Policies	Policy with transportation, work, school conflict, being too costly	Santos et al. (2014); Evenson et al. (2009)

3.5.2 Facilitators to exercise during pregnancy

Facilitators to exercise during pregnancy were reported in 18 studies (reported in 19 articles). A summary of facilitators to exercise during pregnancy from 18 studies (reported in 19 articles) is shown in Table 3.3. In this study, facilitators are divided into three categories: intrapersonal, interpersonal, and environmental. Firstly, intrapersonal category includes benefits of exercise and intrinsic motivation. Secondly, interpersonal facilitator focuses on advice and information from HCPs and social support. Lastly, environmental facilitator comprises weather, and resources/accesses for exercise during pregnancy.

- **Intrapersonal facilitator**

The most cited facilitator for exercise among pregnant women is intrapersonal, that is, the notion of exercise benefits during pregnancy and intrinsic motivation. Intrapersonal factors contribute to increased interest in exercise, self-efficacy, and self-confidence in exercise (Evenson & Bradley, 2010; Leiferman et al, 2011; Da Costa & Ireland, 2013). Short-term benefits of exercise during pregnancy create powerful facilitators for exercise in pregnancy, including the perceived benefits of physical fitness and body shape, easier childbirth, recovery after childbirth, and taking care baby after birth: from immediate or within one-year (Marquez et al, 2009; Cioffi et al, 2010; Leiferman et al, 2011; Krans & Chang, 2012).

Cioffi et al (2010) studied nineteen pregnant women by conducting one-on one interviews and a small discussion group. Pursuant to their research, some pregnant women revealed that exercise during pregnancy improved their weight gain, reduced discomfort as a result of physical and psychological changes, and developed fetal well-being, which motivated them to perform exercise during pregnancy (Cioffi et al, 2010).

Several studies have shown that intrinsic motivation has a significant impact on antenatal exercise such as self-efficacy, self-confidence and beliefs (Evenson & Bradley,

2010; Leiferman et al, 2011). This leads to intention to change health behaviour, particularly exercise. Also, pre-pregnancy activity is found with higher intrinsic facilitators for antenatal exercise than pre-pregnancy inactivity (Haakstad et al, 2009). Self-efficacy correlates with interest and motivation to conduct PA during pregnancy (Melton et al, 2013). Previously active women perceive higher self-efficacy and lower barriers to exercise during pregnancy than pre-pregnancy inactive ones (Da Costa & Ireland, 2013).

- **Interpersonal facilitators**

Interpersonal facilitators are often cited in the studies. Social support from family and friends is the most cited and thus becomes an important facilitator for exercise in pregnancy (Marquez et al, 2009; Leiferman et al, 2011; Melton et al, 2013). Social support, especially emotional support from family members and friends, is significantly related to lower anxiety levels and higher self-efficacy for exercise during pregnancy (Leiferman et al, 2011; Melton et al, 2013). Pregnant women felt that social support reduces negative psychological mood and fear of harming the fetus, as well maintaining exercise behaviour in pregnant women (Krans & Chang, 2011; Leiferman et al, 2011; Riberiro & Milanez, 2011).

Further, advice and information from HCPs have an impact on exercise behaviour in pregnant women (Leiferman et al, 2011; Put, Chuang & Chan, 2015). Informational supports from HCPs facilitate pregnant women to attain adequate knowledge of exercise during pregnancy (Marquez et al, 2009; Riberiro & Milanez, 2011; Fieril et al, 2014; Muzigaba, Kolbe-Alexander & Wong, 2014) and also motivate them to engage in exercise (Marquez et al, 2009; Cioffi et al, 2010; Put, Chuang & Chan, 2015) such as walking, swimming, or yoga (Leiferman et al, 2011).

- **Environmental facilitators**

Health behaviour is associated with the environment, particularly exercise behaviour. Several studies found a positive relationship between environmental factors and pattern of

exercise behaviour (Marquez et al, 2009; Krans & Chang, 2011). Environmental factors include weather, access to resources (i.e. free resources and cost for exercise), and resources of exercise (i.e. green space, gym, and park) that motivate exercise in pregnant women. Pregnant women explained that weather in summer motivated their regular PA. They enjoyed going outside, which increased opportunities for exercise (Leiferman et al, 2011). Latino and non-Latino white pregnant women in America said that good weather encouraged them to engage in exercise (Marquez et al, 2009). Apparently, this is specific to temperate countries. On the other hand, in tropical countries, daytime weather is typically either hot or rainy so there is greater consideration for practical possibilities of outdoor exercise.

Pregnant women indicated that resources of exercise and access to resources of exercise could motivate and facilitate exercise such as availability of exercise classes or groups, a structured exercise programme, free gym membership and low-cost facilities (Marquez et al, 2009; Krans & Chang, 2011; Put, Chuang & Chan, 2015). Some pregnant women mentioned that PA, as a means of transportation such as walking somewhere (e.g. to a local shop), provided a chance to increase opportunities for leisure time PA (Leiferman et al, 2011).

Table 3.3: Facilitators to exercise during pregnancy from 18 studies (reported in 19 articles)

Level	Sub-level	Descriptive facilitators reported in the studies	Reference number of studies
Intrapersonal	1. Benefits of exercise	Individual's perception about short and long-term benefits of exercise such as physical fitness, weight control, improve maternal and fetal health, decrease in discomfort during pregnancy, easier labour and birth, increase in energy, relaxation, sense of well-being and happiness, decrease in depressive symptoms and less negative affects	Marquez et al. (2009); Cioffi et al. (2010); Leiferman et al. (2011); Krans & Chang (2012); Bennett et al. (2013); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Duncombe et al. (2009); Haakstad et al. (2009); Evenson & Bradley (2010); Ribeiro & Milanez (2011); Melton et al. (2013); Da Costa & Ireland (2013); Put, Chuang & Chan (2015); Merkx et al. (2017)
	2. Intrinsic motivation	Positive beliefs, joy/enjoyment, fun activities, part of their routine, self-schema, self-motivation, self-confidence, belief that they are "exercisers", exercise obligation, positive attitudes, perceived norms, behavioural control, intentions towards exercise. Chance to get outside, easy activities	Marquez et al. (2009); Leiferman et al. (2011); Bennett et al. (2013); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Duncombe et al. (2009); Haakstad et al. (2009); Evenson & Bradley (2010); Ribeiro & Milanez (2011); Melton et al. (2013); Da Costa & Ireland (2013); Guelfi et al. (2015); Put, Chuang & Chan (2015); Merkx et al. (2017)

Table 3.3: Facilitators to exercise during pregnancy from 18 studies (reported in 19 articles) (continued)

Level	Sub-level	Descriptive facilitators reported in the studies	Reference number of studies
Interpersonal	1. Social support	Social network and support systems with specific relationships such as friends and family members, emotional and informational support, group exercise/ prenatal classes support/ an opportunity to meet, socialise and expand the support network	Marquez et al. (2009); Cioffi et al. (2010); Leiferman et al. (2011); Krans & Chang (2011); Bennett et al. (2013); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Ribeiro & Milanez (2011); Put, Chuang & Chan (2015); Merckx et al. (2017)
	2. Advice and information	Informational supports from healthcare providers/professionals, adequate knowledge and practice of physical exercise during pregnancy Prenatal classes/Physical activity education programme for pregnant women at antenatal service centres in the communities (offer of information and alternative exercises)	Marquez et al. (2009); Cioffi et al. (2010); Leiferman et al. (2011); Fieril et al. (2014); Muzigaba, Kolbe-Alexander & Wong (2014); Ribeiro & Milanez (2011); Put, Chuang & Chan (2015)
Environmental	1. Weather	Good weather such as summer season	Marquez et al. (2009); Leiferman et al. (2011)
	2. Resources/Access	Accessibility to exercise facilities such as trails and parks, and built environment, transportation, overcoming a lack of affordable, facilities for childcare outside home or neighbourhood. Tools such as instructions DVDs, brochures and posters.	Marquez et al. (2009); Leiferman et al. (2011); Krans & Chang (2011); Muzigaba, Kolbe-Alexander & Wong (2014); Put, Chuang & Chan (2015)

3.6 Summary and report of the findings

The review has summarised the results of 21 qualitative and quantitative studies, reported in 22 articles, by identifying barriers and facilitators for exercise during pregnancy in many different contexts, including western and eastern countries. Intrapersonal level is the most commonly cited in the studies as both key barriers and facilitators for exercise in pregnant women. Health issues related to pregnancy are the most reported barriers to exercise during pregnancy such as symptoms or discomfort during pregnancy and physical limitations. Non-health related issues such as individual's knowledge, perceptions, attitudes and beliefs are often identified as intrapersonal barriers. Benefits of exercise during pregnancy and intrinsic motivation such as self-confidence, positive attitudes and beliefs are reported as intrapersonal facilitators for exercise in pregnant women.

At the interpersonal level, social support from family, friends, and significant people are identified as both main barriers and facilitators for exercise in pregnant women. Advice and information about exercise during pregnancy are also identified as important barriers and facilitators for pregnant women engaged in exercise during pregnancy. At the environmental level, resources of exercise and access to exercise resources are more frequently reported in the studies as both barriers and facilitators for exercise during pregnancy such as accessibility to exercise, sport gyms, or instruction tools for exercise during pregnancy. Weather, an external factor, is consistently reported as a barrier and facilitator for exercise in pregnant women mainly in countries with temperate climates. However, government policy such as policies for transportation, work or school, and cost of resources for exercise is reported in only two studies as barriers to exercise in pregnant women.

The review has clearly identified the barriers and facilitators to exercise in pregnant women. The summary of findings leads to a better understanding of how to design the exercise programme for prompting pregnant women to engage in exercise during pregnancy

until childbirth. It also was importance for identifying a topic discussion and areas for consideration in design of the exercise programme. However, limitations of this review must be acknowledged. The review focuses on barriers and facilitators for exercise in healthy pregnant women. Pregnant women with contraindications to exercise during pregnancy and complications during pregnancy and/or health conditions such as hypertensive disorders and gestational diabetes mellitus (GDM) were excluded from this review. Studies which focused on specific population such as overweight and obese pregnant women or those with higher risk of cardiovascular diseases and/or GDM were also excluded from this review.

In addition, ethnic or cultural background is another issue of consideration. Although most of the studies in this review were conducted in western countries; only two were conducted in Asia: Hong Kong and China, the views of women and HCPs in Thailand on the topics of barriers and facilitators to exercise in pregnancy were discussed before designing an exercise intervention for pregnant women. Therefore, the findings from this review have led to a discussion about the barriers and facilitators to improve exercise behaviour of pregnant women and also applied to design an exercise programme for pregnant women in Thailand.

3.7 Justification for conducting this study

Obesity and overweight (O&O) in pregnant women is a serious health issue in Thailand. The prevalence of O&O worldwide is increasing continuously which causes non-communicable diseases and complications in pregnancy. Meanwhile, exercise during pregnancy can increase physical fitness, decrease risk of cardiovascular diseases and control gestational weight gain, including raising the success rate of controlling obesity and overweight in the next generation. The Department of Health, Thailand conducts the policy that promotes all population performing regular exercise, including pregnant women (DoH, Thailand, 2014). It emphasises on creating motivation and discovering new knowledge so as to promote exercise in Thai pregnant women. The statistics show that women have low level

of exercise during pregnancy and even lower than before they get pregnant. It is noteworthy that while knowledge of barriers and facilitators to exercise during pregnancy is clear, exercise behaviour in pregnant women remains low.

Currently, antenatal care clinics in Thailand do not have a routine exercise programme for supporting the exercise behaviour of pregnant women. Evidence from the previous studies appears inadequate to support the integration of an exercise programme into usual antenatal care in Thailand. As most exercise supports are designed and developed by HCPs or the government, there has been little evidence of designing an exercise programme based on the principles of collaboration between HCPs and clients. It is the challenge for the researcher that was to design an exercise programme that would appeal to pregnant women and could be managed and supported by HCPs. This appeared to require a mixed methods study both quantitative and qualitative approach for improving the exercise behaviour of pregnant women. It seemed appropriate to try to work with both HCPs and pregnant women to develop the exercise programme. It is advisable that a suitable exercise programme for pregnant women should be designed drawing on the guidance of the Thai Government. That exercise programme was subsequently tested in a randomised controlled trial feasibility and used to explore both experiences of participants engaged in an exercise programme and their healthcare professionals' opinions of such a programme.

CHAPTER 4

METHODOLOGY AND METHODS

The purpose of the study was to develop an exercise programme for pregnant women and to test preliminary effects and assess the issues of feasibility and acceptability of the exercise programme and of the randomised controlled trial (RCT) in Thailand. This study focuses on the problem of low exercise behaviour of pregnant women in Thailand that is related to the increasing rate of overweight and obesity. The scoping review in Chapter two identified the nature of the problem. The findings from the narrative review, presented in Chapter Three are of particular relevance to designing the exercise programme for pregnant women and were used in the co-design workshops with women and healthcare professionals (HCPs). Focused discussion took place on the cultural consideration of barriers and facilitators in the context of women's lives in Thailand. The collaboration between HCPs and pregnant women was used to design the exercise programme in order to overcome the key barriers and put in place a programme that would be likely to facilitate exercise in pregnancy. The exercise programme was tested in a feasibility study and subsequently assessed by the pregnant women as well as HCPs. The first part of the chapter explains the research philosophy and rationale for the method. The second part describes multiphase mixed methods applied to this study, including research rigour.

The initial phase involved pregnant women and healthcare professionals (HCPs) who took part in workshops to design an exercise programme during pregnancy. In the second phase, the exercise programme was tested in a feasibility randomised controlled trial (RCT) while pregnant women and healthcare professionals' experiences of the exercise programme were explored by using interviews and focus group respectively.

4.1 Part 1 :Methodology

The philosophical assumptions and research paradigm for the study have been carefully considered during the design. These reflect the researcher's views and decisions to conduct this study in a particular way (Muncey, 2009; Creswell & Plano Clark, 2011). A research paradigm is defined as a worldview, which is a set of the assumptions and beliefs of the researcher in connection with views of realism, existing knowledge and methodology (Muncey, 2009; Creswell & Plano Clark, 2011).

4.1.1 Research philosophy

The paradigm in this study is a pragmatic worldview that focuses on problems, consequences of actions, real world practices and pluralistic methods for collecting and analysing the data (Johnson & Onwuegbuzie, 2004; Johnson et al, 2007; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011). This paradigm addresses the research objectives that require multiple perspectives from a variety of methods to discover reality (Johnson & Onwuegbuzie, 2004; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011). A pragmatic worldview is a philosophy that mixes positivism and constructivism (Muncey, 2009; Cameron, 2011; Creswell & Plano Clark, 2011, Halcomb & Hickman, 2015).

The positivist paradigm focuses on determining reality that is deduced from theories. According to this paradigm, reality is real and truth is universal. Knowledge is thus obtained through direct and indirect observations and measurement to confirm or test a theory (Johnson & Onwuegbuzie, 2004; Creswell & Plano Clark, 2011). Meanwhile, the constructivist paradigm draws on understanding the nature of reality and multiple meanings that are generated inductively from data. Knowledge is hence created through interactions between researchers and participants within the environment (Johnson & Onwuegbuzie, 2004; Creswell & Plano Clark, 2011).

The pragmatic worldview is taken in this study on the following grounds:

- The nature of reality of the exercise behaviour in pregnant women has multiple forms, encompassing both objectivity and subjectivity, which cannot be discovered through either positivism or constructivism alone (Creswell & Plano Clark, 2011). For this reason, pluralistic methods were required to discover reality through measurement in the feasibility RCT and interactions with participants during workshops and qualitative interviews.
- The relationship between the researcher and the participants (both pregnant women and HCPs) being researched is based on real world experiences (Creswell & Plano Clark, 2011; Christ, 2013). The researcher focused on the problems of low level of exercise behaviour among pregnant women in Thailand and addressed the research questions. This relationship is thus a mix between distance and closeness as the researcher collected data from pregnant women and HCPs at research settings.
- Value plays a role in multiple stances that may impact on research processes and interpretations of research findings. The researcher has included both biased (the views of women and healthcare professionals based on their own experiences) and unbiased (objective measurements) perspectives during data collection and analysis that may influence the research process (Creswell & Plano Clark, 2011; Christ, 2013).
- The process of this research was a combination of qualitative and quantitative approaches to discover the reality of exercise behaviour of pregnant women based on the research questions (Creswell & Plano Clark, 2011; Christ, 2013). It is commonly called a mixed methods research (Johnson & Onwuegbuzie, 2004; Johnson et al, 2007; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011).

In other words, the research paradigm of mixed methods is based on a pragmatic worldview that addresses the research problems, practices and consequences of action, rather than either exploring understanding or determining theory (Johnson & Onwuegbuzie, 2004;

Johnson et al, 2007; Creswell & Plano Clark, 2011). Mixed methods research is a mix of both quantitative and qualitative research into a single study. It integrates methodology, data collection and analysis processes to gain a better understanding of the research problems and results (Johnson et al, 2007; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011; Ngamvichaikit, 2015).

4.1.2 Rationale for the use of mixed methods

This study is based on a pragmatic worldview because qualitative and quantitative approaches combined appear to better address problems and answer questions concerning how to improve exercise behaviour during pregnancy in Thailand (Johnson & Onwuegbuzie, 2004; Johnson et al, 2007; Creswell & Plano Clark, 2011). A multiphase mixed methods design was applied to address the following research questions:

1. Can workshops with pregnant women and HCPs be used to design an exercise programme suitable for pregnant women in the context Thai of healthcare service?
2. Is an exercise programme based on the Thai Government's guidance for exercise in pregnancy feasible and acceptable?
3. Is it feasible to recruit to a randomised controlled trial (RCT) for exercise and measure its effects on exercise intervention?
4. What experiences have pregnant women and healthcare professionals (HCPs) had in this exercise programme?

This study was designed to obtain answers to the research questions by using a broad range of data sources both sequentially and concurrently from workshops, both feasibility studies of the RCT and the intervention, a questionnaire, interviews, and focus groups over two phases of the study. It aims to bring about better insights (Johnson & Onwuegbuzie, 2004; Halcomb & Hickman, 2015) because a single method cannot explain all aspects of the exercise behaviour of pregnant women in Thailand. The complementary data can explain and

enhance the understanding of the results within a single study (Johnson & Onwuegbuzie, 2004; Johnson et al, 2007; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011).

The study started with collaboration between pregnant women and HCPs to design an exercise programme during pregnancy through workshops. This exercise programme is considered appropriate for pregnant women in the Thai context of healthcare service because the co-designed programme is based on the actual experiences of pregnant women and HCPs who are stakeholders in real life situations of exercise behaviour during pregnancy. It is noteworthy, however, that feasibility and acceptability, including preliminary outcomes of the exercise programme in the fieldwork, cannot be explored if this study finishes in the phase of designing an exercise programme.

Therefore, the study is designed to test this exercise programme in a feasibility RCT to understand the impacts of the exercise programme on pregnant women. A feasibility RCT is a tool for answering the research questions in terms of feasibility and acceptability of the exercise programme and to test preliminary outcome measures with pregnant women. In addition, qualitative interviews and a focus group after the intervention were employed to better understand the outcomes from the feasibility RCT. Such qualitative method ensures that findings from this study can explain the exercise behaviour of pregnant women in Thailand from views of both pregnant women and HCPs.

4.2 Part 2 :Methods

The research design was divided into two linked phases (see Appendix A). The design of the study is shown in Figure 4.1. The first phase discussed and developed an exercise programme for pregnant women through the workshops in a Thai healthcare setting. The second phase involved a feasibility RCT and a qualitative study, so as to test feasibility of the exercise programme, and to understand the experiences of those participating in the programme.

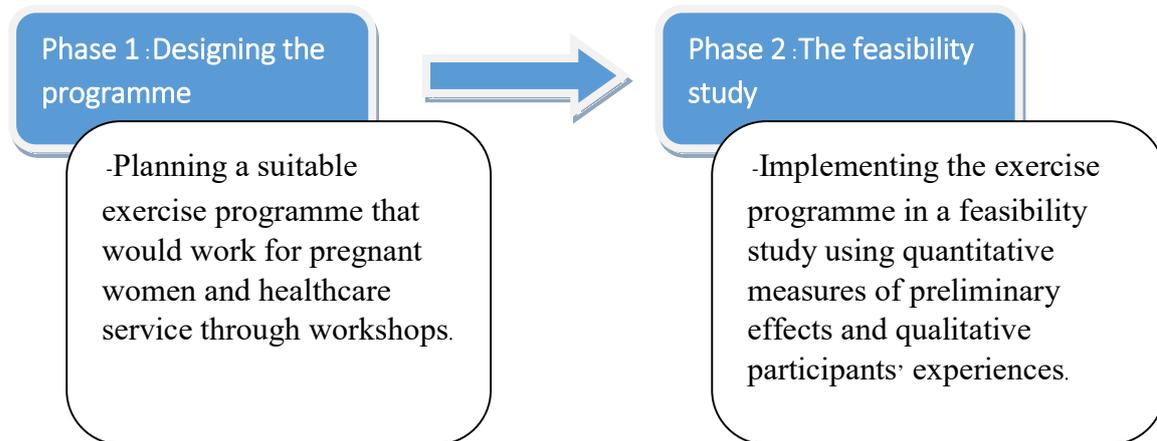


Figure 4.1: Multiphase study design

4.2.1 Population and sample

Women experiencing low risk pregnancy were the main target population while HCPs, who provided data from the perspective of healthcare workers, were counted as the minor one. The study consisted of two phases. The first phase included seven pregnant women, and six HCPs. The second phase comprised two stages: a feasibility RCT including 66 pregnant women, and qualitative components including ten pregnant women for interviews and four HCPs for a focus group.

4.2.1.1 Pregnant women participants

The antenatal clinic offers antenatal care for both low and high risk pregnant women. Normally, the clinic offers antenatal care for low risk pregnant women on at least five occasion: gestational age (GA) less than or equal to 12 weeks, 20 weeks, 26 weeks, 32 weeks, 38 weeks, 40 weeks and 41 weeks or until delivery. Pregnant women at 12-16 and 30-32 weeks of gestation visit the clinic every 1-2 weeks for blood and/or screening tests and collecting the results. Approximately 200 newly pregnant women per month attend this clinic. Antenatal care is provided for 50 women at all stages of pregnancy per day. Approximately 10% of all pregnant women during 2014 and 2015 were found with high risk

pregnancy such as hypertensive disorders during pregnancy and cardiovascular disease (3rd Regional Health Centre, Thailand, 2011; 2015).

4.2.1.2 Healthcare professional (HCP) participants

Generally, the number of HCPs associated with antenatal care at the hospital comprises eight nurses/midwives, two medical doctors, two healthcare educators and four public health workers (3rd Regional Health Centre, Thailand, 2016).

4.2.2 Phase 1 :Workshops

Workshops, including pregnant women and HCPs, were set up to develop the structure of the exercise programme. An exercise programme, based on recommendations of the American College of Obstetricians and Gynecologists (ACOG), American College of Sports Medicine (ACSM) and MoPH, Thailand (ACOG, 2002, 2015; ACSM, 2014, Suputtitada, 2005) (see Appendix B), was discussed in two workshops which took place one month apart in 2016-2017 (14th December 2016 and 13th January 2017).

4.2.2.1 Collaboration between healthcare professionals (HCPs) and clients

The principles of collaboration between HCPs and pregnant women were used in the process of two workshops. Collaboration is defined as the relationships between two or more parties working together (Krishna, Lazarus & Dhaka, 2013; Pestronk et al, 2013; Prybil et al, 2015) as “a partnership for exchanging information, altering activities, sharing resources and enhancing the capacity of another for mutual benefit and to achieve a common purpose” (Himmelman, 2002; Prybil et al, 2015).

In the United Kingdom (UK), the principles of collaboration were raised and acted by the Health Foundation that called “Person-centred care” (The Health Foundation, 2014). This vision has been changed from the way HCPs do to or for people, to HCPs working collaboratively with people for self-management on health and healthcare. There is a potential to improve health outcomes, quality of healthcare, satisfaction of patient and

communication between HCPs and people on their health and health care, including changes in their health behaviour (De Silva, 2011; 2012; 2014; Mulley, Trimble & Elwyn, 2012; The Health Foundation, 2014). Person-centred care supports people who use healthcare service for developing knowledge, skills and confidence for the better decision making in health and health care based on four principles: 1) affording people dignity, compassion, and respect; 2) offering both of coordinated care; and 3) personalised care on support or treatment; and 4) supporting people to recognise and develop strengths and abilities of people to enable them to live an independent and fulfilling life (The Health Foundation, 2014).

In Thailand, the concept of collaboration is relatively new in healthcare service .The principles of collaboration are different from the traditional healthcare service)MoPH, 2010). There have been some changes in relationship between HCPs and clients from the passive health care to collaboration health care through exchanging information, knowledge and experiences, planning of treatment or alternative ways of care, making decision together, processing, and evaluating. The roles of clients and HCPs have shifted from traditional provider-receiver to partnership in healthcare service. The impacts of such collaboration reduce the gap between clients and HCPs and improve satisfaction of healthcare services (Pestronk et al, 2013; Spencer, Dineen & Phillips, 2013; Prybil et al, 2015). Collaboration has happened in the primary health care as a multi-sectoral approach between health and other sectors of communities, including agriculture, education, rural development, and community organisations at individual, group, and community levels (NHDPC, Thailand, 2011; The Primary Health Care Division, Thailand, 2014). Most of the healthcare service was created on a top-down basis by the government (MoPH, 2010; NHDPC, Thailand, 2011; 3rd Regional Health Promoting Centre, Thailand, 2011). The concept of collaboration has been recently introduced and plays a new significant role in healthcare service.

However, principles of collaboration are limited on the part of clients who are conscious and capable of making a decision on their self-management (The Health Foundation, 2012; 2014). From the study about person-centred care for people with long-term conditions (diabetes or Parkinson's disease), clinicians who care for people with long-term conditions mentioned tension and uncertainty in their work to support patients' self-management. They have concerns on health conditions, health-related behaviours and medication-taking of patients. Clinicians feel that patients sometimes over or underestimate their own abilities. Patients' knowledge and skills, including their self-confidence, need more support to be able to manage themselves (Entwistle et al, 2018). There is a relatively small number of studies about collaborative care in Thailand .Most collaboration is conducted across health care providers as a multi-disciplinary approach of a healthcare team (Sindhu, Pholpet & Puttapitukpol, 2010; Saokaew et al, 2012; Choosri et al, 2016). Sindhu, Pholpet & Puttapitukpol (2010) argued that a nurse-led, collaboratively developed programme across health care teams has potential to improve chronic illness patient satisfaction with community care and decrease severity of illness at the third and eight weeks of post-discharge (Sindhu, Pholpet & Puttapitukpol, 2010). Hence, the collaborative approach can be effectively implemented for healthcare service in Thailand as a case for developing country (Saokaew et al, 2012; Choosri et al, 2016).

4.2.2.2 Sample and recruitment for the workshops

The sample comprised thirteen participants: seven pregnant women, and six HCPs.

For pregnant women: A target sample size was 7-10 pregnant women for the workshops. Pregnant women were invited by a poster advertising this study on a notice board at ANC and were initially approached by the reception nurse based on the prompt sheet (see Appendix D). When a pregnant woman expressed willingness to participate in the workshops, they contacted the researcher by telephone (free call) or in person at the ANC during office

hours. Women interested in participation were given full information by the researcher. When the pregnant woman decided to participate in the study, they were asked to give written consent to the researcher at the next visit (see summary Table 4.5). Then, the inclusion and exclusion criteria were screened through the questionnaire (see Appendix E).

Women aged 20 years or older who were able to read, write, speak and understand the Thai language would be eligible for recruitment. Those with any contraindications against exercise during pregnancy, as verified by the Physical Activity Readiness Medical Examination for Pregnancy (Thai version) (PARmed-X) (Davies, Wolfe, Mottola & MacKinnon, 2003; Suputtitada, 2005), and those who already exercised at least 30 minutes a day, three days a week, were excluded from the study.

For HCPs :A target sample size was 6-8 HCPs for the workshops. The sampling grid is shown in Table 4.1. HCPs were invited by a poster advertising this study on a notice board and initially approached by the secretary of the human resource after a monthly meeting (see Appendix F). When HCPs expressed willingness to participate in the workshops, they contacted the researcher by telephone (free call) or in person at the ANC during office hours. The researcher provided the full information sheet and answered any questions. The participants were asked to give a written consent after their decision at their convenience (see summary Table 4.5). HCPs whose works was concerned with antenatal care would be qualified for recruitment. Then, a purposive sampling was conducted (see Appendix G).

Table 4.1: Purposive sampling frame for HCPs in the workshops

Variable	Details of variable	
Nurses/midwives	Who care for women on their return visit (follow up room)	Who care for new clients (admission room)
Specialists	Doctor	Physiotherapist
Health care providers	Healthcare educator	Healthcare worker

4.2.2.3 Process of the workshops

The participants in the workshops assisted in design choices for exercises, discussed how women should be reminded of the exercise schedule, and advised on the content of the leaflet to accompany an exercise programme. Choices from the workshops concerning the materials were used to promote exercise activities and decisions about when to text or make reminder calls, including wording for these. The final decision about the design of the exercise programme was discussed in terms of suitability, safety, and practical application with a physiotherapist who was a consultant in this study (see Appendix C). To ensure accuracy, in the last session of the workshops, the protocol of the exercise programme was shown to the participants and the main findings from both of the workshops were summarised. The process of developing an exercise programme is shown in Figure 4.2.

In both workshops, the participants were split into two small groups (six and seven participants per group). The groups were a mix of pregnant women and HCPs so that the discussion reflected diversity of knowledge and experiences. The researcher is aware that the traditional interaction between pregnant women and HCPs in Thailand is characterised by power imbalance. The researcher thus encouraged pregnant women to contribute to discussions with positive and specific feedback. Their experiences were summarised and acknowledged for reinforcement. The researcher used a range of strategies to ensure that

everyone had a chance to speak and that conversations remained on topic with no single individual dominating.

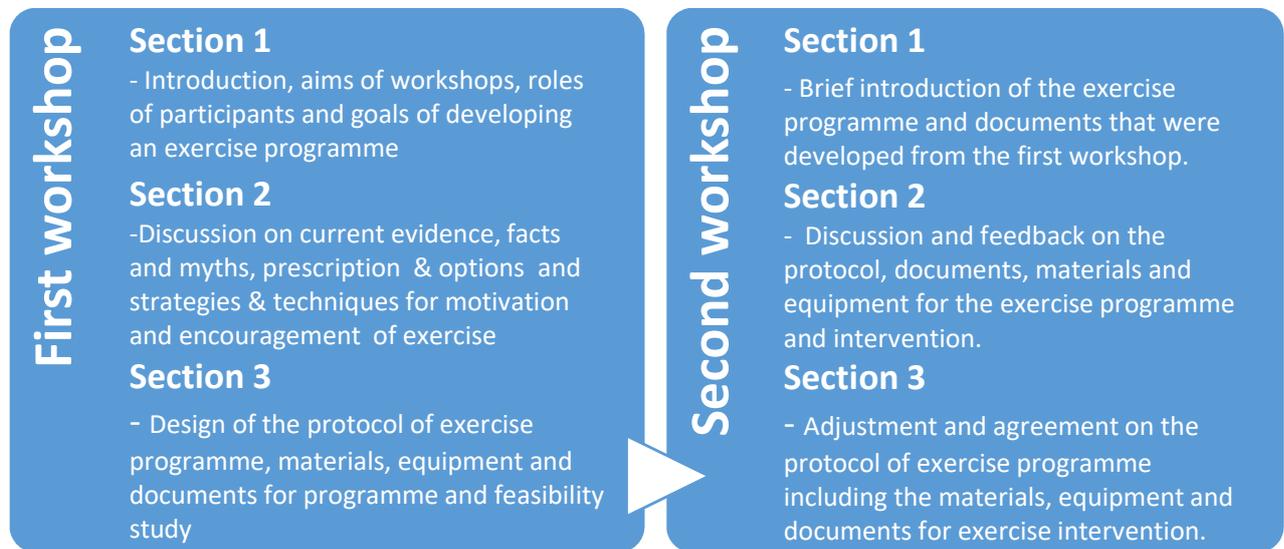


Figure 4.2: Process of developing an exercise programme

In the first workshop, the aims of the workshops and roles of both pregnant women and HCPs were explained by the researcher. Care was taken to ensure everyone's understanding about the need for confidentiality and respect for everyone's views. The researcher gave a short presentation on the importance of exercise in pregnancy and frequency and intensity required, including recommendations of exercise for pregnant women. The discussion began with questions concerning exercise experiences of pregnant women. Then, the participants were split into two small discussion groups.

One discussion group was led by the researcher and the other was led by an assistant researcher (see Appendix V). The assistant researcher is qualified as a nurse at the Tambon Health Promoting Hospital, Banbung, Tambon Nongkrot (sub-district), Banphotpisai district, Naknon Sawan province, Thailand. She has experience working with public health sector in communities and hospitals since 2001. She has been trained as a moderator for group discussion by a nursing and public health institution.

The participants then discussed their knowledge of facts and myths about exercise in pregnancy, and their experiences and beliefs about barriers or facilitators to exercise whilst being pregnant. They also discussed strategies and techniques for motivating and encouraging women to exercise more. In the last session, the main findings were summarised by the researcher and her assistant researcher in each small group. The participants were invited back in the whole group discussion to agree the summary of key issues, and make an appointment for the next workshops.

In the second workshop (one month later), the aims of the workshop, roles of the participants and the first workshops were reviewed by the researcher. Then, the participants were split into two small groups for discussion as in the first workshop. The summary of the first workshop was provided by the researcher and her assistant researcher in each small group. The participants discussed and gave feedback on the proposed exercise programme. The main topic guide for discussing the protocol of the exercise programme was run as follows: facts and myths about exercise in pregnancy, including recommendation of exercise for pregnant women; barriers and facilitators to exercise in pregnancy; and strategies and techniques for motivating and encouraging women to exercise more such as feedback, rewards, goal setting and planning, role models, knowledge and materials for reminder.

After that, the participants went back to discuss in the whole group. The exercise programme was adjusted and agreed by the workshop participants. When the two groups had conflicting results, the researcher referred back to evidence, limitations, and their ideas and then motivated the participants to clarify unclear points based on the consultation with the physiotherapist. Next, their adjustments and agreements of the exercise protocol were summarised by the researcher.

The duration of this phase for designing an exercise programme was eleven weeks: six weeks for the recruitment, and five weeks for the workshops. Each of the two workshops

took about two hours in the afternoon, as antenatal care activities generally take place in the morning. The clinic had nurses/midwives available who could contact the HCPs during the workshops in case of emergency. Participants were offered a travel expense of 150 baht as well as a gift voucher of 300 baht at the end of each of the two workshops.

4.2.2.4 Data collection and analysis of the workshops

The data were collected through the workshops and small group discussions with a digital voice recorder as well as notes taken on a flip chart and note-taking by the researcher and the assistant researcher. The main findings from the workshops were summarised to ensure accuracy and elicit comments from the participants. All decisions made at the development stage were subsequently informed on the content of the exercise programme and the exercise activities were explained to the pregnant women in the exercise intervention by the researcher. The data were managed by the researcher manually. The key themes were identified from the workshops for designing an exercise programme in relation to the exercise behaviour in pregnant women and healthcare service. The outcomes of the discussion regarding which protocols of exercise would work for pregnant women and service providers were organised in a data set in accordance with the topics, and then summarised in an exercise programme handbook. The analysis process was checked for accuracy with the supervisors. All data collected from the design of an exercise programme were used in the feasibility randomised controlled trial.

All data were fully transcribed. The full transcripts were checked and cross-checked with the audio recorder files for accuracy by the researcher and the field supervisor. The transcripts of interviews and focus group were translated from Thai to English language by the researcher. A sample of the transcripts was checked for accuracy by a professional translator. The full transcripts and translations were kept securely on a personal laptop with a

password to protect confidentiality and stored on an external hard drive with encryption as well as UEA computer system, with a firewall to prevent damage or loss.

4.2.3 Phase 2: Feasibility study

The feasibility study included the testing of the intervention and collection of qualitative data on experience of the programme. The design of the feasibility study is shown in Figure 4.3. The design combined both quantitative and qualitative data for addressing the research questions. It was divided into two parts: a feasibility RCT, and qualitative components designed to explore the experiences of those participating in the exercise programme through telephone interviews as well as a focus group designed to examine the experiences of HCPs indirectly involved in the exercise programme. The data were collected and analysed from the participants in the feasibility RCT and then followed up with a qualitative approach by a subset of participants who previously participated in the feasibility study. The results from feasibility RCT and qualitative approach were integrated and explained together.

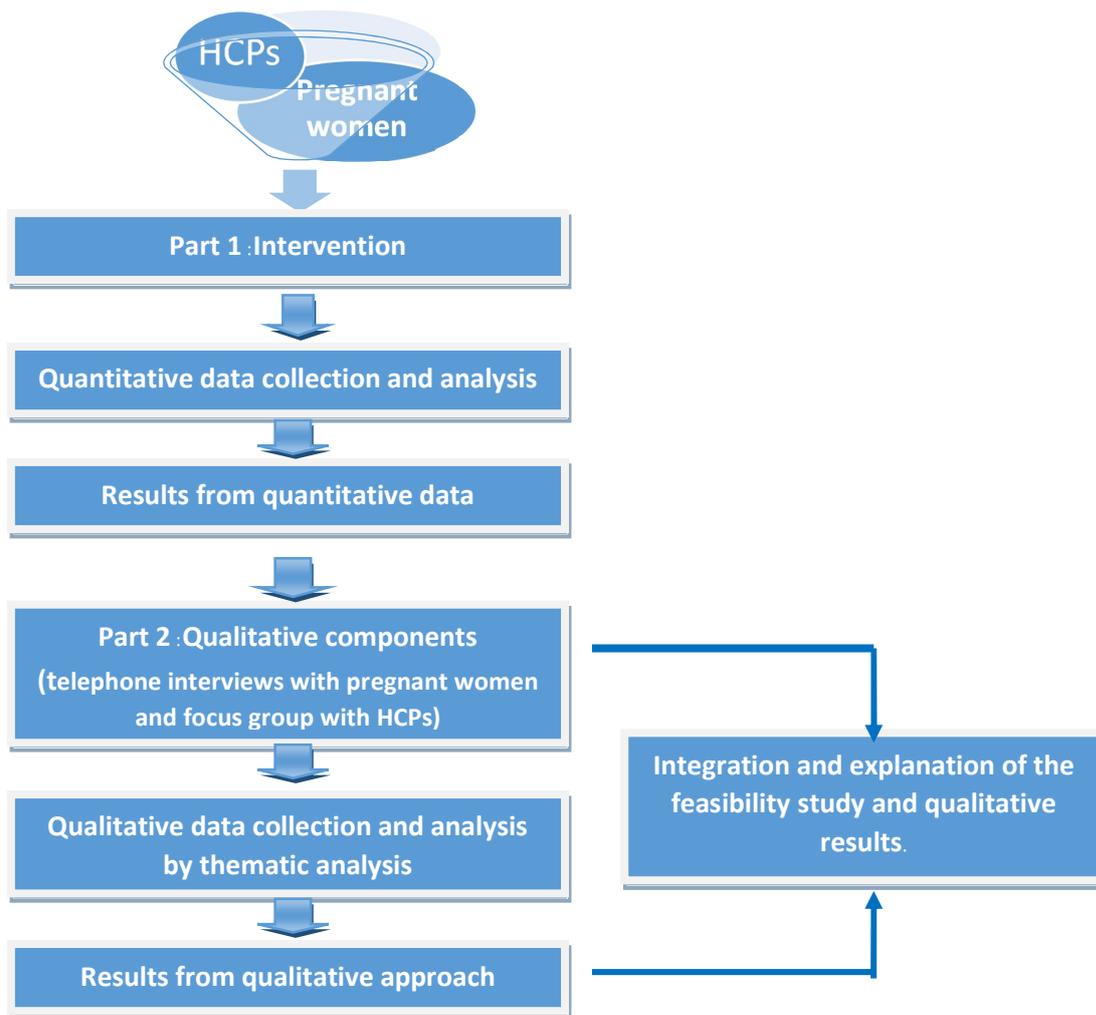


Figure 4.3: Design of the feasibility study

A feasibility study began after the second stage of ethical approval process, where the amended exercise intervention was approved. The timeline of the feasibility study is shown in Figure 4.4.



Figure 4.4: The timeline of the feasibility study

The feasibility RCT was designed to investigate the following issues: the number of women who were willing to participate in the study and be randomised; the suitability of the inclusion criteria; the number of participants who adhered to and terminated the intervention; the number of participants completing the intervention; and the process of data collection. The programme acceptability of the women who undertook the exercise programme was explored through the questionnaire after the intervention. The data were collected from 16-18 weeks of gestation until two weeks after the expected date of delivery (EDD). The outcome measures for the feasibility study are shown in Table 4.2.

Table 4.2: Outcomes measures for the feasibility study

Measures	GA 16-18 wk.	GA 18-20 until 28-30 wk. (During intervention)	GA 30-32 wk. (After intervention)	GA 31-36 wk.	2 wk . after EDD
1. Gestational age (GA)	X	-	X	-	X
2. Height	X	-	-	-	-
3. Body weight (BW)	X	-	X	-	X
4. Blood pressure	X	-	X	-	-
5. Exercise behaviour	X	-	X	-	-
6. Stress score	X	-	X	-	-
7. Acceptability of the exercise programme *	-	-	X	-	-
8. Baby birth weight (Baby BW)	-	-	-	-	X
9. Personal characteristics	X	-	-	-	-
10. Exercise checklist*	-	X	X	X	X
11. Exercise diary*		X	X	X	X
12. Pulse rate*	-	X	-	-	-
13. Telephone interviews * and focus group	-	-	-	X	-

*Only pregnant women who participated in the intervention group

4.2.3.1 Exercise intervention

The study was designed to test three aspects of the research in preparation for developing an RCT in the future: acceptability, feasibility, and assessment of preliminary effects (Bowen et al, 2009). The process of conducting the feasibility RCT study is shown in Figure 4.5 based on the Consolidated Standards of Reporting Trials (CONSORT), 2010 (Schulz, Altman, & Moher for the CONSORT Group, 2010). The CONSORT checklist was reported in the Appendix AA. (Eldridge, et al, 2016). The preliminary effects consisted of primary and secondary outcomes. The primary outcome was defined as the gestational weight gain. The secondary one was defined as the effects on mother and offspring as follows: 1) mother in terms of frequency and duration of exercise behaviour, blood pressure, pulse rate, stress score, and adverse events; and 2) offspring in terms of baby birth weight.

The feasibility study was a parallel group design RCT for comparison purpose. After baseline measures, participants were randomised to either the control or the intervention group at GA 16-18 weeks by groups of four and six blocked randomisation. The randomised blocking in groups of four and six was prepared in advance at University of East Anglia (UEA). The randomisation sequence was placed in sealed sequentially numbered envelopes to confirm the concealment of allocation. After randomisation, participants in both the control and intervention groups were coded by the researcher using the maternal and child health handbook.

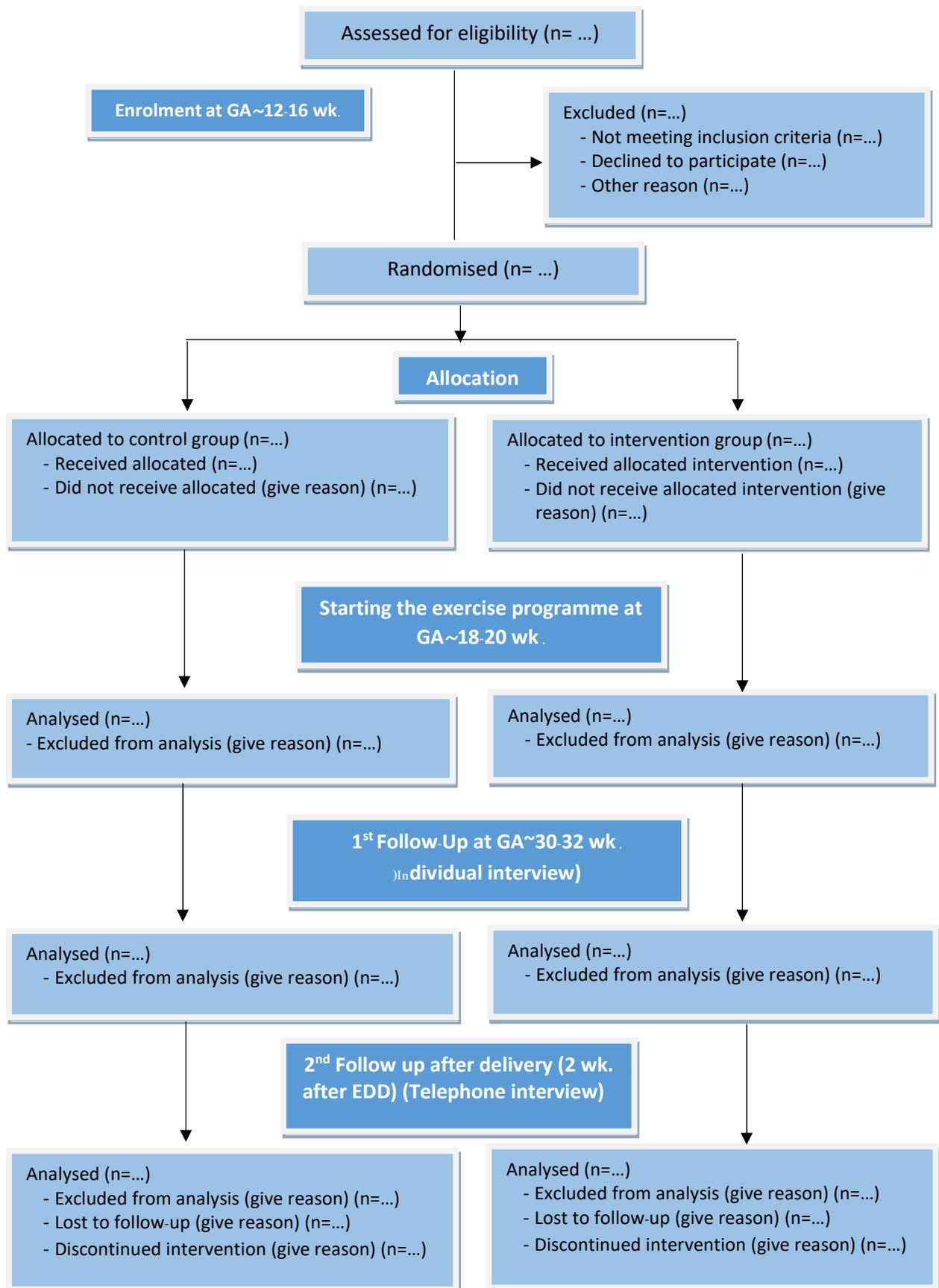


Figure 4.5: Process of the feasibility RCT study (CONSORT, 2010)

The intervention group participated in the exercise programme over a period of ten weeks, from GA 18-20 weeks to GA 28-30 weeks, along with the usual antenatal care while the control group received the usual care only. The exercise intervention and usual care were reported based on the TIDIER framework in Figure 4.6 (Campbell, et al, 2018). Women randomised to the usual care received exercise information and demonstrated workouts at 16-28 weeks of gestational age for 30 minutes in a prenatal education class (3rd Regional Health Centre, Thailand, 2011). After the ten-week intervention, all participants returned to receiving usual care.

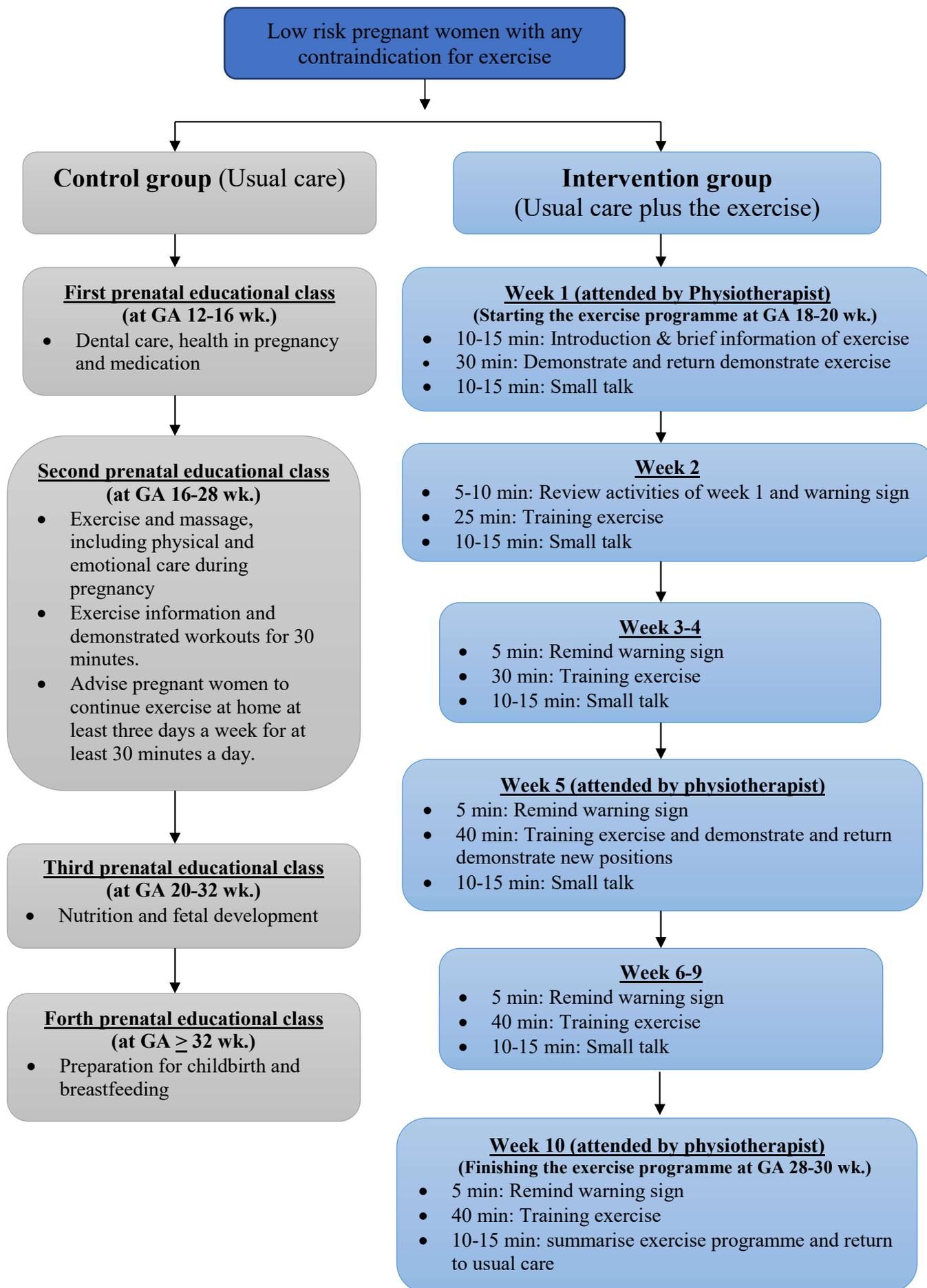


Figure 4.6: Reporting usual care and the exercise intervention

4.2.3.1.1 Sample and recruitment for the exercise intervention

As for the target sample size for the feasibility RCT was 66 pregnant women (33 for the control group and 33 for the intervention group), allowing for a 10 % dropout rate in each arm (Hertzog, 2008). The sample size justification for a feasibility study varies widely depending on the research objective, question, population and context (Arain et al, 2010; Billingham, Whitehead, & Julious, 2013). Browne (1995) recommended a minimum sample size for pilot trial of 30 participants in each arm to estimate a significant parameter (Browne, 1995; Lancaster, Dodd, & Williamson, 2004). From the review of target sample size for pilot and feasibility RCT, which were running within the United Kingdom, using the data from the United Kingdom Clinical Research Network (UKCRN) reported the median sample sizes per arm of feasibility trials were 36, in a range of 10 to 300 participants and pilot trials were 30, in a range of 8 to 114 participants (Billingham, Whitehead, & Julious, 2013).

The pregnant women in the feasibility study were not the same women who took part in the workshops. Inclusion criteria included healthy women between 12 and 16 weeks of gestation for recruitment. Women aged 20 years or older and able to read, write, speak and understand Thai language would be eligible for recruitment. Those with any contraindications to exercise during pregnancy, as verified by the Physical Activity Readiness Medical Examination for Pregnancy Thai version (PARmed-X) (Davies, Wolfe, Mottola & MacKinnon, 2003; Suputtitada, 2005), and those who already exercised at least 30 minutes a day, three days a week, were excluded from the study. Women with extremely high stress scores (score \geq 30 points) during pregnancy were excluded.

Women were invited by a poster advertising the study on a notice board at ANC and initially approached by the reception nurse (see Appendix D). When a pregnant woman expressed willingness to participate in the intervention, they contacted the researcher through telephone (free call) or in person at the ANC during office hours. Women interested in

participation were given full information by the researcher. The researcher took a written consent at the next visit after their decision (see summary Table 4.5). The participants were screened through inclusion and exclusion criteria (see Appendix H).

4.2.3.1.2 Data collection and analysis of the exercise intervention

The data were collected by the researcher in person at baseline (GA 16-18 weeks) (see Appendix J) and after the intervention (GA 30-32 weeks) (see Appendix K) as well as by telephone at two weeks after EDD (see Appendix L) in a private room within the ANC clinic. The total time for each questionnaire was about 15 minutes. The details of instruments are shown in Table 4.3. Safety information was provided based on evidence of ACOG, ACSM and MoPH (Thailand) (ACOG, 2002, 2015; ACSM, 2014, Suputtitada, 2005). When women had contraindications to exercise and serious adverse events during the study, they were excluded from the study. Then, the adverse events protocol was carried out for exercise safety during the exercise intervention by the researcher under supervision of the field supervisor and consultant (see Appendix I). One physiotherapist was invited as a consultant during the exercise intervention on three occasions: the beginning, middle, and end of the intervention. Participants were offered a gift voucher of 1,000 baht for participating in the study and travel expenses of 150 baht per time when they joined an exercise programme at the hospital.

The following five instruments were included:

1. Global Physical Activity Questionnaire (GPAQ) was used to monitor physical activity levels in adults by WHO (Armstrong & Bull, 2006). The validity and reliability were evaluated from two studies by Herrmann, Heumann, Der Ananian & Ainsworth (Herrmann et al, 2013). In this study, the Thai version of GPAQ was used for assessing the exercise behaviour of women. It is also employed for physical activity survey among general people aged at least 15 years old (Division of Physical Activity & Health, Thailand, 2009).

2. Personal characteristics consisted of maternal age, education, occupation and work inside or outside their home, the number of the pregnancy, the number of the delivery, the number of children and the expected date of delivery (EDD).

3. Stress score (see Appendix M) was collected from the women as part of their usual antenatal clinical assessments and these data were then extracted by the researcher. All pregnant women were assessed during GA 16-20 and 28-32 weeks by a nurse in the antenatal clinic, using a stress self-assessment tool within the Thai version of mother and child health handbook (Ministry of Public Health, Thailand, 2012). When women had high scores (≥ 18 points), they would be referred to a counselling nurse for further care as a usual practice of the ANC clinic. Women with extremely high stress score (score ≥ 30 points) were excluded from the study.

4. Acceptability of the exercise programme questionnaire, developed by the researcher, comprised acceptability, satisfaction, reason for adherence or discontinued participation and suggestion for any changes to the exercise programme. The data were collected from pregnant women who participated in the exercise intervention group.

5. Exercise checklist (see Appendix N) was used for referring to the participants' attendance and adherence to the intervention. It was a checklist after each exercise has been completed from the beginning of the intervention (at GA~18-20 weeks) until the end of the exercise intervention by the researcher.

6. An exercise diary (see Appendix N) was used to assess adherence to the exercise intervention to be completed from the beginning of the intervention (at GA~18-20 weeks) until delivery by the participants. The exercise diary consisted of the type and duration of exercise in a day, including the assessment of exercise intensity by pulse rate and talk test. The participants were phoned by the researcher to ask about exercise behaviour from exercise diary at two weeks.

Table 4.3: Details of instruments for the exercise intervention

Instruments	Measure
1. Global Physical Activity Questionnaire (GPAQ)	It was conducted to assess the exercise behaviour of women (Thai version).
2. Personal characteristics	They comprised age, education, occupation and work inside or outside, the number of pregnancies, the number of deliveries, the number of children and EDD.
3. Stress score	It was routinely collected during antenatal clinical assessments by the clinical team .These data were then extracted by the researcher.
4. Acceptability of the exercise programme questionnaire*	It comprised acceptability, satisfaction, reason for adherence to or discontinuing participation and suggestions for any changes to the exercise programme.
5. Exercise checklist*	It was used for referring to participants' attendance and adherence to the intervention. This was a checklist each time the exercise was completed from the beginning of the intervention (at GA~18-20 weeks) until the end of the programme by the researcher.
6. Exercise diary*	The exercise diary was used to assess adherence to the intervention to be completed from the beginning of the intervention (at GA~18-20 weeks) until delivery by the participants. The participants were phoned by the researcher to ask about exercise behaviour from exercise diary at two weeks after the expected date of delivery (EDD).

*Only pregnant women who participated in the intervention group

Medical records were checked for any contraindications to exercise that might exclude a woman from the study. Normally, all women are checked at 18-20, 26-32, and 36-38 weeks of gestation through ultrasound by doctor for fetal position, fetal anomaly, placenta, amniotic fluid and others. Data were also collected from the routine measurements recorded in the handheld records for gestational age, stress scores, blood pressure, body weight, height,

and baby birth weight. Pre-pregnancy body mass index (BMI) were calculated from body weight and height of pregnant women at the first booking at the clinic approximately less than or equal to 12 weeks of gestation (see Appendix O).

4.2.3.1.3 Statistical analyses

The data were analysed using SPSS for Windows version 24.0 (IBM Corp, 2016). A two-tailed statistical evaluation of the study was performed with an alpha of 0.05 as the cut-off for significance, although the feasibility study was not powered to measure the effectiveness of the exercise intervention (Eldridge, et al, 2016). Descriptive data were presented as means and standard deviations, and numbers and percentages for continuous and categorical variables respectively. In order to assess the integrity of randomisation, demographic and baseline characteristics were compared between groups using chi-square tests for categorical variables, t-tests for normally distributed continuous variables and non-parametric Mann-Whitney U-tests for continuous variables with skewed distributions (Field, 2015).

Analysis of covariance (ANCOVA) using a linear mixed model was conducted to compare the difference of exercise intervention and control group on gestational weight gain, baby birthweight. Baseline values :maternal age, pre-pregnancy BMI, and gestational age were included as covariates in the model due to the interaction among gestational weight gain, baby birth weight, stress score, blood pressure, and physical activity (Bang & Lee, 2009; Lancaster et al., 2010; Metgud, Naik & Mallapur, 2012; Nascimento, Surita & Cecatti, 2012; Schellong et al., 2012; Bazyar et al., 2015; Deklava et al., 2015; Fan et al., 2015; Yang et al., 2015; Bartsch et al., 2016; Zanardo et al., 2016; Yang et al., 2017). Group effects between intervention and control groups on total physical activity, blood pressure, and stress score were tested using repeated measures ANCOVA over time at baseline (16-18 weeks of gestation) and 30-32 weeks of gestation (Vickers & Altman, 2001; Field, 2015).

The normality assumption of the residuals of the ANCOVA and repeated measures ANCOVA were verified by checking the data distribution by skewness and kurtosis coefficients, as well as histograms and Kolmogorov-Smirnov and Shapiro-Wilk tests. Conventional assumptions for ANCOVA were verified using formal tests assessing homogeneity of variance (Levene's Test). The statistical hypothesis testing was performed with a probability value or p -value of 0.05 as the cut-off for significance. If $p > .05$, the results of the ANCOVA are less reliable for a conditional distributions are equal. A homogeneity of variance can be assumed when $p < .05$. Assumptions for repeated measures ANCOVA were verified using Mauchly's test assessing Sphericity with p -value of 0.05 as the cut-off for significance. If $p < .05$, p -value was used from the Sphericity Assumed correction row in the "Tests of Within-Subjects Effects" ANCOVA table. If not, p -value was used from the Greenhouse-Geisser (Field, 2015).

In addition, repeated measures ANCOVA was employed for normally distributed continuous variables to compare peak pulse rate with base pulse rate before and after exercise. The normality assumption of the residuals of the variables were verified by checking the distribution of data obtained by skewness and kurtosis coefficients, as well as histograms and Kolmogorov-Smirnov and Shapiro-Wilk tests. Assumptions for ANCOVA were verified using Levene's Test assessing homogeneity of variance. Assumption for repeated measures ANOVA was verified using Mauchly's test assessing Sphericity (Field, 2015).

4.2.3.2 Qualitative component

The qualitative component explored the experiences of pregnant women and perspectives of HCPs on the new exercise programme through: 1) telephone interviews with pregnant women, and 2) one focus group with HCPs just after the completion of the exercise intervention. Their experiences provided better understanding of the exercise behaviour of

pregnant women and provided insights into their experiences of the exercise programme as well as suggestions for improving the design of the exercise programme for pregnant women. Due to limitation of the usual antenatal care appointment, telephone rather than face-to-face was used in follow-up interviews with the participants of the exercise programme. The participants would come for usual antenatal care at 38 weeks of gestation, which was approximately eight weeks or nearly two months after the completion of the exercise programme. Hence, pregnant women were likely to forget some experiences about the exercise programme. Moreover, it would also take more time and increase their costs to come to hospital for face-to-face interviews. In addition, the telephone interviews encouraged the participants to feel free to express experiences about the exercise programme, especially for those who attended the programme less than 60%. However, there were such disadvantages as being unable to observe non-verbal behavior of the participants in the telephone interviews. The qualitative approach was taken over three weeks: two weeks for recruitment, and one week for telephone interviews and a focus group.

4.2.3.2.1 Sample and recruitment for the qualitative component

For pregnant women: A target sample size was 10-15 pregnant women for interviews. Pregnant women who took part in the exercise programme were invited for telephone interviews at the end of exercise programme by the researcher. The sampling grid is shown in Table 4. According to the health programme such as dietary programme for pregnant women and mental health programme the cut-off point for adherence to the programme is set at 60% as meeting the programme's requirement (3rd Regional Health Centre, Thailand , 2011). This study thus used this criterion to explore the experiences of pregnant women who adhered to the exercise programme between less than 60 % and at least 60% and over (at least six weeks out of ten weeks). When a pregnant woman expressed willingness to participate in the telephone interviews, they contacted the researcher by

telephone (free call) or in person at the ANC during office hours. Then, women interested in participation were given full information by the researcher. The researcher took written consent at the next visit (data point collection after the intervention) (see summary Table 4.5). The characteristics of women were checked through the screening question (see Appendix P). Participants were offered a gift voucher of 300 baht for taking part in the telephone interviews.

Table 4.4: Purposive sampling frame for pregnant women in the interviews

Variable	Details of variable	
Number of pregnancy	Primigravida (first time)	Multigravida (second or more)
Maternal age	Age < 30 years old	Age ≥ 30 years old
Work	None or working at home	Working away from home
Adhered to the exercise programme *	≥ 60%	< 60%

*The data were checked from the exercise checklist.

For HCPs: A target sample size was 4-6 HCPs for the focus group, the same ones from the workshops, were the target sample size for a qualitative focus group to be conducted after the exercise intervention completed. At the end of workshops, the researcher provided information about this focus group. When HCPs expressed willingness to participate in the focus group, they contacted the researcher by telephone (free call) or in person at the ANC during office hours. Lists of interested names were collected by the researcher. Then, the researcher reminded them again by providing full information at the end of intervention. The participants were asked to give a written consent after their decision at their convenience (see summary Table 4.5). Participants were offered a gift voucher of 300 baht for taking part in the focus group. The summary of recruitment and consent processes for all stages of the study is shown in Table 4.5.

Table 4.5: Summary of recruitment and consent process for the whole study

Part of the study	Type of participant	Recruitment process	Information sheet provided (see Appendix S)	Consent process (see Appendix T)
1. workshops	Pregnant women	-Invited verbally by reception nurse - Leaflet advertising study -Poster advertising study on a hospital notice board (ANC) (see Appendix U)	Provided by the researcher at ANC after pregnant women indicated they were willing to participate in the study.	Consented by the researcher at the next ANC visit and then the researcher would check if they met the study criteria or not.
	HCPs	-Invited verbally by secretary of the human resource after the monthly meeting -Poster advertising study on a hospital notice board (human resource sector) (see Appendix U)	Provided by the researcher at ANC when they indicated they were willing to participate in the study.	Consented by the researcher at ANC at their convenience and then the researcher would check if they met the study criteria or not.
2. Intervention	Pregnant women	-Invited verbally by reception nurse - Leaflet advertising study -Poster advertising study on a hospital notice board (ANC) (see Appendix U)	Provided by the researcher at ANC when they indicated they were willing to participate in the study.	Consented by the researcher at the next ANC visit and then the researcher would check if they met the study criteria or not.
3. Qualitative component				
3.1 Telephone interviews	Pregnant women	Invited verbally by the researcher at the end of exercise programme (week 10) (GA 28-30 weeks).	Provided by the researcher at the end of exercise programme (GA 28-30 weeks) when they indicate they were willing to participate in the study.	Consented by the researcher at the next ANC visit (data point collection after intervention at GA 30-32 weeks) and then the researcher would check if they met the study criteria or not.
3.2 Focus group	HCPs	Invited verbally by the researcher at the end of workshops .A list of interested names were collected. Then, they were reminded by the researcher at the end of exercise intervention.	Provided by the researcher at the end of workshop and exercise programme when they indicate they were willing to participate in the study.	Consented by the researcher at ANC at their convenience .Then, the researcher would check their consents before the focus group started (around 15 minutes).

4.2.3.2.2 Data collection of the qualitative component

The data were collected through telephone interviews based on the question guide (see Appendix Q) with a digital telephone voice recorder by the researcher. The question guide consisted of the experiences of women on the exercise programme during pregnancy; strengths and weakness of the exercise programme; and suggestions for alternatives or changes to the programme to benefit pregnant women and related healthcare service. Steps in conducting the telephone interviews were as follows: (1) the name, position and contact details of the researcher were introduced to the participants; (2) study information was briefed to the participants on the purposes, benefits and processes of the study, and ethical issues; (3) any questions from the participants were answered by the researcher before starting the interviews; (4) the interviews were conducted and recorded with a digital telephone voice recorder; and (5) the main findings from the interviews were summarised for checking accuracy and correction with the participants (Holloway & Wheeler, 2010; Creswell, 2014). The interviews ended with eliciting the participants' demographic characteristics. Telephone interviews took about 30 to 45 minutes per participant.

In order to reduce bias, the focus group with HCPs was led by the assistant researcher who took part in the workshops as the facilitator of the small group discussion (see Appendix V). For the preparation of the focus group, the summary of the exercise intervention, the focus group were briefed by the researcher about the aims and process one week after the completion of the exercise intervention so as to conduct the focus group effectively. The aims and schedule of the focus group were initially explained in the focus group by the assistant researcher. The consents of these participants were re-checked for data collecting and recording purposes. During the focus group, the participants were briefed with the process of the focus group and the summary of the new exercise programme by the assistant researcher. The topics for discussion were introduced through the question guide to ensure that everyone

in the group would have a chance to voice their opinion and experiences (see Appendix R). The topic guide of the focus group was run as follows: strengths and weaknesses of the new exercise programme; idea on how this exercise programme would fit in the usual antenatal care; and suggestions for alternatives or changes to the programme to better benefit women, including related healthcare service. The main findings from the focus group were summarised so as to ensure accuracy and elicit comments from the participants. The researcher took the field notes and recorded with a digital voice recorder during the group discussion. The focus group was conducted between 45 and 60 minutes at the end of the antenatal care clinic.

4.2.3.2.3 Data analysis of the qualitative component

Thematic analysis was used to analyse latent and manifest data, including the contextual meaning from the perspectives of the participants according to themes. The data were managed by the computer software programme NVivo 11 (QSR international Pty, 2014) as well as manually. The basic process of thematic analysis is depicted in Figure 4.7. Steps in conducting a thematic analysis were as follows (Braun & Clarke, 2006; Holloway & Wheeler, 2010). Firstly, the data were fully transcribed. The full transcripts were then checked and cross-checked for accuracy by the researcher and the field supervisor with the recording. Next, the transcripts of interviews and focus group were translated from Thai to English language by the researcher. A sample of the transcripts were checked for accuracy by a professional translator. The full transcripts and translation were kept securely on a personal laptop with password to protect confidentially and stored on an external hard drive with encryption and on the UEA computer system, which is firewalled for preventing damage and lost.

All transcripts were read and reread several times to understand each interview in depth. The data were compared for similarities and differences among participants based on a

list of all topics from interviews and focus group. Verbatim quotes were highlighted and underlined as key words. Both latent and manifest data content were coded. Manifest content is defined as “what has been said” of the text and latent content is defined as “what intended to be said” of the text (Vaismoradi, Turunen & Bondas, 2013; Bengtsson, 2016). The codes were then checked back with the transcripts for accuracy. The codes were grouped according to initial categories and progressed through an iterative analysis to potential sub-themes and themes. The themes were examined in terms of relationships in two dimensions between data set and codes; and codes and themes. The themes were defined and named for presenting the overall data in each theme. The analysis process was checked for coding and the themes were examined for accuracy with the supervisors. The process of thematic analysis was reported in relation to the research questions and literature.



Figure 4.7: Process of thematic analysis (Adapted from Braun & Clarke, 2006)

4.2.4 Data analysis in the mixed methods design

The data sets from the workshops, quantitative feasibility RCT, and the qualitative approach (interviews and focus group) were involved in addressing the research questions and enhancing better understanding about the results in terms of improvement of the exercise behaviour among pregnant Thai women (Johnson et al, 2007; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011). The process of data analysis in the multiphase mixed methods design is shown in Figure 4.8.

In this study, the data set from the workshops were used to develop the exercise intervention with pregnant women in order to design a protocol of the exercise programme for pregnant Thai women in three main sections: the exercise class format, safety protocol of the exercise programme, and exercise education and training sessions. Then, the data sets from the interviews and focus group were connected with the data set from the feasibility RCT in two steps. In the first step, the data set from the feasibility RCT included descriptive statistics of demographic and baseline characteristics; and preliminary effects of the exercise programme were initially analysed. Before the data collection of the interviews and focus group, the initial feasibility RCT data were considered to clarify two main issues that the findings need to explain and follow up (Creswell & Plano Clark, 2011; Fetters, Curry, & Creswell, 2013).

- The importance of the exercise programme to improve exercise behaviour in pregnant women; and
- The exercise programme would fit in usual healthcare service provided for pregnant women in the Thai context.

In the second step, the data from the qualitative interviews and focus group were compared and analysed with themes elicited from the pregnant women and HCPs. The initial feasibility RCT results were used to inform the themes from the interviews and focus group.

The findings from the interviews and focus group in quotations were useful for explaining exercise behaviour of pregnant women and preliminary effects of the exercise programme from the feasibility RCT results in numeric statistics.

For interpreting the connected results, meta-inferences of this study were drawn from complementary data derived from a collection of the workshops' finding analyses, feasibility RCT, and qualitative approach (interviews and focus group) (Creswell & Plano Clark, 2011; Fetters, Curry, & Creswell, 2013; Venkatesh, Brown, & Bala, 2013). Findings from the multi-phase mixed methods research can lead to improvement of exercise behaviour in pregnant women. Moreover, perspectives of HCPs and pregnant women about exercise during pregnancy, and about the exercise programme within the healthcare service in the Thai context can be linked to the research objectives and questions (Onwuedbuzie & Johnson, 2006; Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011; Eckhardt & DeVon, 2017).

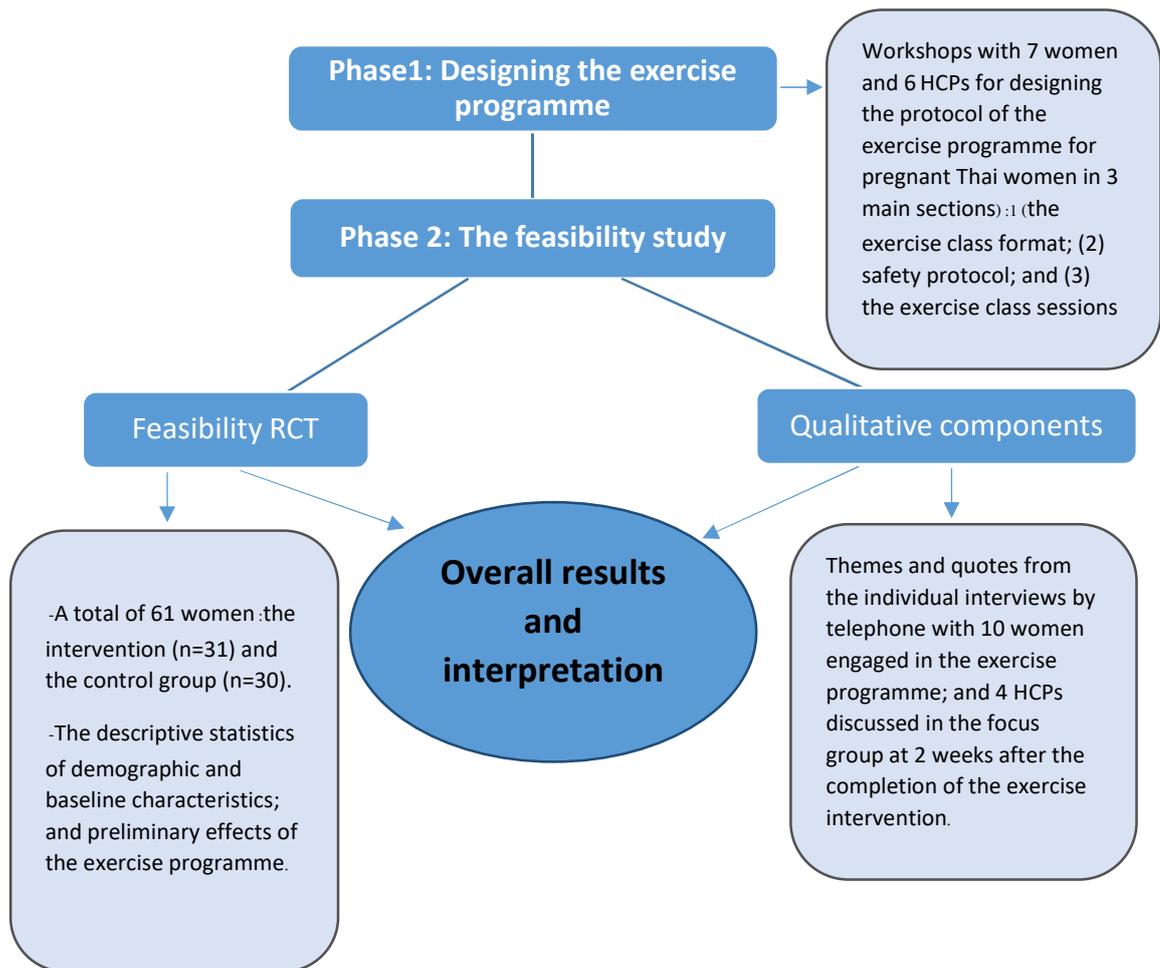


Figure 4.8: Process of data analysis in the multiphase mixed methods design

4.2.5 Setting

The study was conducted at the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand. The workshops and focus group were conducted in a meeting room. The exercise intervention took place at an educational room. Telephone interviews took place in a private room within an ANC. The study is partly funded by Naresuan University, Phitsanulok (Thailand).

4.2.6 Language translation

Translation is defined as a conversion process of text in terms of meaning, interpretation and sociocultural language from one language (source language) to another

(target language) (Casagrande, 1954; Newmark, 1995; Torop, 2002; Hatim & Munday, 2004; Regmi, Naidoo & Pilkington, 2010). Translation process plays a key role in translating findings and/or outcomes from non-English speakers in cross-cultural research and international collaborative studies that are rising in the health research area (Im et al, 2004; Lee et al, 2009; Suhonen et al, 2009). Common problems of a translation process are the accuracy of the translated version in terms of meaning in the source language and socio-cultural context, including time and cost consumption (Khan & Manderson, 1992; Maneesriwongul & Dixon, 2004; Regmi, Naidoo & Pilkington, 2010).

In this study, translation process has been used to share, communicate and disseminate research insights, findings and outcomes, including background and culture of the Thai women and HCPs in English language (Jones, 1986; Maneesriwongul & Dixon, 2004; Lee et al, 2009). The language translation process, which adapted from the Brislin Model (Brislin, 1970; Jones et al, 2001; Lee et al, 2009), is shown in Figure 4.9. All documents, questionnaires, and question guide for telephone interviews and the focus group were translated from English to Thai language while all data from the workshops, feasibility RCT, telephone interviews and the focus group were translated from Thai to English language by the researcher. All translations were checked for accuracy by a professional translator who is a qualified linguist in both Thai and English languages.

The translation process was performed in five stages as follows: (1) the researcher read and reread through the whole text several times. The conceptualisation, context and meaning of the original version were identified; (2) the original version was translated from word to word and word processed in the whole sentence; (3) the meaning of the word and whole sentence were modified and revised after checking the meaning of the whole sentence by the researcher; (4) the translated work was checked and verified for accuracy in terms of meaning and socio-cultural context from both the source and the target languages by a

professional translator; and (5) the translated versions were modified and revised (Jones et al, 2001; Maneesriwongul & Dixon, 2004; Lee et al, 2009; Regmi, Naidoo & Pilkington, 2010).

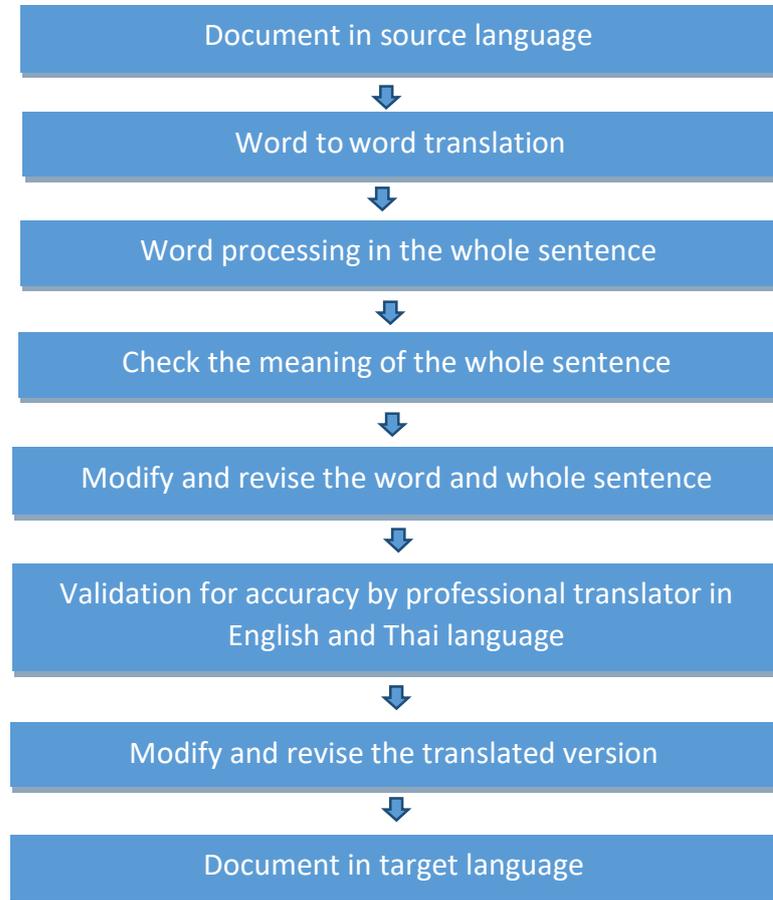


Figure 4.9: The language translation process

(Adapted from the Brislin Model (Brislin, 1970; Jones et al, 2001; Lee et al, 2009))

4.2.7 Study rigour

The rigour of this study refers to the standards to ensure the quality of the study both quantitatively and qualitatively. It also includes specific mixed methods criteria based on the research paradigm, which is a mixed methods study (Creswell & Plano Clark, 2011; Halcomb & Hickman, 2015; Baillie, 2015). In this study, the “inference quality” is mentioned as a way to ensure and evaluate accuracy of mixed methods research, which includes two standards:

design quality and interpretive rigour)Onwuedbuzie & Johnson, 2006; Teddlie & Tashakkori, 2009; Halcomb & Hickman, 2015; Eckhardt & DeVon, 2017).

Design quality refers to the standards to evaluate the design of the study which is appropriate for the research questions based on the methodology and methods of the study. It consists of four components: design sustainability, design consistency, design fidelity, and analytic adequacy for sampling, data collection and analysis processes (Onwuedbuzie & Johnson, 2006; Teddlie & Tashakkori, 2009; Eckhardt & DeVon, 2017). Design sustainability refers to the study design that applies appropriate methods in terms of addressing and being consistent with the research questions. This study was designed involved in all stage of the study from the workshops, feasibility RCT, and qualitative component that were reported the justification for using the mixed methods approach and ensured the all stage of this study link together in a key priority on timeframe. The chronological planning of the study was reported in rich description with details of the process of the study in each stage including timeframe for collecting the data at baseline, the end of the exercise intervention, and after childbirth.

Design consistency refers to the procedures of the study that are consistent with the study design in each stage of the study. Design fidelity refers to the quality and rigours of the procedures in the study in order to achieve adequate sampling for data collection and analysis processes. In this study, all the stages of the study were described in details of procedures of the study that were carried out by the researcher. Data collection in the workshops and qualitative focus group was carried out by the researcher and the assistant researcher. The processes for training of the assistant researcher were described clearly in details following the protocol of the study design that ensured the design consistency and design fidelity. Analytic adequacy refers to procedures or techniques for using the data analysis in each

stage, which are appropriate for addressing the research questions (Onwuedbuzie & Johnson, 2006; Teddlie & Tashakkori, 2009; Eckhardt & DeVon, 2017).

Interpretive rigour means the standards to evaluate the validity of the interpretation of the data from research results so as to ensure the sufficient integration of both quantitative and qualitative findings, which demonstrate accurate and meaningful conclusions. It consists of five components :interpretive consistency, theoretical consistency, interpretive agreement, interpretive distinctness, and integrative efficacy)Onwuedbuzie & Johnson, 2006; Teddlie & Tashakkori, 2009; Eckhardt & DeVon, 2017). Interpretive consistency refers to the process of the interpretation which is clearly demonstrated as well as the final conclusions which consisted of data from the workshops, feasibility RCT and qualitative interviews and focus group. Theoretical consistency refers to the results from both qualitative and quantitative strands that were consistentwith the current knowledge and theory in the field of exercise in pregnancy in data analysis and discussion (Onwuedbuzie& Johnson, 2006; Teddlie & Tashakkori, 2009; Eckhardt & DeVon, 2017).

Interpretive agreement refers to the interpretation of results in this studythat were consistent across people in terms of responses of supervisors as well asdissertation committees. Interpretive distinctness refers to the strength and reliability of integrative results. The results of this study were inferences from the workshops, feasibility RCT and qualitative interviews and focus group that linked with the current knowledge in the field of exercise during pregnancy. Integrative efficacy refers to theintegrativeresults from both quantitative and qualitative strands)workshops, feasibility RCT, and qualitaive interviews and focus group(that were inferred adequately and efficiently (Onwuedbuzie &Johnson ,2006; Teddlie & Tashakkori, 2009; Eckhardt & DeVon, 2017).

4.2.7.1 Quantitative study rigour

The rigour of the quantitative study plays an important role in validity and reliability of the research process in order to ensure the quality and systematic research (Sharts-Hopko, 2002; Shenton, 2004; Giddings & Grant, 2009; Claydon, 2015) and reduce the bias in the trial (Jadad & Enkin, 2007; Smith & Noble, 2014). Processes for ensuring the validity and reliability of this study were applied to quantitative study (Shenton, 2004; Giddings & Grant, 2009). The validity and reliability of the Global Physical Activity Questionnaire (GPAQ) have been examined by Division of Physical Activity & Health, Thailand. The content and face validity of the instrument were reviewed by a panel of five experts and 12 purposive participants. The inter-rater agreement and item level were obtained at .88 and .99 respectively. The criterion and concurrent validity were significant at .33 and .75 ($p < .01$) respectively. The seven-day test-retest reliability was obtained at .76 significantly ($p < .01$) (Division of Physical Activity & Health, Thailand, 2009; Visuthipanich, 2011).

Random sampling was used in the exercise intervention to reduce selection bias and ensure the balance of the potential prognostic factors between control and intervention groups (Altman & Bland, 1999; Shenton, 2004; Jadad & Enkin, 2007; Sainani, 2010; Efird, 2011; Smith & Noble, 2014). The randomised blocking in groups of four and six was prepared in advance under supervision of the supervisors at University of East Anglia (UEA). The random block size between groups of four and six was used to prevent the prediction of the blocked ordering (Altman & Bland, 1999; Efird, 2011). The randomisation sequence was placed in sealed sequentially numbered envelopes to confirm the concealment of allocation. The analytic process of the quantitative data was conducted under the supervision of supervisors and Dr. Jane Skinner as a statistician. The coding of data and values of data were checked by the researcher and rechecked by the supervisors. The quantitative findings were reviewed with supervisors for accuracy (Pannucci & Wilkins, 2010; Smith & Noble, 2014).

- **Generalisation**

The findings from this study cannot be generalised to other situations and locations because this study design was a feasibility study. Nonetheless, the research setting, recruitment process, sampling randomisation, data collection process, data analysis process and context of the feasibility RCT were reported in detail so that these can be applied to conduct a larger RCT in other situations and locations of Thailand and Asia. The characteristics of the participants represented the target population that would be generalised to low risk pregnant women in other parts of Thailand and Asia as well as any Asian women with similar context, culture, geographic, socio- economic)Giddings & Grant, 2009; Claydon, 2015; Halcomb & Hickman, 2015).

1.2.7.2 Qualitative study rigour

The rigours of the qualitative study were obtained in terms of trustworthiness through credibility, confirmability, objectivity and transferability (Holloway & Wheeler, 2010; Anney, 2014). The process of qualitative interviews and focus group were checked by consolidated criteria for reporting qualitative studies (COREQ) in three domains: research team and reflexivity; study design; and analysis and findings (Tong, Sainsbury & Craig, 2007).

- **Credibility**

Credibility is internal validity of the research with respect to the ways in which findings make sense and are valid in compliance with the research objectives and methods. Member checking, peer-debriefing, prolonged engagement in the research setting, and triangulation are techniques to ensure the credibility (Sharts-Hopko, 2002; Shenton, 2004; Holloway & Wheeler, 2010; Anney, 2014; Baillie, 2015). The main findings of the workshops, individual interviews, and the focus group were summarised at the end of the process for examination, coupled with reflective findings with the participants as informal

member checking. The researcher summarised the findings from the workshops, qualitative interviews and the focus group, which were re-examined by the supervisors in each phase of the data analysis, including codes and themes as a peer-debriefing.

The multiple data sources and methods triangulation were applied to confirm the credibility of the findings (Barbour, 2001; Sharts-Hopko, 2002; Shenton, 2004; Fielding, 2010; Holloway & Wheeler, 2010; Anney, 2014; Baillie, 2015). The workshops were designed to mix between the pregnant women and HCPs. Different groups of the participants were of different points of view in developing the suitable exercise programme during pregnancy. Individual interviews with pregnant women and the focus group with HCPs were used to explore and enhance the completeness of their experiences of the exercise programme after the intervention.

- **Dependability**

Dependability refers to the reliability of the study that confirms when the study is repeated, similar findings will be obtained based on the same context, methods, situations and participants (Shenton, 2004; Holloway & Wheeler, 2010; Baillie, 2015). An audit trail is a process to determine the accuracy of the findings through the protocols of data collection to data analysis. In this study, the protocols of data collection and data analysis were checked with the supervisors to ensure that they were described well enough in terms of data collection process, raw data, process of data analysis and interpretation of the findings (Sharts-Hopko, 2002; Shenton, 2004; Anney, 2014; Baillie, 2015).

- **Confirmability**

Confirmability refers to the adequacy of reports from the research aims, questions, process for data collection to finding interpretations through the raw data and process of data analysis (Sharts-Hopko, 2002; Shenton, 2004; Anney, 2014; Baillie, 2015). The research process was recorded with a diary by the researcher in all phases from the workshops, the

feasibility RCT, and the qualitative interviews, and the focus group including the thinking, feelings and contexts behind the decision making. The effect of the researcher on the research process was recognised and addressed because the researcher as an instrument might influence the process of the data collection and data analysis .The data analysis process was demonstrated in rich description to ensure that the findings were interpreted from the qualitative interviews and focus group (Shenton, 2004; Holloway & Wheeler, 2010; Anney, 2014; Baillie, 2015).

- **Transferability**

Transferability refers to external validity concerning research findings, which can be transferred to other situations, locations, and a wider population (Sharts-Hopko, 2002; Shenton, 2004; Holloway & Wheeler, 2010; Anney, 2014; Baillie, 2015). The methods of data collection and data analysis process were reported in rich description of characteristics with the details of research setting, characteristics of participants, and the Thai context. The decision making of the researcher in each stage was demonstrated so that the research processes and context of the study can be applicable for justification to other contexts or situations in the future research.

4.2.8 Ethical approval process

Ethical approvals were required by the Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia (UEA), Norwich, United Kingdom and the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand in two stages. In the first stage, approval was sought in terms of the whole research process. The second stage was an amendment to the initial approval and explained in the exact content of the exercise intervention for the feasibility RCT (see Appendix V).

The entire study met the requirement of the Data Protection Act 1998 (Mullock & Leigh-Pollitt, 2005). The decision to participate was made by individual women

independently and without pressure. The decision of an HCP on participation did not affect their work or responsibilities. Both HCPs and pregnant women could withdraw any time without giving any reason and their withdrawal from the research did not affect the standard of care or work. All participants' data were identified by individual codes, except for copies of the consent form and a code book which contained the names and contact details of all participants. No data could be accessed by anyone other than the researcher and supervisors. The data were presented and reported without personal identification.

During data collection, the researcher used a personal laptop with strong password protection. All files and documents were kept securely in the locked storage at Naresuan University, Thailand. Then, the researcher brought the data (all files and documents) back to UEA. All data collected to that point were retained by the research team, as explicitly set out in the consent form. All electronic data e.g. digital files and transcripts were stored on an external hard drive with encryption and on the UEA computer system, which is firewalled. Personal information will be kept for one year after the end of the study; all other anonymised data will be kept for a period of ten years after completion of the study in locked storage at UEA.

In this study, the ethical principles were applied at every step of the study process. The study was designed to treat all participants, both pregnant women and HCPs, similarly on the basis of equity, fairness, and justice (Mullock & Leigh-Pollitt, 2005; Jahn, 2011). The participants were able to make decisions on their own whether to participate in the study or not: ranging from workshops, feasibility RCT, qualitative interviews to focus group (Mullock & Leigh-Pollitt, 2005; Jahn, 2011). For example, pregnant women and HCPs expressed their views and experiences about exercise during pregnancy based on their personal values and beliefs in the workshops, qualitative interviews, and focus group. Pregnant women who participated in the feasibility RCT were able to decide whether to continue participating or to

withdraw from the exercise intervention any time. This study design provided the benefits for pregnant women in terms of health improvement as well as HCPs in terms of delivery of quality care for pregnant women in a healthcare setting.

In particular, considering potential harm to pregnant women during the exercise intervention as non-maleficence (Mullock & Leigh-Pollitt, 2005; Jahn, 2011), the researcher invited a physiotherapist to the workshops in order to design and exercise programme and to the exercise intervention as a consultant to ensure exercise safety during pregnancy. To prevent harm during the feasibility RCT, pregnant women who participated in the exercise programme were observed closely by the researcher for any warning signs. The process of data collection used in the workshops, feasibility RCT, qualitative interviews, and focus group were designed in order to prevent any potential psychological harm to the pregnant woman and to respect their autonomy. For example, the pregnant women were reminded before the interviews about their choices to answer, stop, or withdraw at anytime. The atmosphere and questions in this study were designed to prevent any uncomfortable feelings among the participants.

CHAPTER 5

FINDINGS OF THE WORKSHOPS

The objective of the first phase in this study was to design an exercise programme for Thai pregnant women in collaboration with pregnant women and healthcare professionals (HCPs) in the workshops. In this chapter, the results from the workshops are presented in five sections: background of the workshops, process of the workshops, findings from the workshops, protocol of the exercise programme for pregnant Thai women, and reflexivity from the workshops.

5.1 Background of the workshops

The workshops took place on 14th December 2016 and 13th January 2017 for approximately two hours in each session, in the prenatal education room, Health Promoting Hospital, 3rd Regional Health centre, Nakhon Sawan, Thailand. Pregnant women and HCPs were recruited between October and November 2016 from an antenatal care (ANC) clinic at the same hospital. A total of thirteen participants included seven pregnant women and six HCPs. The demographic characteristics of the participants are summarised in Table 5.1.

Ten pregnant women were verbally informed about the study by the reception nurse and eight women received information from the poster advertising on a notice board at ANC clinic. Eighteen women received the full information from the researcher. Then, fifteen pregnant women were willing to participate in the workshops. Five women were excluded for either regular exercise or contraindications for exercise during pregnancy, and three women withdrew because they were unavailable on the workshop dates. The pregnant women consisted of both primigravidae and multi-gravidae at all stages of pregnancy.

HCPs whose work is concerned with ANC were verbally informed by the secretary of human resources after the monthly meeting at the hospital. The researcher provided the full

information for eight HCPs who were willing to participate in the workshops and then three HCPs (doctor, healthcare educator (nurse), and sport medicine) withdrew due to their duty and personal reasons. A physiotherapist from Naresuan University was then invited as a consultant in the study (see Appendix V). A physiotherapist, a doctor, two nurses at the ANC clinic, a healthcare educator (nurse), and a healthcare worker were included in the study.

Table 5.1: Demographic characteristics of the participants in the workshops

HCPs (n, %)	Pregnant women (n, %)
Age -20-29 years (1, 16.67%) -30-39 years (2, 33.33%) - \geq 40 years (3, 50%)	Age -20-29 years (3, 42.86%) -30-39 years (4, 57.14%)
Qualification -Nurse (ANC) (3*(1 :educator), 50%) -Doctor (1, 16.67%) -Physiotherapist (1, 16.67%) -Healthcare worker (1 (nurse), 16.67)	Number of gravida -Primigravidarum (4, 57.14%) -Multigravidarum (3, 42.86%)
Years of experiences -Under 5 years (1, 16.67%) -5-10 years (1, 16.67%) -Over 10 years (4, 66.67%)	Gestational age -First trimester (2, 28.57%) -Second trimester (3, 42.86%) -Third trimester (2, 28.57%)
Work -Antenatal care clinic (4, 66.67%) -Family planning and community (1, 16.67%) -Physiotherapy (1, 16.67%)	Work -Inside (housewife) (1, 14.29%) -Outside (6, 85.71%)
Education -Bachelor degree or equal (2, 33.33%) -Master degree and over (2 .33.33%) -Doctoral degree and over (2, 33.33%)	Education -Secondary school or equal (1, 14.29%) -Bachelor degree or equal (5, 71.42%) -Master degree and over (1, 14.29%)

*One of three nurses who participated in the workshops is a healthcare educator

5.2 Process of the workshops

At the two workshops, an exercise programme was discussed and developed based on the recommendations of American College of Obstetricians and Gynaecologists (ACOG), American College of Sports Medicine (ACSM) and Ministry of Public Health (MoPH), Thailand (ACOG, 2002, 2015; ACSM, 2014; Suputtitada, 2005).

The first workshop was observed by the field supervisor. The first session of the first workshop began with the aims and the roles of pregnant women and HCPs as a partnership. Roles of the researcher and her assistant researcher were emphasised as facilitators in order to ensure that everyone had a chance to speak and that conversations stayed on topic. The facilitators aimed to ensure that no one individual dominated the discussions to enable a balance of power between pregnant women and HCPs. Then, the core concept and the prescription of exercise during pregnancy were presented by the researcher. The topic discussion began with the pregnant women's exercise experience, the participants' knowledge of facts and myths, the women's experiences about barriers or facilitators to exercise whilst being pregnant, and strategies and techniques for motivating and encouraging women to perform exercise. A draft of the exercise programme was designed in the last session of the first workshop.

In the second workshop (one month later), the participants returned to discuss and design the exercise programme in pregnancy. Finally, the exercise programme was adjusted and agreed by the participants. All information was recorded with a digital voice recorder with notes taken on a flip chart and a note-taking form by the researcher and the assistant researcher during the workshops and small group discussions.

5.3 Findings from the workshops

Four key themes were identified from the workshops for designing the exercise programme in relation to exercise behaviour in pregnant women and healthcare service: the integration of the exercise programme into the healthcare service; techniques for motivating exercise; a group exercise network; and a follow-up to continue exercise. The abbreviations presented in these findings are as follows: G is for gravida, for example G3 refers to a woman with gravida three. Further, 1st, 2nd, and 3rd are the abbreviations for the numbers of trimester of pregnancy. The first trimester covers 0-13 weeks of gestation. The second trimester covers 14-27 weeks of gestation. The third trimester covers 28-40 weeks of gestation (ACOG, 2018).

5.3.1 Integration of the exercise programme into the healthcare service

Pregnant women and HCPs shared the opinions that the exercise programme should fit in the healthcare service of ANC clinic with respect to contents of exercise during pregnancy, safety during pregnancy, and schedule of the exercise programme.

- **Contents of exercise during pregnancy**

Pregnant women and HCPs said that contents of exercise during pregnancy must contain benefits, contraindications, warning signs, general regulations of exercise and exercise positions during pregnancy. Benefits of exercise during pregnancy should be stated in the first week of the exercise programme so that this can encourage women to exercise during pregnancy.

“Benefits of exercise for pregnant women and their babies should be emphasised because it motivates them to exercise from the beginning of the programme.” (Nurse Educator)

“Exercise outcomes for pregnant women and their babies should be emphasised.” (Nurse ANC 2)

Benefits of exercise consisted of those for mothers and babies. In particular, benefits gained from each exercise's position i.e. standing, sitting and lying down are the key message.

"I want to get an easy child delivery, without pain." (G3, 2nd)

"Benefits of exercise's position for mothers and babies should be elaborated. For example, what are benefits of this exercise's position?" (Healthcare worker)

"Benefits of exercise's position should be focused in each trimester." (G1, 2nd)

For each training session, exercise should be demonstrated and start with basic positions and then progress up to advanced ones. Instructions for exercise should incorporate a plan that women can easily follow in a logical order so that sitting exercises are followed by those in a standing position and end with floor exercises in a lying down position. It helped pregnant women to follow the exercise's positions easily.

"Some positions of exercise are quite difficult to achieve during pregnancy. It is also quite difficult even for women who are not pregnant." (G2, 3rd)

"About the exercise's positions (postures) of the exercise, I think we should begin with simple exercise's positions (postures) and then gradually step up to more challenging exercise's positions (postures)." (Nurse ANC 2)

The exercise's positions should begin with sitting, standing, and lying down positions and should not require any extra equipment.

"The positions of exercise should start from sitting to standing. It should not switch between sittings and standings that may cause dizziness in pregnant women." (Nurse ANC 2)

"Positions of exercise should be easy and can be done everywhere. I am lazy to exercise if positions of exercise are difficult." (G1, 3rd)

In addition, pregnant women and HCPs also suggested that materials for exercise should be simple, easy to access and understand, taking into consideration the socioeconomic status of women. Issues of posters and leaflets were raised in the workshops.

"I think, a poster may be suitable for them because they can get all information in one page." (Nurse ANC 2)

“I think we should have both of them available. A leaflet is good in terms of compact size. We can bring it anywhere and read in leisure time.” (G2, 3rd)

Pregnant women and HCPs agreed to use both posters and leaflets in an exercise programme as these two types of printed matters could function as a tool for continued exercise at home.

“My husband got information about antenatal care better than me because he got information from posters on the hospital's board and leaflets. I think posters and leaflets are good for reading in free time.” (G1, 2nd)

“Poster is useful. Leaflet is also good. It depends on personal attitude to judge whether it is convenient or not. The husband and the other family members might prefer reading from a leaflet.” (Nurse Educator)

- **Safety during pregnancy**

HCPs were of an opinion that the exercise programme must come with safety information for pregnant women. All pregnant women must be screened for contraindications for exercise during pregnancy before engaging in any exercise programme.

“All pregnant women who participate in the exercise programme should be confirmed with safety and practical application so that they can take exercise in daily life.” (Doctor)

“All pregnant women will be checked for contraindication of exercise during pregnancy by nurse (ANC) before joining the exercise in the prenatal education class.” (Nurse ANC 1)

“They can check for contraindication of exercise by nurse.” (Physiotherapist)

Pregnant women and HCPs confirmed that there was a common concern about the safety of exercise when pregnant women continued exercising during pregnancy at home.

“I would like to know how to exercise during pregnancy. What is appropriate exercise during pregnancy? And what is good for me?” (G2, 1st)

“I have fear and anxiety for exercise. I don't know if exercise is safe.” (G2, 3rd)

There was agreement that there should be regular reminders about warning signs to look out for during exercise given every week of the exercise programme so that pregnant women gain self-confidence in safety and thus being able to exercise at home.

“However, there might be warning signs when they exercise during pregnancy. These signs should be reminded to pregnant women every week so that they will be aware and able to notice if something bad happens.” (Physiotherapist)

Pregnant women and HCPs suggested that exercise intensity should be taught and self-checked every week of the exercise programme to ensure the safety of exercise in pregnancy. The suggested that pulse rate and talk test should be advised for those who want to do the self-check for exercise intensity because it is so easy that any pregnant women can apply while exercising at home.

“Talk test will be used to assess if you can talk or sing. It's an easy way to apply.” (Physiotherapist)

“I don't know how to take exercise during pregnancy. What's an appropriate workout? In my opinion, I will use the talk test which is easy to assess the exercise intensity. If I cannot talk or carry on a conversation, it means that I'm taking intense exercise. What do you think?” (G1, 2nd)

“I think, it's (checking pulse rate and talk test) may be useful for exercise at home if I know how to do it. It means exercise is safe for me and my baby.” (G2, 1st)

- **Schedule of the exercise programme**

Pregnant women and HCPs agreed that each exercise class in the exercise programme should be conducted in an educational room of the hospital in the afternoon on Thursday and Friday over 10 weeks. This is because HCPs have a lot of activities for usual care in the morning and there is also usual care for pregnant women with complications such as gestational diabetes mellitus (GDM), hypertensive disorders during pregnancy, and anaemia in the afternoon on Monday to Wednesday.

“There are lots of activities at the clinic in the morning. ...In addition, I have a lot of meetings in the afternoon on Monday and Tuesday. ...Ten weeks is enough for testing the effects of the programme.” (Healthcare worker)

“The care standards of ANC require a lot of activities. In the morning, we are quite busy with both usual care and educational class for pregnant women. In the afternoon, we also have usual care for complicated pregnant women on Monday to Wednesday such as anaemia class, and low weight gain class.” (Nurse ANC 2)

Pregnant women said that most of them might have more free time in the afternoon on Thursday and Friday.

“I feel most of us pregnant women who work outside might have time to attend exercise class in the afternoon on Thursday and Friday before weekends. ...Ten weeks is OK for motivating women.” (G3, 2nd)

“Normally, I always want to make an appointment for antenatal care at the hospital on Thursday and Friday because I am quite busy on Monday to Wednesday.” (G2, 1st)

In addition, each exercise class should take approximately 45 minutes. Pregnant women may pay less attention and feel exhausted or bored if each session takes more than one hour.

“If you want me to exercise more than one hour. It’s getting boring.” (G3, 2nd)

“Exercise class should not be longer than one hour because the participants might feel bored and the nurse might be exhausted as well. It would not attract people to enjoy the exercise programme.” (Nurse Educator)

“Both HCPs and pregnant women agree that approximately 45 minutes is better for an exercise class.” (Nurse ANC 2)

5.3.2 Techniques for motivating exercise

A key to success for improving the exercise behaviour during pregnancy is motivation. Pregnant women and HCPs shared similar views on this topic. Motivation techniques might be helpful to engage pregnant women in an exercise programme.

“The key point is to build motivation for exercise. We realised that even with our support, they don't exercise due to a lack of motivation. Motivation is thus a key to success.” (Nurse ANC 1)

“I think motivation is the most important factor.” (Nurse Educator)

Informational support, feedback, goal setting, and role model were identified as key factors by the workshop participants. These were employed in the exercise programme.

“If I want to exercise, I will do by myself. Although you give me a lot of support or force me, I may not do it, if I feel lack of motivation to do it.” (G3, 2nd)

It was suggested that informational support should be used for motivating pregnant women to exercise. This type of support would provide knowledge of exercise and would

make pregnant women aware of the importance of exercise. This is consistent with the above-mentioned result that pregnant women and HCPs agreed that benefits of exercise should be emphasised in the exercise class.

“Knowledge is the most important. If you understand the benefits of exercise for babies, it will motivate you to exercise.” (Physiotherapist)

“I agree with you. A lack of information is the cause of stopping exercising during pregnancy.” (G3, 2nd)

Normally, most pregnant women focus on their baby's health. When they get information about benefits of exercise for mothers and babies, it is likely that they will develop an exercise habit during pregnancy.

“We should point out the success outcomes of exercise. We should focus on the benefits of exercise and how to exercise during pregnancy because that motivates us to exercise.” (G1, 3rd)

Pregnant women and HCPs added that informational support may reduce anxiety about the safety of exercise in pregnancy.

“I have fear and anxiety for exercise. I don't know if exercise is safe.” (G2, 1st)

“I think a lack of information is the cause of fear and anxiety for exercise.” (Nurse Educator)

Demonstration and repeated activities should be used in the exercise programme to ensure that participants well understand exercise positions.

“ Demonstration and repeated activities act as informational support for pregnant women to gain a clear understanding about the positions of exercise. This technique helps them (pregnant women) exercise at home properly.” (Nurse Educator)

Pregnant women should get feedback on the exercise's position during repeated demonstration, which would support them to remember appropriate exercise positions and thereby being able to exercise at home.

“ In my opinion, demonstration and repeated demonstration by instructor give me more confidence in exercise at home.” (G2, 3rd)

“Coaches or trainers must be experts in exercise who can both give information and demonstration. In this way, I will be more confident and safer when I exercise at home.” (G2, 1st)

Feedback is one of the techniques utilised in the exercise programme. Pregnant women and HCPs reiterated that positive feedback encouraged pregnant women to regularly exercise during pregnancy, especially for exercise at home.

“Feedback after each exercise class supports pregnant women to think back about what they’ve done and they want to do? It makes them realise about the appropriate way to exercise at home?” (Nurse Educator)

Feedback could be in the form of a small talk approximately 5-10 minutes after the exercise class. Such feedback could include cheer up quotes to continue exercise, feedback about problems and how to solve them during exercise. However, negative feedback should be channelled in a proper way as this may affect pregnant women’s feelings about exercise.

“While giving the feedback after performing the exercise, there might be a pep talk to cheer them up to continue exercise at home.” (G1, 1st)

“Feedback also helps us (HCPs) evaluate the exercise class such as instruction, teaching, and atmosphere. It also improves the quality of the exercise class.” (Nurse ANC 2)

“...the feedback should be given approximately 5-10 minutes after each exercise class.” (G2, 1st)

Goal setting was raised in the workshops by the physiotherapist for motivating women to continue exercise until childbirth.

“We should set the goal per week. For example, we can set how long we will perform exercise as a goal, maybe a shorter time at the beginning of the exercise. After that, we can increase the duration and set it as a goal. That would motivate us to challenge what we can do next time.” (G1, 1st)

Pregnant women should start to set their short-term goal of exercise in the first few week and then progress up to meet the recommendations of exercise in pregnancy.

“I think there should be a short-term goal for exercise. The true outcome would be too long to be seen. It’s a good idea to set the goal into several steps. I agree that frequency

is set at 10 times per posture and then increased later until the post antenatal period.”
(Physiotherapist)

“ We will exercise around 25-30 minutes. Don't take too much time. It should be a gradual progress. Don't rush.” (Nurse ANC 2)

A role model is a substantial supporting factor for motivating pregnant women to exercise. This can be a successful woman who performs regular exercise during pregnancy such as well-known actresses, celebrities, or healthy pregnant women.

“ I think making use of a role model would be great. If there are women who succeeded in exercise during pregnancy and are healthy both themselves and their children, we should ask them to give a talk in the class. That would be a great motivation. They might be a well-known actress or the women who have received services in this hospital.” (G1, 1st)

“If we have a role model as a pregnant woman with a healthy, good shape, and a cute baby such as superstars, I want to exercise like them.” (G3, 2nd)

However, a role model who is a well-known actress or celebrity may be less useful than healthy woman for motivating exercise during pregnancy. This is because some pregnant women may recall that such well-known actresses are beautiful and have a good shape before pregnancy. It may not create any impact on regular exercise in pregnancy.

“ It would be good to have a role model. But it doesn't make a big difference if we can't find one. Role model is not necessarily to be well-known actresses because they are far more beautiful than us. That's not realistic. I think pregnant women who regularly exercise and get antenatal care here will be a good role model for exercise.” (G1, 2nd)

Pregnant women and HCPs shared an opinion that a role model should be chosen from women who perform regular exercise during pregnancy with no hidden agendas in business.

“Before pregnancy, I used to follow Instagram of superstars who have a good shape. Finally, it turned out she wants to sell supplement products for diet and I feel bad about it.”
(G1, 1st)

“ Some superstars always present and promote their products. There are hidden agendas in business. It's not only exercise.” (Doctor)

Pregnant women and HCPs also commented that rewards should not be used in the exercise programme.

“For me, I don’t care about rewards. I do something I want to. I don’t really need any reward.” (G2, 3rd)

Rewards were mentioned in the workshops as one of the motivation techniques. Rewards may act as a motivator some women who did not intend to exercise but it was thought that the exercise might stop when the rewards finished. Pregnant women may stop exercise after finished the rewards.

“In my opinion, I am not interested in any reward or money. If I want to exercise, I will do it by myself. I focus on its benefits and it is really good.” (G1, 3rd)

“I don’t agree about giving rewards. It seems unsustainable.” (Physiotherapist)

In addition, the budget of the organisation may not be sufficient to sustain a reward system. Generally, a reward system for pregnant women who continue exercise during pregnancy is unavailable in antenatal care clinic. It thus seems difficult to use this technique for motivating pregnant women in the real situation.

“Right. We can’t support this kind of thing forever.” (Nurse Educator)

“We don’t have enough budget for gift giving for all pregnant women. It’s too much. It’s impossible to give rewards for exercising pregnant women in the long term. If we got funds from the government, we might be able to give a health reward such as (Thai) herbal sauna and massage after childbirth, which is associated with exercise and health promotion during pregnancy.” (Nurse ANC 2)

However, if an organisation is able to set a budget for supporting pregnant women as a reward, it should be treated as a health reward such as herbal massage or health products. This is a proper way to go as it is associated with health promotion in pregnant women.

“If you have a budget, it would be OK to give rewards. Anyway, nobody expects to get a reward for exercise.” (G2, 2nd)

5.3.3 Group exercise network

Group exercise network, as identified by the workshop participants, may play a crucial role for promoting exercise behaviour in pregnancy.

“Exercise group network should be initiated to promote women to exercise together. Within the group, they can exchange information and support each other. It is a good idea. Group network encourages them to exercise.” (G1, 2nd)

Pregnant women and HCPs commented that group exercise network is one of two-way communication modes between pregnant women and HCPs. They discussed that this communication mode could be used to share their ideas and experiences about exercise during pregnancy.

“In my experience, we should form an exercise group network. Pregnant women will share their ideas and experiences, including building motivation for exercise.” (Doctor)

“I think a group chat (Line) for sharing experiences and ideas to support the group.” (Nurse ANC 1)

“Group network is for sharing information about exercise.” (G2, 3rd)

Pregnant women also expressed the group exercise might be useful for supporting their feeling and emotion of exercise during pregnancy.

“We should share and discuss about our feeling as well. We might get tired and bored of getting knowledge and just performing exercise. Sharing with others would be helpful to stabilise our emotion.” (G2, 3rd)

Pregnant women could receive informational and emotional support through a group exercise network that encouraged pregnant women to increase their level of exercise during pregnancy.

“We can send leaflets to the group chat (Line). Everyone can open and read the files anytime they want. ...Posters and brochures can be uploaded as files or photos on the group chat (Line) application as well.” (G3, 2nd)

“The group chat is for updating information as well as emotional support. For example, if I have a group exercise, I can talk to them more often.” (G1, 2nd)

Furthermore, in order to motivate pregnant women to exercise, a reminder of the exercise schedule could be provided weekly via the group chat application at least two days before the exercise class (Tuesday and Wednesday).

“ We should send texts about the date and time of the exercise class to pregnant women via the group chat every week, maybe one or two days before an exercise class.” (Doctor).

“It’s a good idea to remind me via text in the group chat because I can read when I have time. If you call me, sometimes I may not be able to answer.” (G2, 3rd)

“It’s ideal to send texts two days before the exercise class. If I have things to do, I will be able to manage time for exercise. One day in advance may be too soon to plan anything.” (G3, 2nd)

5.3.4 Follow-up to continue exercise

In the workshops, pregnant women shared their views about how to follow up on continuing exercise at home until childbirth. The follow up process might help pregnant women review their exercise behaviour during pregnancy. The data also helped HCPs get information on promoting the exercise behaviour of pregnant women, including improving quality of care.

“Sometimes I cannot remember if I exercised or not. I thought I regularly exercised, but I wasn’t sure about it.” (G1, 2nd)

“A follow-up from healthcare professionals motivates them to continue exercise. We will talk about problems and how to solve the problems. It is very important. There must be some evaluation of the outcomes, satisfaction, or results of exercise programme.” (Nurse ANC 2)

Participants reached a consensus that in order to follow up on the exercise behaviour of pregnant women who participated in the exercise programme, HCPs should ask about the frequency and duration, including types of exercise. HCPs should also advise them to record their exercise behaviour on an exercise diary in each exercise class.

“It will be good if they (HCPs) ask me about exercise behaviour in each exercise class.” (G2, 1st)

“I think exercise diary sounds great as it keeps track of what I’ve done.” (G1, 2nd)

“You (HCPs) should do both asking and advising me to record my exercise level on the exercise diary.” (G2, 3rd)

5.4 Brief summary: protocol of exercise programme for pregnant Thai women

As a result of workshops, the protocol of the exercise programme, based on recommendation of ACOG, ACSM and MoPH (ACOG, 2002, 2015; ACSM, 2014; Suputtitada, 2005) was designed as a hospital-based group exercise class once a week, 20-40 minutes/session over ten weeks (total of ten prescribed sessions) (see Appendix W). Exercise classes should split pregnant women into two small classes (16-17 women a class) at an educational room on Thursday and Friday, from 1.30 to 2.30 pm. The exercise training should be under the supervision of the researcher as an instructor in consultation with a physiotherapist. The target population should be pregnant women without contraindications for exercise, based on the checklist of the Physical Activity Readiness Medical Examination for Pregnancy in the Thai version (PARmed-X) (Davies et al, 2003; Suputtitada, 2005) at gestational age (GA) 18-20 weeks until GA 28-30 weeks.

The exercise programme should include both exercise education and exercise training sessions. During the exercise class, pregnant women should be observed closely and any warning signs will be picked up by the researcher. If pregnant women experienced any contraindications and/or warning signs against exercise, they should be referred to nurses (ANC) for further care. Pregnant women should do a self-report pulse rate using carotid pulse check (base rate and peak rate). The overall goal of exercise should be emphasised. This is to encourage pregnant women to achieve moderate exercise comprising 30 minutes or more of accumulated exercise in a day (at least ten minutes a session), at least three times a week (ACOG, 2002; ACSM, 2014). The participants should be advised to perform exercise at home at least twice a week.

Posters and leaflets (see Appendix X) should be provided for pregnant women at the first class of the exercise programme. The exercise information such as leaflets and posters should be uploaded on the group chat application (Line application). Line application is a

freeware chat application for instant communications on electronic devices such as smart phone, tablet computer or personal computer (Kujitjuerwong, 2012). The exercise schedule (see Appendix Y) should be updated as a motivator for exercise at least once a week via the group chat application. All participants will be reminded at least two days before exercise class via the group chat by the researcher. If the participants did not respond, the researcher would phone them directly via chat call application (Line call) or phone number.

5.5 Reflexivity from the workshops

The workshops took place in a prenatal education room, at the hospital. The room was quiet without disturbance from outside. One group was on the left of the room and the other was on the right. During the small group discussion, each group did not disturb each other. All participants sat on the floor for the discussion, which made them relaxed and equal. Topics for discussion started with general health behaviour during pregnancy and then scoped on the topic of exercise during pregnancy whereby the pregnant women felt free to open mind and share their ideas. HCPs at ANC and pregnant women had a close relationship due to the continuous antenatal care during pregnancy. This atmosphere reduced power imbalance between pregnant women and HCPs. The positive atmosphere thus provided a chance for the researcher to gather rich data. From the researcher's diary, the participant's expressions showed satisfaction with the workshops. There was a break every 30-40 minutes with refreshments. During the workshops, all participants could change positions as they wanted such as sitting on the chair or high fowler's position.

“Before the workshops, I was planning to set the meeting room for discussion on the table. I changed my mind though. Instead, I used a prenatal education room as it was convenient for both pregnant women and HCPs who participated in the workshops. When they expressed their ideas, they could feel a sense of equality, thereby reducing power imbalance between pregnant women and HCPs in traditional Thai culture. In addition, both groups are familiar with the prenatal education room so this created a perfect atmosphere for open discussion.

After the workshops, pregnant women said that they were happy to discuss in this room while sitting on the floor. It looked like an informal discussion. They had been afraid to express their opinions, thinking that it was quite academic. Although pregnant women developed a close relationship with HCPs through ANC here and discussed with them about childbirth plan, they were afraid that the discussion might affect their relationship. When they saw HCPs sitting on the floor in relaxed positions, they felt relaxed as well. In addition, HCPs talked as friends, discussing something like general health behaviour. Concurrently, the researcher emphasised the aims of this workshops, which made pregnant women free to express ideas, which positively affected the workshop outcomes.” (Researcher’s diary)

After the workshops, HCPs and pregnant women expressed their feeling and their opinion about the collaboration for designing the exercise programme. The collaboration is quite new in Thai healthcare service.

“I think, it’s good for us to share and make a decision what I want to do? Or what I don’t want to do? And why?” (G1, 2nd)

“This is quite new in the usual care because it gave patients (pregnant women) to participate with us for designing this exercise programme.” (Nurse ANC 1)

“I never do it before. ...I think, most of the healthcare service were designed and provided by HCPs.” (G3, 2nd)

The workshops gave chance for pregnant women and HCPs to communicate on their health and healthcare service.

“The workshops gave me a chance to talk with women. ...Why we forced them to do that? ...We don’t want to blame them but we want them to do appropriate for their health behaviour.” (Nurse ANC 2)

“Regularly, I got commands that what should I do? ...I don’t want that. ...I want to talk and discuss with them (HCPs). ...What’s the way suit for my health and lifestyle?” (G1, 3rd)

HCPs mentioned that this exercise programme is quite a new model in the Thai healthcare system for encouraging clients and HCPs to develop the healthcare service together. Traditionally, most of the healthcare services and/or activities were conducted from the government policy or from HCP perspectives rather from the client perspectives.

“We have guidelines from Public Health Department, and then we adjusted them in accordance with our antenatal care .Our developers included researchers, doctors, nurses, health educators, sport scientists, but not patients (pregnant women) until we ended up with the current programme.” (Nurse ANC 1)

A range of strategies were used to ensure that all participants had a chance to express their real experiences as equal partnership and no single individual dominated. In the first workshop, the first small group finished discussion on time while the second group finished five minutes later. However, the delay did not affect the overall schedule of the workshops. All participants actively expressed their experiences and ideas. Two women had been quiet in the first 15 minutes of the workshop. After they received motivation from other participants, they actively expressed themselves. Furthermore, no one in the workshop talked too much and dominated the other participants. In the second workshop, the schedule was run on time. All participants also actively expressed experiences and ideas. Pregnant women appeared more familiar with HCPs because they talked generally before starting the workshops about things such as series on television. The overall discussion in both workshops stayed on the topic.

“I felt nervous about the workshops. I wondered how I can get rich data from the workshops. I cannot run it again. I don't have enough time. I also worried about the regulation of the Ethics Committee. Everything should be run on schedule. I must conduct it on time. My assistant researcher and I prepared and made clear the aims and schedules of the workshops, especially those related to topics for discussion. I wanted to get rich data and to be aware when someone talks too much or someone keeps quiet.” (Researcher's diary)

CHAPTER 6

RESULTS OF THE FEASIBILITY STUDY

The objectives of the feasibility study were to determine the feasibility and acceptability of the exercise programme, and their preliminary effects; and to explore experiences of the research participants engaged in the exercise programme during pregnancy, including their perspectives of the healthcare professionals (HCPs) on the exercise programme. The findings from the exercise intervention and qualitative components (interviews and focus group) are presented in this chapter.

6.1 Exercise intervention

The exercise programme was tested in a feasibility randomised controlled trial (RCT) so as to determine the feasibility and acceptability of the protocol, including the preliminary effects of the exercise programme on pregnant women.

The exercise programme was delivered once a week, 20-40 minutes per session over 10 weeks (10 prescribed sessions) in the afternoon at a hospital-based group exercise class during 11th May 2017 to 14th July 2017. All exercise classes were instructed by the researcher in consultation with a physiotherapist who attended the first, fifth, and tenth weeks of the group exercise class. Each exercise training session included dynamic exercises: five-minute warm up for muscle stretching, 10-15 minutes muscular workout, 10-15 minutes cardiovascular exercise and five-minute cool down formuscular progressive relaxation. The exercise training session increased progressively from 20 minutes during the first week to 40 minutes at the fifth week. It started with a set of five repetitions per exercise and progressed to two sets of 10 repetitions. Pulse rate were recorded by a self-report using carotid pulse check of base rate and peak rate (see Appendix W).

6.1.1 Recruitment process

The recruitment process took place over four weeks. The feasibility RCT study is summarised in Figure 6.1 (CONSORT, 2010). In the first week, pregnant women with low risk pregnancies were invited by leaflets and posters advertising the study on a hospital notice board. Around one hundred leaflets were provided for pregnant women. Initially, it seemed that the women were not so interested in the study because most of the leaflets were left at the waiting area of the antenatal care (ANC) clinic. Only 25 women of women who got the leaflets in the first week of the recruitment process expressed interest in participating in the study (25%). Then the week after, the reception nurse verbally invited and gave a leaflet for 125 women over two weeks (average 10-15 women a day); 92 women were interested in participating in the study (73.6%). One hundred and seventeen women were provided with the full information and an information sheet by the researcher in a conversation which lasted around 10-15 minutes per person. Of 117 women, 13 women declined to participate due to the long involvement required by the study (11.11%).

One hundred and four women consented to participate in the exercise intervention (88.89%). Of 104 consenting women, 38 of them did not meet the inclusion criteria for the following reasons. Four women already regularly exercised at least 30 minutes a day for 3 days a week. Four were aged under 20 years. Further, four had history of vaginal bleeding. Three women had a severe anaemia (haemoglobin < 10 mg%) due to thalassaemia. Another three had a previous premature labour. Two women had a history of mental health problems and stress score > 30 points, and eight women had high risk of medical conditions: hypertension and diabetes. Another six women declined to participate in the study for personal reasons while the other four planned to move back to their hometowns.

Initially 66 women who met the inclusion criteria were enrolled (63.46%). They completed a baseline questionnaire and were randomised to either the intervention (n = 33) or

the control group (n =33). Five women were excluded completely from the study. The dropout rate was 7.58%. During the exercise intervention, three pregnant women were excluded from the control group. Two women were found to have low lying and partial placenta praevia at 28 weeks of gestation by ultrasound. One woman had a motorcycle accident at 26 weeks of gestation. Two women were excluded from the exercise intervention. Another woman was diagnosed with placenta praevia at 26 weeks of gestation. The other has moved from town at 27 weeks of gestation (see Appendix Z). The total sample size of this study was 61 pregnant women: the intervention group (n =31) and the control group (n = 30).

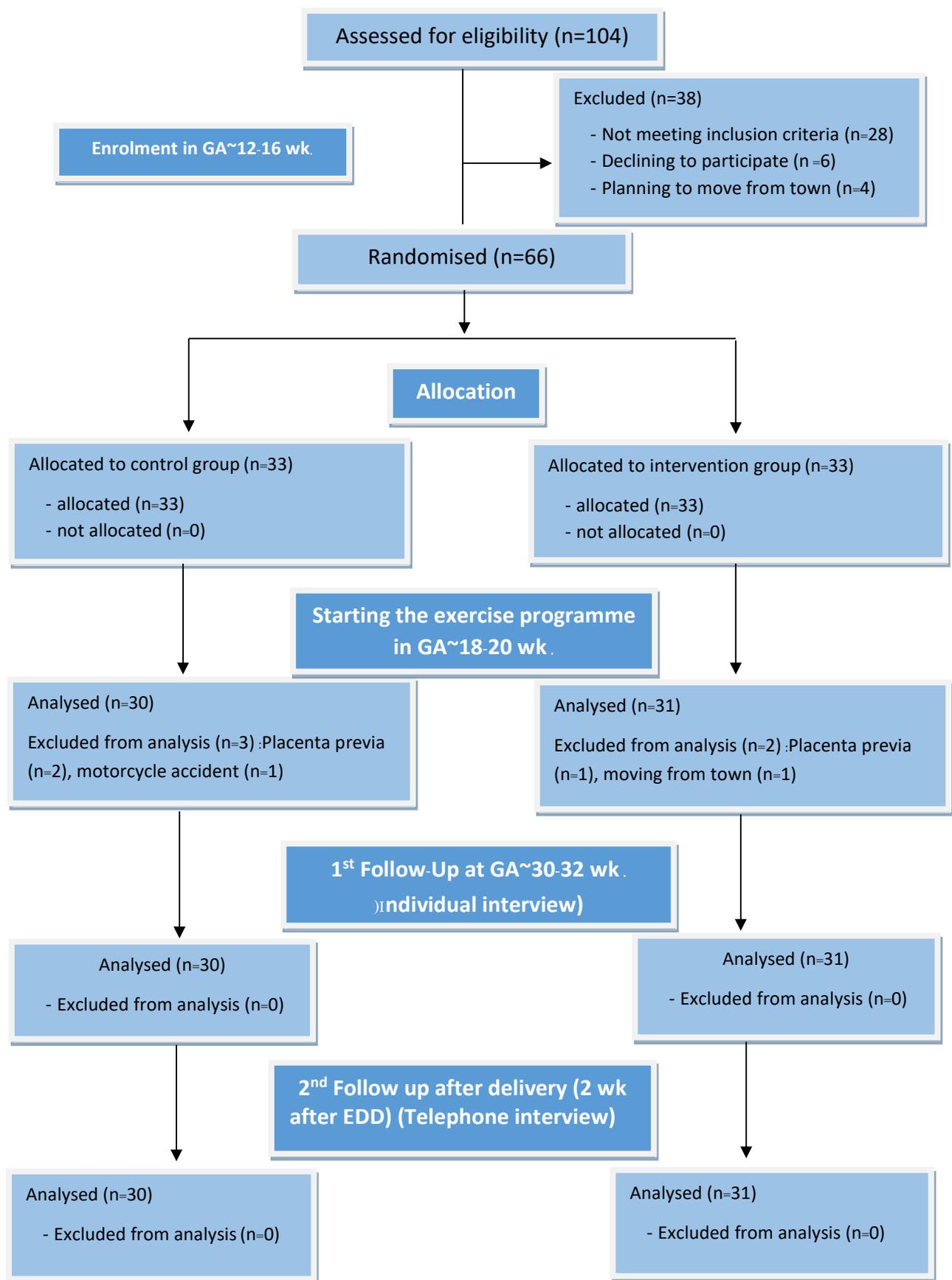


Figure 6.1: Flow diagram of the feasibility RCT study

The results of the exercise intervention are presented in three sections: demographic characteristics of the sample, preliminary effects of the exercise intervention, and feasibility and acceptability of the exercise intervention. The preliminary effects of the intervention consisted of gestational weight gain, baby birth weight, total physical activity and exercise frequency and duration, pregnancy outcomes and pulse rate of the participants during exercise intervention.

6.1.2 Demographic characteristics of the sample

Demographic characteristics did not differ significantly between the intervention and control groups. In keeping with CONSORT guidelines, the tests of significance were not carried out on baseline characteristics (Eldridge, et al, 2016). The demographic characteristics of the intervention and control groups are summarised in Table 6.1. The sample was aged between 20 and 40 years. The mean maternal age was 28.23 years with standard deviation (SD) of 5.67 years. The sample had pregnancy number between 1 and 4. Most of them were multigravida (65.57%). The sample earned family monthly income between 10,000 and 100,000 baht a month respectively. The mean and SD of their income were 27,147.54 and 15,455.14 baht a month. One-third of the sample had completed high school education (34.42%), and 37.72% of them held a Bachelor's degree. Almost half of them worked outside home (44.26%). The sample had pre-pregnancy body mass index (BMI) between 17.07 and 31.22 kg/m². The mean and SD of pre-pregnancy BMI were 22.57 and 3.90 kg/m² respectively. Nearly half of them had a healthy pre-pregnancy BMI between 18.5 and 22.9 kg/m² (47.54%). All participants were residents of Nakhon Sawan, Thailand, in both rural (village or countryside) and urban (town) areas.

Table 6.1: Demographic characteristics at 16-18 weeks of gestation

Baseline characteristics mean (\pm SD) or n (%)	Intervention group (n = 31)	Control group (n = 30)
Maternal age^a	29.10 \pm 6.28	27.33 \pm 4.90
Family income^c	30,258.06 \pm 9,332.13	23,933.33 \pm 9,303.07
Pre-pregnancy weight^a	55.48 \pm 8.15	59.67 \pm 11.72
Pre-pregnancy BMI^a	21.95 \pm 3.11	23.22 \pm 4.55
-Underweight (BMI < 18.5 kg/m ²)	6 (19.35%)	2 (6.66%)
-Healthy (BMI 18.5-22.9 kg/m ²)	15 (48.39%)	14 (46.67%)
-Overweight (BMI 23-29.9 kg/m ²)	10 (32.26%)	9 (30%)
-Obesity (BMI \geq 30 kg/m ²)	0	5 (16.67%)
Educational level^b		
-Primary school	1 (3.23%)	0
-Secondary school	5 (16.12%)	7 (23.33%)
-High school	11 (35.48%)	10 (33.34%)
-College degree	2 (6.46%)	1 (3.33%)
-Bachelor degree	12 (38.71%)	11 (36.67%)
- \geq Master degree	0	1 (3.33%)
Gravida^b		
-Primigravida	11 (35.48%)	10 (33.33%)
-Multigravida	20 (64.52%)	20 (66.67%)
Occupation^b		
-Government /employee	10 (32.25%)	12 (40%)
-Self-employed	6 (19.35%)	4 (13.33%)
-Agriculture	4 (12.90%)	3 (10%)
-Housewife	11 (35.50%)	11 (36.67%)

^a t-test for continuous variables

^b χ^2 test for categorical variables

^c Non-parametric test :Mann-Whitney U test

Table 6.1: Demographic characteristics at 16-18 weeks of gestation (continued)

Baseline characteristics mean (\pm SD) or n (%)	Intervention group (n = 31)	Control group (n = 30)
Location of work^b		
-Inside home	7 (22.58%)	5 (16.67%)
-Outside home	13 (41.94%)	14 (46.66%)
-None	11 (35.48%)	11 (36.67%)
Area of living^b		
-Urban area	15 (48.39%)	15 (50%)
-Rural area	16 (51.61%)	15 (50%)

^a t-test for continuous variables

^b χ^2 test for categorical variables

^c Non-parametric test :Mann-Whitney U test

6.1.3 Preliminary effects of the exercise intervention

The preliminary effects consisted of primary and secondary outcomes. The primary outcome was total gestational weight gain. The secondary outcomes included the frequency and duration of exercise behaviour, blood pressure, pulse rate, stress score, and baby birth weight. Among the participants, there were no adverse events related to exercise reported during the exercise intervention until childbirth.

Analysis of Covariance (ANCOVA) was used to analyse the difference between intervention and control groups (Vickers & Altman, 2001) for total gestational weight gain (TGWG), and baby birth weight values. A repeated measures ANCOVA using a linear model was used to compare the effects of group allocation (intervention and control groups), time (baseline at 16-18 weeks of gestation, and 30-32 weeks of gestation) and their interaction on total physical activity, blood pressure and stress score. Maternal age, pre-pregnancy BMI and gestational age were entered as covariates due to their significant association with baby birth weight, TGWG, stress score, blood pressure, and physical activity (Won Bang & Sun Lee,

2009; Lancaster et al., 2010; Metgud, Naik & Mallapur, 2012; Nascimento, Surita & Cecatti, 2012; Schellong et al., 2012; Bazyar et al., 2015; Deklava et al., 2015; Fan et al., 2015; Yang et al., 2015; Bartsch et al., 2016; Zanardo et al., 2016; Yang et al., 2017).

The normality assumption of the residuals of the variables was verified by checking the distribution of the data obtained by skewness and kurtosis coefficients, including histograms, Kolmogorov-Smirnov and Shapiro-Wilk tests. The assumption of homogeneity of variance for ANCOVA was tested using Levene's Test. The assumption of Sphericity for repeated measures ANCOVA was tested using Mauchly's test (Field, 2015). Pre-pregnancy BMI values were square root-transformed because of moderate right skewness. Square root-transformed pre-pregnancy BMI was entered as a covariate in ANCOVA and repeated measures ANCOVA model. Diastolic blood pressure at 30-32 weeks of gestation, stress score at baseline and 30-32 weeks of gestation values were log-transformed due to right skewness.

- **Total gestational weight gain**

Pre-pregnancy weights did not differ significantly between intervention and control groups ($t(59) = -1.613, p = .113$) (Table 6.1). TGWG in the intervention and control groups is summarised in Table 6.2. TGWG was calculated as weight at delivery minus pre-pregnancy weight. TGWG was the dependent variable in the ANCOVA model. Groups of study (intervention and control groups) were used as a fixed factor while maternal age, pre-pregnancy BMI, gestational age at delivery, and baby birth weight were entered as covariates. TGWG differed significantly between the intervention and control groups after adjusting for maternal age, pre-pregnancy BMI, gestational age at delivery, and baby birth weight, $F(1, 55) = 58.934, p < .001, \text{partial } \eta^2 = .517$. More women in the intervention group had appropriate TGWG, according to the recommendation made by the Institute of Medicine (IOM, 2009), than the control group with an average weight gain of 12.64 (± 2.51) kilograms

(kg.) for the intervention group, and 17.73 (± 4.61) kg. for the control group (The American College of Obstetricians and Gynecologists (ACOG), 2013).

- **Baby birth weight (BBW)**

Baby birth weight (BBW) was the dependent variable in an ANCOVA model with maternal age, pre-pregnancy BMI, gestational age at delivery, and TGWG as covariates. The baby birth weight in the intervention and control groups are summarised in Table 6.3. There was no significant effect of the exercise intervention on baby birth weight with an average birth weight of 3,084.84 (± 307.63) grams for the intervention group and 3,176 (± 485.09) grams for the control group, after controlling for maternal age, pre-pregnancy BMI, gestational age at delivery, and TGWG, $F(1, 55) = 3.891, p = .054, \text{partial } \eta^2 = .066$. Most of the babies in the intervention and control groups had appropriate birth weight (BBW 2,500-3,499 grams) between 90.32% and 60% respectively. However, baby low birth weight was not found in the intervention group.

Table 6.2: Total gestational weight gain in the control and intervention groups

Variable mean (\pm SD)	Intervention (n = 31)	Control (n = 30)	Absolute effect size (95%CI)	p-value ^a	Adjusted effect size (95%CI)	Adjusted p-value ^b
Total weight gain (kilograms)	12.64 \pm 2.51	17.73 \pm 4.61	-5.09 (-6.98 to -3.2)	<.001	-5.73 (-7.22 to -4.23)	<.001
-Appropriate GWG	26 (83.87%)	6 (20%)				
-Excessive GWG (>IOM)	3 (9.67%)	24 (80%)				
-Inadequate GWG (<IOM)	2 (6.46%)	0				

^a Unadjusted analysis

^b Linear or generalised linear mixed model for covariate factor, maternal age, pre-pregnancy BMI, gestational age at delivery, and baby birth weight

Table 6.3: Baby birth weight in the control and intervention groups

Variable mean (\pm SD)	Intervention (n = 31)	Control (n = 30)	Absolute effect size (95%CI)	p-value ^a	Adjusted effect size (95%CI)	Adjusted p-value ^b
Baby birth weight (grams)	3,084.84 \pm 307.63	3,176 \pm 485.09	-91.16 (-298.6 to 116.2)	.383	257.69 (-4.12 to 519.5)	.054
-Low birth weight (BBW < 2,500 grams)	0	3 (10%)				
-Appropriate birth weight (BBW 2,500-3,499 grams)	28 (90.32%)	18 (60%)				
-Large birth weight (BBW \geq 3,500 grams)	3 (9.68%)	9 (30%)				

^a Unadjusted analysis

^b Linear or generalised linear mixed model for covariate factor, maternal age, pre-pregnancy BMI, gestational age at delivery, and total gestational weight gain (TGWG)

- **Total physical activity (PA) and exercise frequency and duration**

Total PA at baseline (16-18 weeks of gestation) did not differ significantly between the intervention and control groups ($t(59) = .269, p = .789$). A repeated measures ANCOVA was conducted to compare PA in the intervention and control groups over time at baseline (16-18 weeks of gestation and 30-32 weeks of gestation). Maternal age and pre-pregnancy BMI were entered as covariates in the model. There was a significant effect of the exercise intervention on the total PA after controlling for maternal age, and pre-pregnancy BMI, $F(1, 57) = 21.283, p < .001, \text{partial } \eta^2 = .272$. The total PA in both intervention and control groups is summarised in Table 6.4.

The total PA was calculated from different behavioural domains: work, transport, and recreation. The Metabolic Equivalent of Task (MET) is commonly used to express the intensity of physical activities, and also to analyse physical activity data in minutes per week (WHO, 2004; Singh & Purohit, 2011). Pregnant women in the intervention group increased their total PA from the average of 1,601.94 (± 530.97) MET-minutes/week at baseline (16-18 weeks of gestation) to 2,385.16 (± 516.63) MET-minutes/week at the end of the exercise intervention (30-32 weeks of gestation), while women in the control group decreased their total PA from the average of 1,546 (± 633.47) MET-minutes/week at baseline to 1,340 (± 314.87) MET-minutes/week at the end of the intervention. In addition, most women who participated in the exercise intervention at 30-32 weeks of gestation did exercise during pregnancy, following ACOG's recommendation (ACOG, 2002, 2015; ACSM, 2014; Suputtitada, 2005), at least 30 minutes a day, 3 times a week (24, 77.42%). On the other hand, most women in the control group indicated they did not perform exercise at 30-32 weeks of gestation 22 (73.34%).

Table 6.4: Total physical activity in the control and intervention groups

Variable Mean (\pm SD)	Intervention (n = 31)	Control (n = 30)	F	p-value ^a	Adjusted effect size (95%CI)	Adjusted p-value ^b
Total physical activity						
(MET-min/wk.)			21.283	<.001		
-Baseline (GA 16-18 wk.)	1,889.4 \pm 493.2	1,852 \pm 587.1			31.94 (-256.9 to 320.8)	.826
-Follow-up (GA 30-32 wk.)	2,643.6 \pm 493.2	1,635.5 \pm 288.2			1,010.4 (793.6 to 1,227.2)	<.001
	Baseline (GA 16-18 wk.)		Follow-up (GA 30-32 wk.)			
	Intervention	Control	Intervention	Control		
	(n =31)	(n =30)	(n =31)	(n =30)		
Exercise behaviour, n (%)						
(ACOG's recommendation)	24 (77.42%)	24 (80%)	0	22 (73.34%)		
-No exercise	7 (22.58%)	6 (20%)	7 (22.58%)	4 (13.33%)		
-Inadequate exercise	0	0	24 (77.42%)	4 (13.33%)		
-Exercise						

^a P value differences within groups

^b P value for effect of intervention between groups (Repeated-measurements ANCOVA for covariate factors: maternal age and pre-pregnancy BMI)

- **Pregnancy outcomes: blood pressure and stress score**

Systolic and diastolic blood pressure (BP) at baseline (16-18 weeks of gestation) did not differ significantly between the intervention and control groups (Systolic BP: $t(59) = -1.215, p = .229$ and Diastolic BP: $t(59) = .748, p = .458$). Systolic and diastolic blood pressure were taken as the dependent variable in the repeated measurement ANCOVA model over time at baseline and 30-32 weeks of gestation. Groups of study (intervention and control groups) were entered as a fixed factor while maternal age and pre-pregnancy BMI were entered as covariates.

After controlling for maternal age and pre-pregnancy BMI, systolic blood pressures differed significantly between the intervention and control groups over time at baseline and 30-32 weeks of gestation, $F(1, 57) = 11.126, p = .002, \text{partial } \eta^2 = .163$. However, diastolic blood pressure did not differ significantly after controlling for maternal age and pre-pregnancy BMI, $F(1, 57) = 1.418, p = .239, \text{partial } \eta^2 = .024$.

Stress score at baseline (16-18 weeks of gestation) did not differ significantly between intervention and control groups, $t(59) = .343, p = .733$. Stress score was taken as the dependent variable in the repeated measurement ANCOVA model over time at baseline (16-18 weeks of gestation) and 30-32 weeks of gestation. Groups of study were entered as a fixed factor while maternal age and pre-pregnancy BMI were entered as covariates. Stress scores differed significantly between the intervention and control groups over time at baseline and 30-32 weeks of gestation after controlling for maternal age and pre-pregnancy BMI, $F(1, 57) = 14.079, p < .001, \text{partial } \eta^2 = .198$. Pregnancy outcomes: blood pressure and stress score are summarised in Table 6.5.

Table 6.5: Pregnancy outcomes :blood pressure and stress score

Variable mean (\pm SD)	Intervention (n = 31)	Control (n = 30)	F	<i>p</i> -value ^a	Adjusted effect size (95%CI)	Adjusted <i>p</i> -value ^b
Systolic blood pressure (mmHg.)			11.126	.002		
-Baseline (GA 16-18 wk.)	109.03 \pm 12.7	112.67 \pm 10.52			-3.346 (-9.42 to 2.73)	.274
-Follow-up (GA 30-32 wk.)	108.35 \pm 6.48	121.2 \pm 11.38			-12.187 (-16.90 to -7.48)	<.001
Diastolic blood pressure (mmHg.)			1.418	.239		
-Baseline (GA 16-18 wk.)	61.48 \pm 9.79	59.8 \pm 7.64			2.465 (-1.65 to 6.582)	.235
-Follow-up (GA 30-32 wk.)	60.13 \pm 7.14	63.1 \pm 7.29			-.017 (-.041 to .008)	.174
Stress score (point)			14.079	<.001		
-Baseline (GA 16-18 wk.)	11.94 \pm 2.63	11.73 \pm 2.73			.017 (-.036 to .069)	.523
-Follow-up (GA 30-32 wk.)	8.77 \pm 1.87	13.23 \pm 2.27			-.178 (-.224 to -.131)	<.001

^a *P* value differences within groups

^b *P* value for effect of intervention between groups (Repeated-measurements ANCOVA for covariate factors: maternal age and pre-pregnancy BMI)

- **Pulse rate of the participants during exercise intervention**

Pulse rates of the participants in the exercise intervention group (n = 31) was self-reported using carotid pulse (both base rate before and after exercise, and peak rate during exercise) every week of the exercise classes. The timeline for recording pulse rate of the participants in the intervention group is shown in Figure 6.2. Base pulse rate before exercise was recorded before starting warm up exercise. Peak pulse rate was recorded after muscular workouts and aerobic exercise .Base pulse rate after exercise was recorded after cool down exercise.

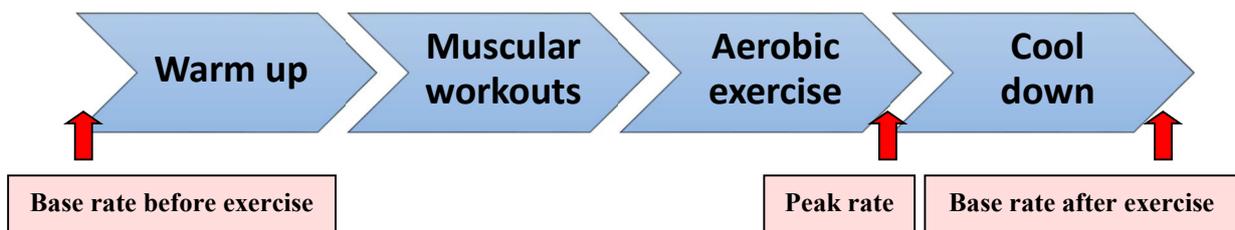


Figure 6.2: The timeline for recording pulse rate of the participants

A repeated measures ANCOVA was conducted to compare the pulse rate of participants in the exercise group at base rate before exercise, peak rate of exercise, and base rate after exercise controlling for maternal age and pre-pregnancy BMI. The pulse rate of the participating women in the intervention group is summarised in Table 6.6. There was a significant effect of exercise on pulse rate after controlling for maternal age and pre-pregnancy BMI, $F(1, 28) = 207.814, p < .001, \text{partial } \eta^2 = .881$. The pulse rate of pregnant women indicated that pregnant women performed moderate intensity of exercise. Moderate intensity of exercise during pregnancy is safe for pregnant women (Davies, Wolfe, Mottolo & MacKinnon, 2003; ACSM, 2014; ACOG, 2015).

Table 6.6: Pulse rate of participants in the intervention group (n = 31)

Variable mean (\pmSD)	Exercise intervention	F	<i>p</i>-value^a	Adjusted effect size (95%CI)	Adjusted <i>p</i>-value^b
Pulse rate (beats per minute, bpm)		207.814	<.001		
-Base rate before exercise	77.08 \pm 3.16			66.296 (49.452 to 83.140)	<.001
-Peak rate	115.30 \pm 2.35			116.669 (103.861 to 129.477)	<.001
-Base rate after exercise	77.21 \pm 2.69			69.204 (54.553 to 83.855)	<.001

^a *P* value differences within groups

^b *P* value for effect of intervention in groups (Repeated-measurements ANOVA for covariate factors: maternal age and pre-pregnancy BMI)

6.1.4 Feasibility and acceptability of the exercise intervention

Feasibility and acceptability of the exercise intervention were analysed through a questionnaire (see Appendix L) with women (n = 31), who participated in the exercise intervention, at two weeks after completion of the intervention (GA 30-32 weeks of gestation) in terms of adherence rate, completeness of data collection, follow up, satisfaction of the exercise intervention, reasons for continued or discontinued participation and suggestions for any changes to the exercise programme.

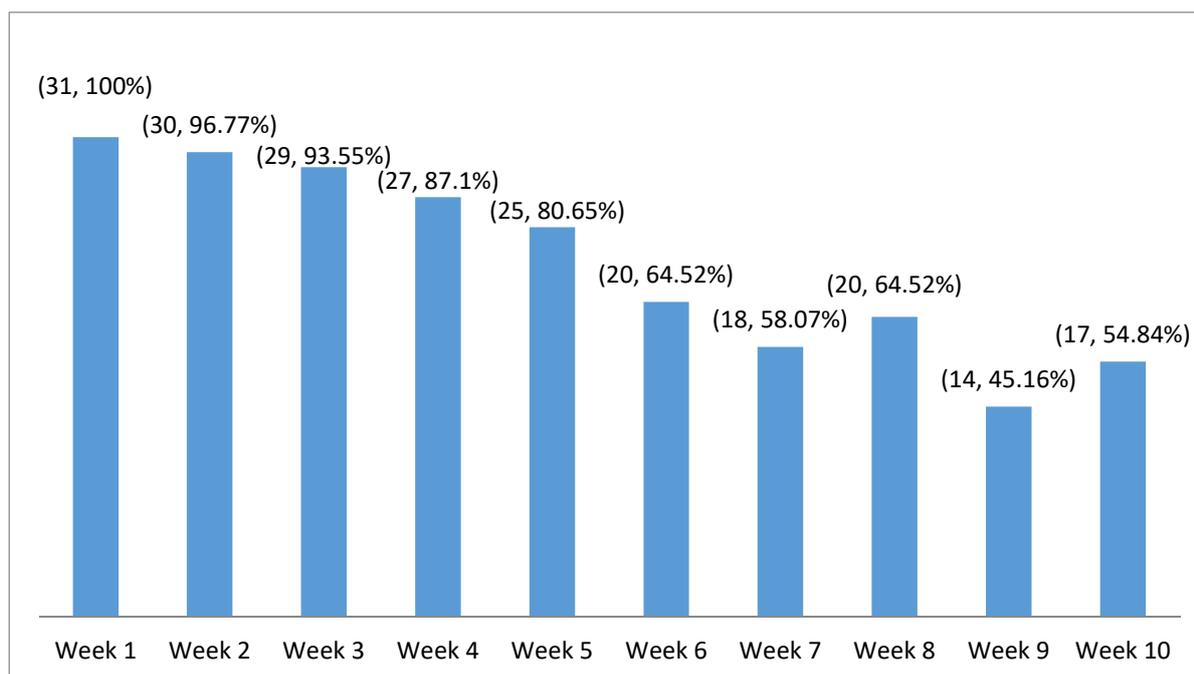
- **Exercise programme**

According to the feedback from participants after the exercise class, the atmosphere of the class seemed quiet and very formal in the first week. In the second week, a welcoming environment was created to enhance a positive atmosphere, friendliness and two-way communication. Each woman was called by her first name. From the third week, the participating women became relaxed and actively participated in the class.

- **Adherence to the exercise intervention**

Adherence rate was calculated from the number of times each woman attended over the course of the exercise intervention (n = 31). The number of women in each exercise class is shown in Figure 6.3. Around half of the women who participated in the exercise programme adhered for 80% of the exercise programme, which means that they attended at least 8 weeks) 17, 54.84%. Nearly one-third of women adhered to the exercise programme between 60-79% (9, 29.03%). Five women participated less than 60% (16.13%). The total number of their absence was 86 times. Reasons for their absence included: being busy with work and duties (43, 50%), transportation (no car) (8, 9.30%), poor weather (6, 6.98%), making merits on Buddhist days (5, 5.81%), and visiting family in another town (4, 4.65%) respectively. Occupations, locations of work, and areas of living were identified as factors associated with the number of absences from the exercise classes.

Figure 6.3: The number of women in each exercise class (n, %)



- **Follow up and exercise intervention fidelity**

All participants completed the follow-up questionnaire at two weeks after the completion of the exercise intervention (GA 30-32 weeks of gestation). All of them were interviewed by telephone after their expected date of delivery (EDD) (100%). Each interview took approximately 15-20 minutes. The data were collected completely from medical records because medical records were manually taken by nurses in compliance with audit standard.

An exercise diary was recorded by each of the women in the intervention group from the beginning of the intervention until delivery (n = 31). Participating women were telephoned by the researcher about the exercise two weeks after EDD. Five women stopped recording their exercise behaviour after the end of the exercise intervention (16.13%) due to the complication of the exercise record and difficulties in recording. They thought it was a waste of time to keep the exercise record every day.

From exercise diary, most of the women who continued exercise until delivery (26, 83.87%) exercised at least three days a week for at least 30 minutes a day (19, 73.08%).

Seven women continued exercise less than three days a week for at least 30 minutes a day (7, 26.92%). Most of them gave as their reasons for continuing exercise until delivery that they wanted to reduce discomfort during pregnancy, especially low back pain, leg cramp, muscle strain and insomnia. However, five women stopped exercise around two weeks after the end of the exercise intervention as a result of their duties, tiredness from work, and a lack of motivation (16.13%).

- **Acceptability of the exercise intervention**

All of the pregnant women who participated in the exercise intervention (n = 31) agreed that the exercise programme should be made as part of the usual ANC at clinic. Most of them were satisfied with the overall exercise programme (30, 96.77%). Women were highly satisfied with the duration of each exercise class, saying that it provided sufficient demonstrating and training (28, 90.32%). The exercise programme encouraged women to gain a better understanding of exercise, changing their attitudes of exercise, and increasing the frequency and duration of their exercise behaviour. Women indicated that the exercise programme was helpful in maintaining their fitness level (13, 41.94%) and reducing discomfort during pregnancy (20, 64.52%) such as leg cramp, backache, insomnia, and muscle strain, including stress and anxiety while increasing relaxation. Women also enjoyed the exercise programme partly because there was an exercise group network for sharing their experiences (24, 77.42%) and motivating them to continue exercise (during pregnancy and after delivery). In this way, two-way communication can occur as both the instructor of the exercise programme and the pregnant women can learn from each other. On the other hand, women commented that the positions of some of the exercises in this programme, such as pelvic rock hands and knees and leg lift were quite difficult to master in the first few weeks (21, 67.74%).

In addition, time is another issue of concern as this exercise programme will be integrated in a part of the usual care at the ANC clinic. Most of the women suggested that an exercise appointment should be made on the same day of their visit at ANC clinic (18, 58.06%). Women felt it was a waste of time and money when they travelled to hospital for the exercise only over 10 weeks .In their opinion, it would be better to conduct such a class every three or four weeks. It is unnecessary to arrange a weekly class as they have many other duties to fulfil (20, 64.52%). They added that exercise programme should be reduced from a weekly basis to at least once a month during the second and third trimesters or around four or five times over 10-12 weeks during the second trimester)22, 70.97%(. Women also said that HCPs should regularly update their exercise knowledge so that they will be able to deliver such knowledge to pregnant women in a proper and effective way (19, 61.29%).

6.2 Qualitative component

This section reports the findings of interviews with pregnant women and a focus group with HCPs approximately two weeks after the completion of the exercise intervention between July and August 2017. The findings from the two groups of participants will be reported separately before the synthesis as follows: 1) Results of interviews with pregnant women, and 2) Results of focus group with HCPs.

6.2.1 Results of interviews with pregnant women

Ten pregnant women, who participated in the exercise programme over 10 weeks, were interviewed by telephone at 30-32 weeks of gestation by the researcher although 14 had expressed an interest in participating in interviews. Two women withdrew from the interviews because of their duties. The demographic characteristics of pregnant women are summarised in Table 6.7. In an interview with another woman, there was a storm and that made her mobile phone signal unclear. The other woman became unavailable due to her child's illness. All interviews were recorded with a digital telephone voice recorder. Participants were residents of Nakhon Sawan, Thailand, in both the rural (village or countryside) and urban (town) areas. The age of participants ranged from 20 to 40 years. The average income of participants was 27,000 baht a month. Most of the participants had a healthy pre-pregnancy BMI (60%).

Table 6.7: Demographic characteristics of pregnant women in the interviews

Demographic characteristics	Number (n)	Percentage (%)
Age		
-20-29 years	5	50
-30-39 years	4	40
- ≥40 years	1	10
Number of gravida		
-Primigravidarum	4	40
-Multigravidarum	6	60
Occupation		
-Employee	1	10
-Self-employed	2	20
-Agricultural	2	20
-Housewife	5	50
Work		
-Inside home	7	70
-Outside home	3	30
Education		
-Secondary school or equal	4	40
-High school or college degree	3	30
-Bachelor degree or equal	3	30
Pre-pregnancy Body Mass Index (BMI)		
-Underweight (BMI < 18.5 kg/m ²)	1	10
-Healthy (BMI 18.5-22.9 kg/m ²)	6	60
-Overweight (BMI 23-29.9 kg/m ²)	3	30
Number of participation in an exercise programme		
-Less than 6 times (< 60%)	4	40
-Between 6-7 times (60-79%)	2	20
-At least 8 times and above (≥ 80%)	4	40

Four main themes emerged from the interviews following the exercise programme . The themes and sub-themes are shown in Table .9. Topics of telephone interviews covered a range of issues on pregnancy and exercise, including the exercise intervention as follows: participant’s experiences with the exercise intervention; strengths and weakness of the new exercise programme; ideas on how this exercise programme would fit in the usual antenatal care; and suggestions for possible changes to the programme in order to better benefit women and the related healthcare service.

Table 6.8: Themes and sub-themes from interviews with pregnant women

Themes	Sub-themes
1. Exercise is easier than I think	1.1 Exercise is not for rich people only 1.2 Exercise is easy to access through healthcare service
2. I want to become a modern mum	2.1 I want to be a healthy mum 2.2 Exercise during pregnancy is a new trend in Thailand
3. Doubts and concerns at the beginning	3.1 I have excuses to stop exercise 3.2 Family traditional views as an influencing factor 3.3 Other health messages are louder
4. I get active and keep up with exercise until childbirth	4.1 support and guidance helped me to continue 4.2 I can take simple exercise at home 4.3 Group exercise has motivated me to continue exercise

Theme 1: Exercise is easier than I think

This theme illustrates how women changed their views and attitudes about exercise during pregnancy, which is a main concept underpinning the other themes. Pregnant women expressed their thoughts about exercise before enagaging in the exercise programme: exercise was difficult to do and far away from their daily life. After pregnant women participated in the exercise programme, they had changed their mindsets and attitudes about exercise during pregnancy.

“I never thought about exercise anyway... I know the benefits of exercise, but it’s difficult, far away, and costly... It’s impossible .Now that I’ve learned about exercise, I understand it isn’t difficult or costly.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

“I thought it)exercise (is difficult for me... .It)exercise (was not easy for me... I never exercised before .When I tried exercise in this pregnancy, it’s better than I thought .It’s not complicated, either.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

Exercise in the real world is dissimilar to what they previously thought .In other words, it is easier than they think. They gained a better understanding of exercise and how to manage exercise activity during pregnancy in their daily life.

“The exercise programme is easier to follow than I previously thought .There is no advanced knowledge required.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

Sub-theme 1.1: Exercise is not for rich people only

Initially, the participants perceived exercise during pregnancy as relatively expensive as a result of social media and celebrities’ lifestyle. In their view before participating in the exercise programme, it appeared that, exercise requires specialist materials and equipment. Rather than spending on exercise, pregnant women wanted to save money for the baby’s birth, raising their baby, and future expenses.

“There are some yoga courses for pregnant women though .But these courses are expensive, plus exercise clothes and yoga mats.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“I saw some pregnant celebrities exercise on TV... I don’t think I can handle that .I thought exercise needed a lot of equipment and clothes... .What I saw on TV were cushions, balls, tread mills .I cannot afford such things.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

They therefore concluded that exercise in pregnancy would be suitable for rich people or celebrities.

“It may be appropriate for the rich, not the average.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

“ Gyms bring in pricey exercise equipment from abroad, and their members are rich people... .Exercise in pregnancy in the countryside is not easy for families with middle income like mine, but the rich in the nearby market might be able to do so.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

After pregnant women participated in the exercise programme, they have changed their attitude that exercise is for rich people only. The exercise programme helped them take simple exercise that can be done in daily life.

“Now I can take regular exercise during pregnancy without extra money.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“After I engaged in the exercise programme, I realised it doesn’t need money for exercise.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“I joined in the exercise programme because it’s good and free.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Sub-theme 1.2: Exercise is easy to access through healthcare service

The participants expressed an opinion that women who live in urban areas in a big city such as Bangkok, and Chiangmai have better access to advanced healthcare services during pregnancy (e.g .exercise information, choices of fitness centre, and exercise training) than those in the countryside. Their point of view indicated that exercise during pregnancy is thought of as a privilege for those who live in urban areas.

“I come from a relatively wealthy family in urban areas (Bangkok) ...Bangkok can offer plenty of facilities for pregnancy like food choices, exercise courses, and doctors.” (20 years, G₁P₀, GA 33⁺⁵ wk.)

“Further, exercise classes for pregnant women offered by private hospitals in Bangkok are so expensive.” (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

The pregnant women shared their experience of struggling to access exercise classes or exercise courses for pregnant women in this town)Nakhon Sawan: outside Bangkok(.

“In my first pregnancy, I didn’t exercise at all... I had the antenatal care with a nearby public health centre. ...They didn’t offer any exercise class for pregnancy. ...If I wanted to exercise I should go for the care in Bangkok. ...They didn’t advise much about how to access exercise classes or an exercise course for pregnant women in other hospitals, just emphasised on following on the usual care appointments.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

Women in the countryside tend to focus on their livelihood rather than exercise .They think exercise is only for women with financial readiness.

“During my first pregnancy, I didn’t exercise at all .I used an antenatal care service with a rural hospital where I wasn’t instructed much. ...Our livelihood comes first.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

After their participation in the exercise programme, pregnant women realised that it is easy to access healthcare service for exercise during pregnancy in the public hospital as part of additional service available for all. Hence, they thought of this exercise programme as an upgrade of healthcare service in the public hospital.

“If public hospitals in both rural and urban areas are able to provide the same service free of charge, it means an upgrade of their service that can be accessed by everyone.” (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

“It’s good for pregnant women who live in rural areas. They can have a choice and access exercise at the same level of service to those who live in urban areas. ...If such a programme is available at all the public hospitals, women from low to middle classes will be able to access exercise during pregnancy to be provided as standard service.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

The participants appreciated having had the opportunity to exercise in pregnancy. They also felt that this exercise programme is a great choice for pregnant women who live in Nakhon Sawan province.

“I think it’s good for me to have a choice for exercise during pregnancy and it’s easy to access relevant information and training from here (in the public hospital, Nakhon Sawan).” (20 years, G₁P₀, GA 33⁺⁵ wk.)

“It’s a great for women who live in Nakhon Sawan to have a choice.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Theme 2: I want to become a modern mum

This theme reflects the experiences of women who exercised during pregnancy after they have changed their mindset and attitude about the exercise .Pregnant women commented that the exercise programme had motivated them to exercise for health and for their baby during pregnancy .They also expressed their exerciseattitude associated with body image and

beauty. This can be viewed as the transition from a traditional to modern mother, which is a new trend in Thailand.

“I want to be a modern young mother with a good figure, like celebrities. ...I don’t want to look old.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“After delivery, I don’t want to have a big body and I don’t want that for my baby, either. ... I want to be a good-shaped mother.” (20 years, G₁P₀, 32⁺⁵ wk.)

For some women who saw themselves as older, the main concern is about staying young.

“I think it benefits me and my baby.I’m getting old now. ...This programme has inspired me to exercise. ...I started exercising.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“This is my second pregnancy so I am not so healthy like young mothers. I mean my body shape, skin, looks and aura are not as good as younger mothers.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Sub-theme 2.1: I want to be a healthy mum

Pregnant women felt that they were more active as compared to the pre-pregnancy period as well as previous pregnancies. They perceived the benefits of exercise and expressed a desire to continue exercising until the birth of their babies. Thus, benefits of exercise for mothers and their babies play a key role in exercise behaviour during pregnancy.

“My reason for exercise is basically my baby. I feel, I’m getting old and my health is not perfect. ...As a farmer, I have pain in my back and legs and the pain worsens when I get pregnant .In fact, I just left it like that since my first child. When I get pregnant again, I have to take care of my health. ...I decided to start exercise .It’s not for me but for my baby.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Pregnant women who is older pregnant women also commented that exercise during pregnancy assisted them to decrease risk of complications during pregnancy such as gestational diabetes mellitus (GDM).

“I think it benefits my baby and myself. ...The exercise programme seems interesting as it can benefit my baby. I learnt it from my previous pregnancy and I know what I missed back then. So, I want to do better for this pregnancy. ... This programme has inspired me to

exercise. I'm pregnant this age so I have diabetes risk. Maybe it's not enough to go on diet. To better reduce this risk, I started exercise .It does help.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

Pregnant women recognised numerous positive impacts of exercise during pregnancy on the physical health and well-being of both mothers and babies. Pregnant women said that exercise reduced risk and discomfort during pregnancy such as low back pain, leg cramps, and muscle strain.

“The programme helps us see the benefits of exercise .It urges us to care for health. ...For me, I don't have backache at all. ...I don't feel numb, either. Maybe it will happen later. But I think if we exercise regularly, there would be no backache or numbness.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“It Exercise during pregnancy (helps relieve my lower back pain and leg cramps .I feel better after exercise.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

At the same time, it also improved their well-being by reducing stress and anxiety, helping with sleep, and a more positive mood.

“I feel exercise is good for my health... .I felt relax after exercise. ...It also helped me to get better sleep. ...My husband told me I look happy and no mood swings.” (20 years, G₁P₀, 32⁺⁵ wk.)

They also felt the benefits of exercise on their body shape and beauty, particularly after delivery which motivated them to engage in exercise.

“I intend to start and keep exercising after delivery because I want to get my figure back .I don't want to look old.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“Even after delivery, I also want to exercise .I want to get back in shape .I don't want to have a big body. ...My stomach doesn't have stretch marks, either.” (20 years, G₁P₀, 32⁺⁵ wk.)

“This is my second pregnancy so I am not so healthy like young mothers. I mean my body shape, skin, looks and aura are not as good as younger mothers. But if I keep exercising, this will help firm muscles. My muscles will not be saggy and ugly .So, I pay attention to continue exercise.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

In addition, pregnant women were aware of other health behaviour during pregnancy after participating in the exercise programme. They wanted to be a healthy mum.

“I wanted to be a healthy mum. ...I’m aware of all healthy behaviour during pregnancy ,not for exercise only.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

“After I joined in the programme. ...I feel, I have healthier behaviour than before. ...I eat healthy diet, avoid junk food and sweets.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

Sub-theme 2.2: Exercise during pregnancy is a new trend in Thailand

Pregnant women had an opinion that exercise during pregnancy is a new trend in Thai society. Thai people these days, especially young people recognise the importance and benefits of exercise. Exercise in pregnancy is a trend introduced from abroad (Western style) pregnant celebrities on a variety of media, especially online platforms.

“Celebrities these days exercise when they’re pregnant. This exercise trend is from overseas. ...And I’m interested because it’s from Western countries.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“Exercise in pregnancy is trendy now. We got the idea from other countries. ...Now I’ve learned it’s popular among local and international celebrities, I searched for more information and decided to do it.” (20 years, G₁P₀, GA 33⁺⁵ wk.)

From this, point of view participants regarded themselves as being in the trend of modern mothers.

“I usually watch news on the internet and became interested when I saw video clips about exercise in pregnancy. Most pregnant celebrities ...exercised during their pregnancies . Plus, my husband is up to new trends .Exercise in pregnancy is trendy in Thailand now while it is common in Western countries, I think. Now pregnant celebrities exercise so we want to follow them.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

Such a trend is clearly influenced by Western lifestyles. There was also a comment commonly expressed by women in this study that this trend is now becoming very popular in Thai society.

“Now exercise is getting popular in Thailand. ...I think this exercise trend is from Western countries and that’s the reason why many celebrities follow it.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“People in Western countries are wealthier and more civilised than us in Thailand .All expensive products are from those countries. ...The rich or celebrities are often half-

Americans. ...Hence, they adopt Western cultures and lifestyles. Exercise in pregnancy is adopted from Westerners or Thai people studying abroad. ...Similarly, celebrities who exercise in their pregnancies have a mixed race. They live a Western lifestyle in Thailand. ...Not only celebrities, but also the Prime Minister does it. And people around me, too. That's why I want to try exercise, too." (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Theme 3: Doubts and concerns at the beginning

This theme reflects the experiences of pregnant women during the first few weeks of the exercise programme. Pregnant women perceived barriers to continuing with exercise during pregnancy. These factors impacted their decision to continue or stop exercise. They also expressed their worry that exercise may harm their babies. Pregnant women thus felt reluctant to exercise during pregnancy. They worried about the safety and were unsure about the importance of exercise during pregnancy. From their perspectives, exercise during pregnancy is not the top priority in antenatal care.

"The first month of exercise is extremely important. It's like the period to judge if I can continue exercise or not. I have to admit that it needs a will and stamina. Otherwise, I would quit from the first month." (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

"As I said, in the first month, you will get lazy .Once you have a reason for that, you can definitely do it. It's hard to say. You know how determined you are. ...Both my husband and my mother share a bad attitude about exercise in pregnancy." (20 years, G₁P₀, GA 32⁺¹ wk.)

Meanwhile, the pregnant women reported that HCPs in the clinic tended to focus on nutrition, baby's health, and the prevention of any danger to their pregnancies and babies, rather than exercise. Exercise, in these discussions, seemed less important during pregnancy. In other words, there are concerns from their family views which cause an obstacle to continue exercise during pregnancy.

"Mostly they HCPs (told me about food: what I could eat. ...I wasn't instructed much about exercise during pregnancy." (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

"They (My family members) are afraid that exercise will make me too thin and the baby too small." (20 years, G₁P₀, GA 32⁺¹ wk.)

Sub-theme 3.1: I have excuses to stop exercise

Pregnant women recalled their intrapersonal barriers to continue exercise after the first few weeks of the exercise programme. Women perceived many obstacles to exercise such as numerous excuses and laziness, especially for women without exercise experience.

“I was lazy at first though... .Previously, I got tired easily and gave up .Things have been better around the third or fourth week .This is different from the first two weeks.” (20 years, G₁P₀, GA 33⁺⁵ wk.)

“I have to admit .If I don’t have a strong will, I can’t beat it .I’m lazy with many excuses such as safety of my baby... .Without determination, I might quit halfway.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Pregnant women also expressed their intention to overcome such intrapersonal barriers in the first few weeks.

“The most difficult part is to beat yourself .I have to admit I was so lazy in the first few weeks. But after I got sweat, I felt refreshed and motivated to continue.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

“I have motivation to exercise. In the first few classes, I was lazy.The most difficult thing to beat is my mind. ...So, I was trying to exercise as much as I can. It’s getting better from the third time. Now I can do it by myself for my health and my baby’s. No more hesitation.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Participants explained that they were too tired to do exercise because of household chores, taking care of their other children, and full-time jobs.

“Once I’ve joined the programme and seen other people in the class exercising, I try to exercise twice a week. ...Although I don’t work full time, I have to raise my kid, send and pick up him/her from school, cook for three meals, plus housework. These activities almost take up my whole day. I try to find time for exercise though.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

“I never exercised before. When I tried exercise in this pregnancy (in the first few week), I was tired. ...I spend my whole day doing housework and taking care of my husband and kid, so I have no time for exercise, I think.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

In addition, participant women also indicated that some exercise positions such as pelvic rock on hands and knees, and leg lift were quite difficult to achieve in the first few

weeks of the exercise programme, especially as they had no previous experience of exercising. Some women felt bored and doubtful about continuing exercise during pregnancy.

“It’s not easy for me. But after a few times, it’s getting better because I’ve learned how to do it correctly. ...I felt bored. ...It takes longer to learn for people who never exercise before like me.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“There are some difficult postures such as cat hissing and leg raising. ...I doubted if I should continue or stop exercise. ...But after a few weeks, these have become easier .Other postures can be achieved easily.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

“Some postures are quite difficult to follow, but after a few classes, I can do that.” (20 years, G₁P₀, GA 32⁺¹ wk.)

Sub-theme 3.2: Family traditional views as an influencing factor

Pregnant women perceived interpersonal barriers caused by their family’s beliefs and that made them unsure about continuing exercise during pregnancy. There is a set of traditional views that exercise during pregnancy might be risky for the babies.

“I felt confused about continuing exercise in the first few weeks. When I told my mother. ...She disagreed saying that exercise might get the baby dead. ...She still doesn’t understand. She told my grandmother and then the grandmother disagreed as well.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“In the initial period of my first pregnancy, my husband didn’t allow me to do any job. ...However, my husband and his mother didn’t want me to do anything. They’re afraid of miscarriage.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Their family members tended to believe that body movements require a lot of energy and were concerned that some exercise postures e.g. leg raising, and bending could be dangerous for pregnancy and the baby, especially causing risks of miscarriage.

“They’re afraid that exercise will make me too thin and the baby too small.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“Those days Thai people didn’t exercise during pregnancy because they thought it’s dangerous. Old people will never agree with the idea of exercising, moving body or raising legs. Back then, they didn’t allow pregnant women to do anything, just resting because they’re afraid of danger and miscarriage.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

In traditional views, the purposes of exercise were to lose weight and get a perfect shape, rather than being aware of the benefits to pregnancy for both expectant mothers and their babies.

“When I started exercising, at first my family complained a lot. They don’t understand why pregnant women should exercise. They think I just want to imitate celebrities or to look good .People often think exercise is for losing weight. ...Both my husband and my mother share a bad attitude about exercise in pregnancy.” (20 years, G₁P₀, GA 32⁺¹ wk.)

In addition, most of their family members thought that exercise was unnecessary or inappropriate in pregnancy. Rather than exercise, pregnant women should pay attention to nutrition during pregnancy so that they can deliver healthy babies.

“In my first few months of pregnancy, I didn’t exercise at all, just eating and sleeping. I mainly focused on food and my husband didn’t want me to do anything, just taking a rest. My mother agreed with him.” (20 years, G₁P₀, 32⁺⁵ wk.)

“I had to talk for so long to get my mother to agree. ...I don’t think she fully gets it, but she is trying to admit that things can change over time. ...However, she still worries when I exercise at home. ...They think, I should worry about diet rather than exercise.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

Sub-theme 3.3: Other health messages are louder

Pregnant women commented that they perceived HCPs at the clinic focused on other health behaviour during pregnancy such as healthy eating, usual antenatal care appointments, fetal movement counting, and vitamin supplements, rather than exercise. Pregnant women received information about exercise only once during pregnancy from health educators (nurse) as a routine part of care in the prenatal class in the second trimester (16-25 weeks of gestation) for 20-30 minutes.

“In my first pregnancy (around one and half year ago), I got exercise information from prenatal class for 20-30 minutes, I am not sure about the exact duration. She (nurse) taught me and checked on my mother and child handbook, when I attended the exercise class (usual care). I think it may not be enough for me to exercise at home.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

“When I go to hospital for the usual care, doctors and nurses always talk about food, my weight, my baby’s weight, diabetes, or any abnormality in order to prevent any dead fetus in utero, including low weight gain. ...Both doctors and nurses emphasise on these things and they rarely touch on exercise.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

They also recalled that they did not get information about exercise from doctors.

“When the doctor says or advises anything, I will remember and try to follow that. ...The doctor can see me for short time, so they must choose important issues to say. ...I never get information about exercise during pregnancy. ...I think, exercise seems less important. If it is important why the doctor never says so to me.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

Doctors usually emphasised nutrition, baby’s health and growth, complications and danger to mothers and babies as a priority of antenatal care.

“I have met the doctor around 10-15 minutes per session. It is not enough to talk about exercise during pregnancy with her. Regularly, she (doctor) always emphasises on how to prevent complications during pregnancy, healthy eating and fetal movement counting.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

“Doctor also focused on regular antenatal care appointment, food, medicine (vitamin supplements), and fetal movement counting, including any abnormality during pregnancy.” (20 years, G₁P₀, GA 33⁺⁵ wk.)

Pregnant women had doubts about continuing exercise. They also felt exercise did not seem important during pregnancy in the healthcare setting.

“Exercise is not the first priority of antenatal care. ...In the prenatal class, nurses teach me how to exercise during pregnancy. ...I felt she taught me as a routine care. ...It makes me feel unsure about continuing exercise or not.” (20 years, G₁P₀, GA 33⁺⁵ wk.)

“They (HCPs) didn’t advise much about exercise, just emphasised on following the usual care appointments during pregnancy. ...I am not sure, is it (exercise) important for me?” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

“I have a question. ...Is exercise necessary for pregnant women? ...If yes, why doctors and nurses did not advise me to do exercise, just like they did on healthy diet and usual care appointment or fetal movement counting.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Theme 4: I get active and keep up with exercise until childbirth

This theme suggests that exercise behaviour of pregnant women can be sustained. Pregnant women expressed their intention to continue exercise as a daily routine during pregnancy.

“I intend to exercise as long as possible, maybe until delivery.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

After the first few weeks, pregnant women pointed out they regularly exercise and want to continue to exercise as long as they can (until childbirth) because they can gain support and motivation from the programme.

“Once I intend to do something and I get support, attention, instruction and consultation, I can make it. ...Motivation or support for exercise could help me continue exercise.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“It’s hard to tell how long I will continue exercise. I intend to exercise for good health and a firm body so that I can take good care of my kid. ...Supports from the exercise programme help me regularly exercise and I hope to continue exercise until childbirth.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Pregnant women added that the informational support (knowledge and training) boosted their self-confidence in starting to exercise at home and the emotional support motivated them to continue exercise.

“I like exercise for its benefits. ...I plan to continue exercise until delivery. ...If I did not get supports in both knowledge and training, I may not be able to maintain exercise.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

“This is the key to keep us exercising. ...I feel more confident in continuing exercise at home.” (20 years, G₁P₀, GA 32⁺¹ wk.)

Furthermore, pregnant women explained that they enjoyed the opportunity to exchange their exercise experience with other pregnant women and instructor (researcher) and physiotherapist.

“When we have problems or doubts, we want to share or consult with those who are kind.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“The strong point is that the programme contains an exercise group. I’ve got classmates with the same gestational age and we can exercise together. ...In the group, we can share information with each other, particularly exchange or compare how we’re going with exercise in pregnancy. ...It’s much easier to ask or share in a smaller group.” (20 years, G₁P₀, GA 32⁺⁵ wk.)

Sub-theme 4.1: support and guidance helped me to continue

Pregnant women reiterated that support is one of the crucial factors for starting and maintaining exercise in daily life. Information about exercise helped them gain a better understanding, self-confidence in their ability and to protect themselves from risk during the exercise. The structured nature of the exercise programme enabled women to learn about the benefits of exercise and establish their own knowledge and confidence over time to sustain exercise at home in between classes. This is particularly important for those without exercise experience. The exercise content emphasised key issues such as prescription for exercise and observation of abnormal symptoms during exercise.

“It’s not easy for me. But after a few times, it’s getting better because I’ve learned how to do it correctly ...That made me sure of my baby’s safety. ...It takes longer to learn for people who never exercise before like me. ...I want to make sure I can exercise correctly. That’s why I joined every time to boost my confidence in exercise.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“Now I intend to exercise until my delivery and afterwards. I know how to start and notice abnormality that may impact my baby. We learn step by step. If it’s like one-time learning, I don’t think most pregnant women can remember everything. There are also reviews on key issues.” (20 years, G₁P₀, GA 32⁺¹ wk.)

Exercise training in the programme supported pregnant women to gain better understanding on stages of exercise and exercise positions, increase self-confidence and proper exercise during pregnancy correctly at home in terms of warm up and cool down to reduce risk of muscle and joint injury. They also stated that exercise during pregnancy is not easy for most pregnant women as they cannot do it at home after one-time instruction and

practice. They tended to feel worried or lack confidence about the safety of their babies and themselves initially.

“I think I’m worried because I’m not sure about my ability to exercise. Then I wasn’t confident if I could remember the exercise postures taught in class. What should I do if I exercise and something goes wrong with my pregnancy? ...If they teach only once like they did in prenatal class, there is no way I can remember.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

“At first, I wasn’t sure how to exercise at home. ...I need to know how to do the right exercise postures for my safety and my baby’s. ...Personally, I like the lecture and demonstration. ...They (usual care) taught only once, and there were not enough instructors to take care of everyone. So, it was difficult to start exercise from just one lecture or demonstration. ...With this programme, I can pick up the instructed exercise postures and apply them to my daily exercise.” (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

Instructor (researcher) taught them by demonstration, return demonstration, and regular practice, this can boost pregnant women’s confidence to continue exercising during pregnancy.

“What I like most about the programme is its flexibility so I can apply the exercise techniques by myself at home. All I need to know is what to be careful about or notice and what steps there are. It helps me better understand exercise during pregnancy and what procedures I should follow.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“With demonstration and practice, I feel exercise isn’t hard. We can do it at home. ...Anyway, we have to be sure that we have been taught the correct way of exercise. ...So, I think demonstration and practice are important. ...Once I remember how to exercise properly, I’m confident to do it at home.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

Pregnant women commented that goal setting in the exercise class supported women to continue exercise during pregnancy. The exercise’s position started with the easy and then progress up with advanced exercise’s position. It supported women to continue exercise as a physical and emotional supports.

“The exercise class start with easy and short time for exercise and then progress up to longer time with an advanced position of exercise that helped me to getting goal for exercise in each week ... step by step.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

In addition, if they had any questions when they did exercise at home, they could ask instructor (researcher) in the next class as two-way communication .In this way, pregnant women gained high confidence to continue exercising during pregnancy.

“ There are demonstrations and that makes me think it’s not so hard .When we joined the prenatal class, there was only one demonstration by a nurse so it seemed hardNonetheless, when I entered this programme and joined several sessions... .Now I can do by myself at home. If I had any questions, I can ask in the next class... .This programme works better than the exercise demonstrated in the prenatal class because there are several sessions which promote our learning and practice.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

The follow up process supported women to continue exercise. Pregnant women indicated that the exercise’ diary and feedback after each the exercise class motivated them to continue exercise. The completion of the exercise’ diary and general conversation after class supported women to increase self-awareness on their exercise behaviour.

“Feedback and the exercise’s diary helped me to know myself and motivate me to continue exercise.” (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

“Small talk also motivated me to continue exercise.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

The participants started a group chat via group chat application (Line application) and discovered that such a group chat could motivate them to continue exercise. It is thus an alternative channel to communicate about exercise with the instructor (researcher) . It is another tool to remind the participants of the exercise class as well.

“Moreover, there is a group chat on exercise via Line to remind me of the exercise schedule and motivate me to continue exercise.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

“The advantage of Line is that it is easy to join a group where we can exchange information. I feel relaxed with the group chat. ...If I have any questions, I can contact the instructor (researcher). Sometimes telephones are difficult. It is easier with Line. I can read or leave a message when I am free.” (20 years, G₁P₀, GA 32⁺¹ wk.)

Pregnant women commented that posters and leaflets were useful to motivate them to exercise. Photos of exercise’s positions in the poster were clear and easy to follow when they

continued exercise at home. In addition, the posters with cartoon characters showing exercise's positions were interesting too.

"Posters and leaflets are useful for me to continue exercise. I can read or look at them when I have free time. The posters with cartoon characters are cute and interesting." (29 years, G₁P₀, GA 32⁺⁶ wk.)

"I like the poster as it displays exercise's positions in large frames so it is very easy to follow." (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

The participants stated that the online version of posters and leaflets (with uploaded files via the group chat application) were very useful as they could see the files anytime. It is easier to open the files. Some of the participants added that they might have left the posters and leaflets somewhere, but they still saw the online version.

"I always use the posters and leaflets (online version) as it's easier and I can see the files everywhere." (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

"I left the posters and leaflets (paper version) somewhere. Yet, I can use the online version so I can see the files at home." (20 years, G₁P₀, GA 32⁺¹ wk.)

Furthermore, pregnant women revealed their experience about the atmosphere in the exercise programme, which promoted emotional support. They felt enjoyment and relaxation in the class where their classmates were friendly. This reinforced their participation and kept them motivated to exercise during pregnancy.

"Seeing other people in the class doing it, I feel motivated. The atmosphere helped. ...The exercise group was quite small. The instructor (researcher) could take care of everyone. It was different from another exercise group arranged by prenatal class." (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

"I had a good time. I like to exercise with people. It was enjoyable and relaxing - we chatted while taking exercise. It was like a girl group at school." (20 years, G₁P₀, GA 32⁺¹ wk.)

"It's fun. I like this group as we can teach and chat with each other while taking exercise. I enjoy the class so much that I can go every day. ...I like the atmosphere and other things." (40 years, G₃P₁A₁L₁, GA 32⁺⁵ wk.)

Sub-theme 4.2: I can take simple exercise at home

From the questionnaire after completion of the exercise intervention, most pregnant women were concerned about a weekly exercise class at the hospital that did not fit with their daily routines. They felt the exercise programme took too much time and money. In the interviews, pregnant women also felt that it was a waste of time to spend over ten weeks on the exercise programme at the hospital after they learned and knew how to exercise at home. Women felt that holding exercise classes separately from the antenatal appointments was inconvenient. Pregnant women pointed out that time spent on weekly exercise at the hospital over ten weeks is too much for pregnant women who take care of their children, and especially for those with a full-time job outside the home.

“The biggest problem for me is time. As the programme is run in office hours, I have a teaching job. ...As result, I could make it only fives classes even with my intention to join.... For this programme, it costs me nothing, except time. This is an issue for me as I work full-time.” (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

“Even with my pregnancy, I still have to take care of house chores and my first kid. ...For this reason, I could join only five sessions. ...I can take simple exercise at home because I know how to do it properly from the exercise classes. ...It’s inconvenient for those with a small kid or farming job like me to come every week.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

In addition, women suggested the integration of exercise into the routine antenatal care service would be helpful to them and help encourage them to sustain exercise.

“Exercise sessions may be combined with the antenatal care or added to prenatal class. For example, prenatal class takes about an hour, they may add exercise and make it an hour and a half in total as a booster for maintaining exercise. ...I can continue exercise at home.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

They suggested that the exercise class should be conducted every three to four weeks and on the same day as the ANC appointment. They felt it is unnecessary to attend a class every week. They indicated that the exercise programme should be reduced from every week

visit to at least once a month during the second and third trimesters or around 4-5 times over 10-12 weeks during the second trimester.

“ It would be better if we can make it the same day as the usual care. People with full time jobs cannot take days off every week. ...The integration of the programme into the usual care would be a good choice. ...But there is no need to come every week .Maybe every three or four weeks, like the usual care which is a monthly appointment, is enough.” (29 years, G₁P₀, GA 32⁺⁶ wk.)

“After some more attendances, I manage to exercise by myself at home. I don’t think I need to visit hospital for all classes. ...but I need to practise in class (at the hospital) for four or five times to be able to exercise at home.” (34 years, G₃P₁A₁L₁, GA 33⁺¹ wk.)

Women also suggested that HCPs should update their knowledge for promoting exercise in pregnancy effectively. It would help pregnant women to increase self-confidence and to continue exercise at home until childbirth.

“I think, doctors and nurses should update their knowledge about exercise in pregnancy and give me an up to date information to exercise during pregnancy properly. ...I think, it’s good for motivating me to continue exercise until delivery.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“I want all nurses and doctors should teach me an update information for exercise in pregnancy. ...I may feel more confidence to do exercise at home.” (31 years, G₂P₁L₁, GA 32⁺³ wk.)

Sub-theme 4.3: Group exercise has motivated me to continue exercise.

The group exercise network was a key aspect in motivating women to exercise.

“Group exercise network helps me stay motivated in exercise during pregnancy, when they told me about positive effects of exercise, which are real experiences of exercise.” (23 years, G₂P₁L₁, GA 33⁺³ wk.)

Pregnant women were of the opinion that the way the exercise group and the programme instructor (researcher) communicated with them via chat application (Line application) motivated them to continue exercise.

“ It enables us to join an exercise group where we can exchange information via such channels as Line group.” (20 years, G₁P₀, GA 32⁺¹ wk.)

“In my opinion, having a reminder like Line group can help those who are developing an exercise habit. ...I think it’s better to go in a moderate way with messages like ‘we should exercise three times a week’ and the frequency of reminder should be once a week.” (33 years, G₃P₁A₁L₁, GA 34⁺¹ wk.)

Given this experience, it would seem important to recommend that any exercise programme contains some means of online communication to encourage women to motivate each other.

“Group exercise network is crucial .It supports me to do a lot more. ...In the group, we can share information with each other, particularly exchange or compare how we’re going with pregnancy. ...As I have no one around me with exercise experience during pregnancy to share with, it’s good to exchange with them. In this way, the group motivates me to exercise.” (20 years, G₁P₀, 32⁺⁵ wk.)

They felt it differed from the traditional care in which only HCPs provided information to pregnant women as one-way communication.

“This (group exercise) motivates me to continue exercise. ...Moreover, there is a Line group for exercise to remind me of the exercise schedule. When I go to the usual care, I just listen to nurses ’advice on many things, and I may or may not follow. ...This group gave me a chance to learn more by asking other pregnant women or sharing ideas and experiences.” (36 years, G₂P₁L₁, GA 34⁺⁵ wk.)

6.2.2 Results of focus group with Healthcare professionals (HCPs)

The focus group included four HCPs consisting of a physiotherapist, a healthcare educator (nurse), and two nurses at antenatal care clinic. All HCPs had also taken part in the design workshops for the exercise programme in the first phase of the study. The demographic characteristics of HCPs are summarised in Table 6.9. While nurses are directly involved in the antenatal care clinic, they are also indirectly involved in the exercise programme as facilitators. In the exercise class, they prepare the room as well as refreshments, and provide IT support. A physiotherapist was directly involved in the exercise

programme as a consultant who visited the exercise class at the first, fifth, and tenth week of the exercise programme. The focus group was conducted in a meeting room at the hospital by an assistant researcher. All data in the focus group were recorded with a digital voice recorder and in notes by the researcher. The age of participants ranged from 35 to 58 years. Most of them had ten-years experience in antenatal care service.

Table 6.9: Demographic characteristics of HCPs in the focus group

Demographic characteristics	Number (n)	Percentage (%)
Age		
-30-39 years	2	50
-≥40 years	2	50
Qualification		
-Nurse (ANC)	3	75
-Physiotherapist	1	25
Years of experiences		
-5-10 years	1	25
-Over 10 years	3	75
Work		
-Antenatal care clinic	3	75
-Physiotherapy	1	25
Education		
-Bachelor degree or equal	2	50
-Master degree or over	2	50

Three main themes emerged from the focus group which captured experiences related to the exercise programme. The themes and sub-themes are shown in Table 6.10. The topics covered included: pregnant women's experiences in the exercise programme; strengths and weaknesses of the new exercise programme; ideas on how this exercise programme would fit in the usual antenatal care; and suggestions for possible changes to the programme to better benefit women and related healthcare service. HCPs received some feedback from women

who took part in the exercise programme and they were encouraged to share it without naming any individual.

Table 6.10: Themes and sub-themes from focus group with HCPs

Themes	Sub-themes
1. More benefits of the exercise programme than we expected	1.1 The exercise programme helps pregnant women to increase exercise their behaviour 1.2 The exercise programme helps promote healthy behaviour in pregnancy
2. Concerns with workload of HCPs	
3. Tailoring the exercise programme to fit in the usual care	3.1 Integration into the usual care 3.2 Continued promotion of exercise in pregnancy

Theme 1: More benefits of the exercise programme than we expected

This theme illustrates the expectations of HCPs about benefits of the new exercise programme for pregnant women. HCPs expressed their positive experiences as they realised the importance and benefits of exercise during pregnancy for women. They were hoping that the new exercise programme could motivate pregnant women to see the importance of exercise during pregnancy as well. In their opinion, exercise is relatively new in Thailand so it is hard for pregnant women to realise the importance of exercise during pregnancy.

“Exercise during pregnancy is relatively new in Thailand. I hope to see this programme help pregnant women realise the importance and benefits of exercise.” (Nurse ANC 1)

“Anyway, it’s hard to make rural communities see the importance of exercise in pregnancy. ...Actually, exercise is trending in Thailand because of the exercise trend in pregnant celebrities. ...I think this exercise programme might motivate pregnant women to exercise. It (the exercise programme) is a tool to raise awareness of exercise in pregnancy (Nurse educator)

In fact, HCPs saw that the exercise programme made pregnant women aware of the importance of exercise and also motivated them to change their exercise behaviour. As a result of the exercise programme, pregnant women increased both frequency and duration of exercise during pregnancy.

“I didn’t expect that programme can change exercise behaviour of pregnant women. I thought that it’s quite hard to achieve, but the programme can help that.” (Nurse ANC 2)

“It does help increase the frequency and duration of exercise during pregnancy.” (Physiotherapist)

In addition, the programme encouraged pregnant women to develop their overall healthy behaviour during pregnancy such as healthy eating and sleeping. The programme seems to offer a new choice to improve the quality of healthcare service for pregnant women.

“I feel that they have healthier behaviour while being engaged in exercise. They (pregnant women) said that they can sleep well after joining in the exercise programme. They don’t wake up during the night anymore.” (Nurse ANC 2)

“Exercise in pregnancy thus supports them (pregnant women) to develop awareness about healthy behaviour during pregnancy for the benefits of themselves and their babies. Some pregnant women told me that they were more careful about eating sweets, cakes, and sweetened drinks such as Thai milk tea and canned drinks.” (Physiotherapist)

HCPs perceived the benefits of the new exercise programme for pregnant women better than they previously expected.

“It (the exercise programme) is good for improving our service care for pregnant women.” (Nurse ANC 1)

“In fact, the exercise programme could promote for regular exercise better than I imagined before the exercise programme started.” (Nurse educator)

Sub-theme 1.1: The exercise programme helps pregnant women increase exercise their behaviour

HCPs saw that the new exercise programme helped pregnant women increase exercise in both frequency and duration during pregnancy. HCPs added that pregnant women became

more interested in the exercise programme when they talked to HCPs about their changing exercise behaviour during pregnancy.

“Pregnant women increase their frequency and duration of walking and aerobic exercise. Most of them attended the exercise class every week, which is beyond my expectation.” (Nurse educator)

“The exercise programme will help to change exercise behaviour of pregnant women. I think, it’s quite hard to make that happen, but the exercise programme can.” (Nurse ANC 2)

They mentioned the benefits of exercise such as reducing back pain and leg cramp during pregnancy.

“Further, it helps raise awareness of the importance of exercise among pregnant women and increase their exercise behaviour during pregnancy. Exercise also relieves backache, numbness, and stress in pregnancy, which leads to easy delivery. Pregnant women try to attend the new exercise class as much as they can.” (Nurse ANC 1)

Exercise also helped them to sleep better, feel more relaxed, and fresh.

“I think it (the new exercise programme) is a tool motivating women to continue exercise ...and helps improve their physical health and well being.” (Nurse ANC 1)

HCPs indicated that pregnant women continue their attendances to the new exercise programme more than expected.

“Most of them attended the exercise class every week, which is beyond my expectation.” (Nurse educator)

Sub-theme 1.2: The exercise programme promotes broader healthy behaviour in pregnancy

HCPs commented that the exercise programme also helped pregnant women raise awareness about the importance of healthy behaviour during pregnancy. HCPs perceived that pregnant women participating in the new exercise programme had better self-care during pregnancy than usual.

“Pregnant women who participated in the exercise programme intended to be healthy for themselves and their babies. ...I felt that they had healthier behaviour after engaging in exercise.” (Nurse ANC 2)

“In my view, the exercise programme helps pregnant women raise awareness about healthy behaviour for mother and baby. ...They (pregnant women) had higher self-care during pregnancy. ...They intended and acted to be healthy mums.” (Nurse educator)

Pregnant women seemed to pay more attention to being healthy during pregnancy such as taking regular exercise, going to bed early, and eating healthy food that positively affect their physical health and well-being.

“Exercise in pregnancy helps them (pregnant women) raise awareness about healthy behaviour during pregnancy for mothers and babies. ...They (pregnant women) talked to me about their healthy behaviour. They choose to eat healthy food and try to behave healthily during pregnancy such as sleeping at least 8 hours at night.” (Physiotherapist)

Theme 2: Concerns with workload of HCPs

This theme illustrates HCPs' concern about how the introduction of a regular exercise programme might impact on their workload in the antenatal care clinic. It is noticeable that HCPs designed the new exercise programme and realised its overall benefits for pregnant women as well as healthcare service. However, they expressed a concern that if the exercise programme is integrated into the clinic, that might increase their workload. This is because, from their point of view, exercise during pregnancy is not the main Key Performance Indicators (KPIs) for the antenatal care service.

“Workload is an issue that needs consideration because it's difficult to do. This can put too much workload for nurses, physiotherapists, and sport scientists.” (Physiotherapist)

“I accepted this programme had more benefits for pregnant women and our work. I understand that this programme was designed by us, but the real situation is quite different. This (the new exercise programme) puts too much work and time for me. It might take me too much time for teaching pregnant women for the whole 10 exercise classes. And I still have some other duties to perform. Plus, exercise is not a main KPIs that we must achieve. ...I can feel too much workload.” (Nurse educator)

HCPs said that exercise during pregnancy is not the key goal of antenatal care. HCPs focused on the KPIs of antenatal care clinic related to their main responsibilities to reach the goals of healthcare services such as nutrition, and continuing antenatal care, while decreasing

risks and abnormal symptoms in pregnancy. KPIs of antenatal care clinic specifies early booking before 12 weeks and receiving prenatal care at least four times during pregnancy, to reduce the rate of neonatal and maternal death, and monitoring the rate of baby low birthweight (<2,500 grams) (Department of Health, Thailand, 2016).

HCPs indicated that their routine care for exercise covers the policy of the organisation about exercise in pregnancy. Hence, exercise seems less significant in healthcare service. They feel the exercise programme may increase their workloads.

“It might take more time to operate the programme despite the fact that exercise is not the main KPIs.” (Nurse ANC 1)

The new exercise programme may take additional time for the usual care. The exercise programme was conducted in a hospital-based group exercise in the afternoon once a week, 30 minutes per session over 10 weeks. (10 prescribed sessions in total). As pointed out by HCPs, it may increase workload for nurses to do everything over ten weeks of the new exercise programme.

“I know the benefits of this programme for pregnant women and how it improves the quality of our care, but I’m afraid it will increase our workload here. ...If we have a new exercise programme, that might cause extra workloads, especially for nurses (educator).” (Nurse ANC 2)

HCPs were of the opinion that the exercise programme which runs over 10 weeks in the afternoon is too much for their workloads in the antenatal care clinic.

“I feel, it (the exercise programme) is too much for our routine work. This programme runs in the afternoon, separately from the routine prenatal class for women. In my opinion, 10 weeks for promoting exercise might put too much work for me.” (Nurse ANC 1)

“I think it’s not good for our workload and we still have other jobs to do, apart from promoting exercise in pregnancy. ...It’s quite too much work for us to run only the exercise programme over 10 times.” (Nurse ANC 2)

They pointed out that the antenatal care clinic has regular prenatal care for pregnant women during pregnancy at least four classes in the morning. Such classes cover health

behaviour, birth plan and breast feeding, including exercise during pregnancy. From their perspectives, the new exercise programme appears to take too much time than usual care.

“This puts too much work and time for me .It might take me too much time for teaching pregnant women for the whole 10 exercise classes. We have a regular prenatal class for pregnant women. And I still have some other duties to perform. I feel too much overload.”
(Nurse educator)

Moreover, HCPs added that the time spent on weekly exercise at hospital over 10 weeks is too much for pregnant women who take care of their elder kids, and especially for those who work full time outside home.

“It is thus more difficult for them to attend for the whole ten times.” (Nurse ANC 1)

“Some pregnant women work at home or have their own business, but others work for the government or private firms. ...It is a hassle for them to visit hospital for the usual care and again for exercise.” (Nurse ANC 2)

HCPs considered that the exercise programme is costly. Pregnant women had to spend on 10 trips to hospital, and some of which are not on the same day as the usual antenatal care.

“ It is too much for them. Plus, it is not so common for pregnant women in rural communities to often visit hospital, which may be costly for them.” (Nurse educator)

“It needs time and money to take a trip to hospital just for exercise.” (Nurse ANC 2)

Theme 3: Tailor the exercise programme to fit in the usual care

This theme reflects the opinions of HCPs on the possibility of integrating the new exercise programme into the usual antenatal care clinic. They agreed that the concept of the exercise programme might be integrated into the usual care. This is because the overall benefits of the programme on promoting exercise behaviour in both frequency and duration of exercise during pregnancy, and the broader context of healthy behaviour during pregnancy. They also suggested that details of the new exercise programme are adjusted so that the programme would fit in the usual care and their workloads.

“I admitted that this programme had benefits for pregnant women and our work. ...The exercise programme had benefits to improve the quality of our antenatal care. It is possible to integrate the programme into the whole system of antenatal care by making it as part of the routine job, without increasing workload, time, and cost for both service providers and recipients.” (Nurse educator)

“It is possible to bring the core concept of the exercise programme to the usual antenatal care clinic. I think that some details of the programme protocol should be changed though.” (Nurse ANC 1)

Sub-theme 3.1: Integration into the usual care

While agreeing on the idea that the new exercise programme should be integrated into the prenatal education class, HCPs indicated that the new exercise may increase their workload if it runs as it did in the feasibility study. The new exercise programme should be reduced from 10 weeks in a row to four prenatal education classes. Normally, all low risk pregnant women attend the prenatal education at least four times during pregnancy in the morning after visiting the doctor for approximate 30-45 minutes.

“ We should focus on the benefits of exercise by trying to make their attendances fewer and combining the exercise to each usual care. As we already have prenatal class, we can integrate exercise into each different subject. For example, before nutrition subject, we can teach stretching. In this way, pregnant women will join at least exercise demonstration for four times and review how to exercise, while seeing its importance and building a good attitude toward exercise.” (Nurse educator)

“I think, it might be better to integrate the exercise programme in to each prenatal class. The new exercise programme may be added in to the prenatal class for 15-20 minutes, followed by another topic as part of usual care. ...It will be time-saving to promote exercise during pregnancy without increasing workload for HCPs in ANC clinic.” (Nurse ANC 2)

HCPs suggested that the programme should be boosted for low risk pregnant women in the very morning session while waiting for antenatal care.

“There should be some exercise in the morning session before the antenatal care and after paying homage in the national anthem. ...We would suggest 10-minute exercise while waiting. This highlights the importance of exercise, and urges exercise activities at every

antenatal care. It should be easy exercise so that anyone can do while standing or sitting in a chair.” (Nurse ANC 1)

In addition, HCPs commented that the online (uploaded on Line application) version of the posters and leaflets was useful for motivating pregnant women to continue exercise at home as it was convenient for pregnant women to access exercise information. On the contrary, most pregnant women left the paper version of posters and leaflets about health information during pregnancy at the clinic in the past.

“In my view, the [online version] of the posters and leaflets were nicer. They were more useful for pregnant. In the past, I saw many leaflets (health information during pregnancy) left at the clinic. And when they (pregnant women) wanted to look for more information, they couldn’t find anything to read.” (Nurse ANC 2)

“This kind of materials (posters and leaflets) are easier for women because they can information everywhere.” (Nurse educator)

HCPs further commented that the online version of the posters and leaflets is interesting with its design being different from the materials usually found at the clinic. This version thus can better attract pregnant women’s interest while providing the exercise information.

“[The online] version of posters and leaflets is interesting. ...The design is quite different from the usual posters and leaflets in the usual care. ...The new version with colours and pictures are more attractive.” (Nurse educator)

Sub-theme 3.2: Continue promoting exercise in pregnancy

HCPs commented that promoting exercise during pregnancy should not be restricted to the prenatal education class only. As HCPs pointed out, the main goal for promoting exercise during pregnancy is that pregnant women continue regular exercise at home until delivery.

“The most important thing is how to make pregnant women exercise regularly. I don’t want pregnant women to stop exercise after the end of programme or prenatal class. And that can happen from the working of all healthcare providers. This must be driven toward the

same direction in order to keep pregnant women exercising. There must be supports so that pregnant women can continue until after delivery.” (Nurse ANC 1)

In this regard, HCPs have a role to motivate and support pregnant women to continue exercise through the exercise programme, which should be integrated as usual care in the clinic from the first visit until delivery.

“Information must be passed on and promoted continuously from pregnancy to childbirth by all HCPs of the ANC clinic.” (Physiotherapist)

“There is another way to urge exercise, apart from nurses. That is, we design exercise in a systematic way. ...every staff member should urge pregnant women in the same way and in every single step of antenatal care. ...We should make it as part of the process like the regular antenatal care such as taking dietary supplements or counting fetal movement.” (Nurse ANC 2)

HCPs elaborated that the doctor has an important role in the clinic for promoting exercise during pregnancy in the Thai context.

“I strongly agree on the key role of doctors. This is one way to urge exercise, apart from nurses.” (Nurse ANC 2)

“When pregnant women meet a doctor, we can ask the doctor to give a brief reminder of exercise like one to two minutes. ...In this way, the doctors’ reminders and suggestions can boost continued exercise.” (Physiotherapist)

HCPs also advocated that keeping an exercise diary in the exercise programme is useful to monitor the exercise behaviour of pregnant women. The exercise diary is also helpful for HCPs to use this information for supporting pregnant women to continue exercise at home.

“It (exercise diary) is good to monitor their exercise behaviour at home. ...It’s very useful for us to use this information for promoting exercise during pregnancy.” (Nurse ANC 2)

“We can know their exercise behaviour through the exercise record (diary). It makes us know the way to support them to continue exercise until delivery. ...Usually, we don’t have any information of their exercise behaviour.” (Nurse educator)

In addition, HCPs viewed that a group exercise network is a resource that can work to motivate pregnant women to continue exercise regularly via group chat application.

“Another outstanding point is creating a network to exchange information. This network also urges for exercise by pregnant women themselves so they have a platform to support each other. ...This serves as a motivator from within the pregnant women’s community to continue exercise.” (Nurse ANC 1)

This is two-way communication which created a better understanding of exercise behaviour in pregnant women and enabled HCPs to gain better insights into their problems and concerns. It is also the improvement of the quality of healthcare service from the traditional way of communication.

“This is another channel to remind them of the exercise schedule. They quite like it. This is our point of not sticking to the same old channels. We have adjusted our communication channels between service providers and recipients to better suit their changing lifestyle and society. We offer them choices to access information, not only pamphlets or posters only, but also a group network via chat application.” (Nurse ANC 2)

CHAPTER 7

DISCUSSION

This chapter aims to discuss insights into the findings gained from the workshops, the feasibility randomised controlled trial (RCT), and the interviews with pregnant women and focus group with healthcare professionals (HCPs). This discussion considers the study findings in relation to the extant knowledge. The chapter is presented in five sections: feasibility for conducting a larger trial with the exercise programme, acceptability of the exercise programme, trends of exercise in pregnancy in Thailand as a ‘modern mum’, workshops for designing the exercise programme, and strengths and limitations of the study.

7.1 Feasibility for conducting a larger trial with the exercise programme

The present study demonstrated that it would be feasible to conduct a larger RCT with an exercise programme to improve exercise behaviour in pregnant women. The recruitment rate from the antenatal care clinic was successful in encouraging pregnant women to join the study due to the women’s desire to be a modern mother. The interviews showed that exercise during pregnancy has become a new trend in Thailand where women want to be good-looking and healthy. Furthermore, face-to-face recruitment is likely to increase the recruitment rate for a larger trial. In the first week of the recruitment process, the rate was quite low. Only a quarter of the pregnant women were interested in participation. Pregnant women were initially approached with leaflets that were provided by the reception nurse and posters advertising the study on a hospital notice board. This method seemed inefficient for recruiting pregnant women for this study. Verbal invitation and direct distribution of the leaflets by the reception nurse were then added into the recruitment process. This strategy resulted in a recruitment rate which was three times higher compared to the first week of the recruitment process. This finding indicated that face-to-face recruitment by healthcare

providers is more efficient for attracting pregnant women to participate in the study (Kim & Lennon, 2008). Among the participants, there were no complaints or reports shown in relation to the participant information sheet and consent form. The participant information sheet gave detailed information so that they would know exactly how to participate in the study. Sufficient information about the research was provided as well in order to ensure that there was no explicit or implicit coercion. In other words, the participant information sheet in this feasibility study proved to be practical for providing important information about the study for participants in a larger trial.

The screening question for recruiting pregnant women for the exercise intervention was useful for screening as well as randomisation. Four of 104 women (3.85%) were excluded due to teenage pregnancy (women aged under 20 years). Another four (3.85%) were excluded because they had already regularly exercised at least 30 minutes a day for three days a week. In this study, nearly one third of women (19 of 61 women) were overweight and only five women were obese. However, in a larger trial, it will be better to categorise pregnant women into three groups: healthy (BMI 18.5-22.9 kg/m²), overweight (BMI 23-29.9 kg/m²), and obese (BMI \geq 30 kg/m²) by adding this criterion in to the screening questions. In this way, it will be possible to compare each group's results for the exercise intervention.

Around one fifth (20 of 104 women) were excluded as verified by the Physical Activity Readiness Medical Examination for Pregnancy Thai version (PARmed-X) (Davies, Wolfe, Mottola & MacKinnon, 2003; Suputtitada, 2005) due to contraindications to exercise such as medical conditions, and mental health problems. Nearly one tenth (10 of 104 women) declined to participate in the study for personal reasons and planned to move back to their hometowns. Initially 66 women (63.46%) who met the inclusion criteria were enrolled in the exercise intervention. Five of these 66 (7.58%) were excluded during the period of the exercise intervention due to health problems. The dropout rate was under 10% in each arm

(control and intervention groups). In the future a larger trial, this ineligibility and dropout rate should be considered to estimate the available number of pregnant women. In addition, the strength of this exercise intervention was drawn from checking pregnant women for any contraindications and warning signs during the intervention. This process guaranteed the safety of the exercise intervention for low risk pregnant women. In a larger trial, close collaboration in a research team between researchers, nurses/midwives and clinicians, physiotherapists and staff is suggested to monitor a safety protocol for participants in the exercise intervention across multi-antenatal care clinics (Johnson, Barach, Vemooij-Dassen on behalf of the HANDOVER Research Collaboration, 2012; Bandholm et al, 2017).

Adherence rate to the exercise intervention group was greater in the first five weeks of the exercise programme. However, the adherence rate dropped after the fifth week of the exercise programme. Around half of the pregnant women (less than 60%) who participated in the exercise programme cited work and duties as reasons for their absences. Most of the pregnant women responding to the questionnaire at the end of the programme reiterated that they thought it was time-consuming and thus unnecessary to exercise at the hospital every week. The qualitative data also showed that pregnant women did not attend the programme in the hospital because they could take simple exercise at home after having learned how to exercise safely in the first five weeks. Even so, the study indicated that pregnant women in the exercise group increased their total physical activity (PA) while women in the control group decreased their total PA at the end of the intervention. The overall adherence rate to exercise was high. This means that although the exercise programme over ten weeks has been designed to improve the exercise behaviour of pregnant women, the number of exercise classes need to be re-considered in accordance with the context and adherence rate to a larger trial.

The data collection process revealed that the questionnaire and telephone interviews were successful in collecting the data at baseline as well as at the end of the exercise programme. All data were completely collected from pregnant women, medical records, and telephone interviews. Pregnant women did not complain about the data collection process. This implies that data collection from the questionnaire and medical records would be useful in a larger trial. Moreover, the fidelity rate of the exercise programme was high, which means that the promotion of continued exercise behaviour until childbirth was successful. Most pregnant women who participated in the exercise programme met the recommendations of exercise for pregnant women and continued exercise properly. Around one fifth of women in the exercise group (16.13%) stopped exercise after the end of the exercise programme for personal reasons. Five of the 31 pregnant women complained about the exercise diary that it was useless to record exercise in daily life. They felt that keeping an exercise diary was inconvenient and also a waste of time to do so every day. For this reason, the exercise diary should be redesigned to make it easier or friendlier for participants and researchers for data collection in a larger trial. However, telephone interviews after delivery should be carefully planned in terms of cost and time in the future trial because this feasibility study had a small sample size. In the interviews, both women and HCPs mentioned the usefulness of a chat application as a communication channel between women and HCPs. The chat application (individual chat) might be a good idea to gather data for a larger trial.

7.2 Acceptability of the exercise programme

This exercise programme was drawn from the Thai Government guidance for exercise in pregnancy. It is noteworthy that this study was different from the previous studies about exercise for expectant mothers in Thailand which examined the effect of the self-efficacy enhancement programme (Mornsang, 2009) and the self-efficacy promotion and social support programme (Parnkasem, 2013) on the exercise behaviour of pregnant women. The

programmes in those two studies were delivered once a week, including five minutes warm up, five to thirty minutes walking, and five minutes cool down over nine weeks. While the exercise behaviour in those two studies was measured by the questionnaire (four points Likert scale) (Mornsang, 2009; Parnkasem, 2013), the exercise interventions did not meet the recommendations of the exercise that women in low risk pregnancy should perform at least 30 minutes of moderate-intensity exercise (Suputtitada, 2015).

The exercise programme in this study was successful in encouraging pregnant women to increase physical activity and exercise behaviour. Physical activity of pregnant women who participated in the exercise programme was significantly higher at the end of the exercise intervention, compared to that of the control group as well as the baseline. Pregnant women perceived that the exercise programme motivated them to increase physical fitness and exercise behaviour during pregnancy. They were aware of the importance and benefits of exercise during pregnancy and wanted to be healthy mothers. Goal setting of the exercise programme in each week enhanced their self-confidence in continuing exercise. Similarly, feedback and an exercise diary boosted pregnant women's self-awareness in maintaining exercise behaviour.

Such views are consistent with the most frequently cited intrapersonal facilitators for exercise in low risk pregnant women (Marquez et al, 2009; Cioff et al, 2010; Evenson & Bradley, 2010; Leiferman et al, 2011; Krans & Chang, 2012; Da Costa & Ireland, 2013). Pregnant women in the intervention group also thought it was easy to access the exercise programme as part of the standard care service at the public hospital. This is related to environmental facilitators for exercise in terms of resources and accessibility which enable women to increase frequency and duration of exercise during pregnancy (Marquez et al, 2009; Krans & Chang, 2011; Put, Chuang & Chan, 2015). Almost all of the women said that they enjoyed the exercise programme as a group exercise. In other words, a group exercise

was more likely to encourage women to continue exercise during pregnancy, thereby intending to continue exercise until or after childbirth.

Pregnant women perceived exercise during pregnancy as easier than they had previously thought (before engaging the exercise programme). Motivation techniques used in the exercise programme changed their views by leading them to believe that exercise is easy for everyone, not for rich people only. Such techniques consisted of informational and emotional supports, goal setting, feedback, exercise follow up via an exercise diary, a reminder of the exercise via a group chat application, and environmental support. Their views are associated with several studies of intrinsic motivation which argue that a positive attitude can change exercise behaviour in pregnant women within non-Asian populations (Haakstad et al, 2009; Evenson & Bradley, 2010; Leiferman et al, 2011; Da Costa & Ireland, 2013; Melton et al, 2013).

Supportive guidance in the exercise programme was given through informational as well as emotional support from the instructor (researcher). The physiotherapist can also boost confidence in safety of exercise during pregnancy among the women. This could lead pregnant women to reduce emotional stress and anxiety about exercise during pregnancy (Leiferman et al, 2011; Riberiro & Milanez, 2011; Melton et al, 2013; Fieril et al, 2014). The exercise schedule and benefits of exercise were provided through reminders to motivate pregnant women to continue exercise via the group chat application. These findings are confirmed by interpersonal facilitators that impact exercise behaviour during pregnancy such as higher self-efficacy, self-confidence, and self-motivation (Marquez et al, 2009; Krans & Chang, 2011; Muzigaba, Kolbe-Alexander & Wong, 2014; Put, Chuang & Chan, 2015).

Preliminary effects of the exercise programme indicated that the total gestational weight gain of the exercise group significantly differed from that of the control group. The intervention group had better gestational weight gain than the control group, in compliance

with the recommendations of the Institute of Medicine (IOM) (IOM, 2009). This finding confirms previous research which reported that moderate intensity of exercise assists in efficiently controlling standards of maternal gestational weight gain based on pre-pregnancy BMI (Brown & Avery, 2012; Jiang et al, 2012; Sui, Grivell & Dodd, 2012; Makinde, Adeyemo & Ogundele, 2014; Seneviratne et al, 2014). According to the interviews with women, those who participated in the exercise programme noted that exercise during pregnancy encouraged them to be back in good body shape after childbirth.

Moreover, this study found that the exercise intervention group possessed significantly lower systolic blood pressure than the control group. The mechanism of regular exercise during pregnancy decreases arterial stiffness and increases blood circulation (Kawabata et al, 2012). It also enhances vagal activity that reduces cortisol and substance P, as well as increases serotonin. This could reduce blood pressure and heart rate in low risk pregnant women (Horak & Osman, 2012). A case control comparison between recreational physical activity and the risk of pre-eclampsia among 201 women with pre-eclampsia and 383 normotensive pregnant women revealed that pregnant women who engaged in regular physical activity during the first 20 weeks of pregnancy and during the year before pregnancy had lower risk of pre-eclampsia than those with a sedentary lifestyle (Sorensen et al, 2003). Blood pressure during pregnancy can also be reduced by exercise (Field, 2011; Horak & Osman, 2012). Hence, exercise during pregnancy reduces systolic blood pressure that is an influential factor reducing the risk of gestational hypertensive disorders (Sorensen et al, 2003; Scholten et al, 2014).

The intervention group had significantly lower stress scores than the control group. Pregnant women felt more relaxed when engaging in the exercise programme. It also improved insomnia symptom and well-being during pregnancy according to the qualitative findings. Regular exercise during pregnancy produces endorphins, releases higher levels of

dopamine and increases serotonin (Kawabata et al, 2012; Alikhami, Molaie, & Amiri, 2015). Endorphins is a chemical in the brain that acts as natural painkiller that reduces stress and/or anxiety and improves the ability to sleep as well (Alikhami, Molaie, & Amiri, 2015). Dopamine makes people energised and relaxed (Alikhami, Molaie, & Amiri, 2015) and serotonin is associated with better mood, happiness, and well-being (Yong, 2007; Alikhami, Molaie, & Amiri, 2015). The exercise programme helped pregnant women who participated in the exercise programme with reducing discomfort during pregnancy such as low back pain and fatigue. In addition, it also provided opportunities to meet a group of pregnant women in the exercise class which developed a group exercise network and social relationships with other pregnant women. These findings are in line with other studies that found benefits of exercise during pregnancy include a decrease in stress, anxiety, and insomnia symptoms of women (Prather, Spitznagle & Hunt, 2012; Guskowska et al, 2013; Fieril et al, 2014). Further, HCPs noticed pregnant women who participated in the exercise intervention developing broader healthy behaviour during pregnancy. These results indicate that the exercise programme is likely to support pregnant women to have better self-care that increases self-awareness on healthy behaviour.

Moreover, benefits of exercise during pregnancy are associated with improving the viability of the placenta and placental functional capacity, increasing amniotic fluid level and endothelium dependent vasodilation. These results are related to the prevention of fetal distress, the reduced risk of pre-eclampsia (Prather, Spitznagle & Hunt, 2012), and supported the overall fetal growth (Melzer et al, 2010). Regular exercise affects insulin sensitivity, adipose tissue, endocrine regulation and muscle mass that reduces a risk of macrosomia (Siebel, Carey & Kingwell, 2012) and increases a rate of appropriate baby birth weight (Doustan et al, 2012; Seneviratne et al, 2014). However, no significant difference is found in the effect of exercise intervention on baby birth weight in this study. Baby birth weight is

associated with both diet and exercise factors (Leddy, Power & Schulkin, 2008; Davies et al, 2010; Squibb, 2014; Doyle, 2014). Most of the babies born from mothers in the exercise group were not found with low birth weight. This is confirmed by previous research stating that healthy babies without low birth weight are born from exercising mothers (Artal & Toole, 2003; Siebel, Carey & Kingwell, 2012; Tomic et al, 2013). This finding will boost confidence in safety of the exercise during pregnancy with respect to baby low birth weight. It is noteworthy that, however the sample size in this feasibility study was small and thus may be insufficient to identify any impact of this exercise programme on baby birth weight.

The qualitative findings indicated that the exercise programme facilitated pregnant women to reduce excuses and increase confidence in exercise during pregnancy. From the previous studies, busyness or a lack of time is the principal and most prevalent reason given by non-exercising women. Several other studies indicated low motivation, dislike for exercise, a lack of interest, a lack of knowledge and low self-efficacy (Evenson et al, 2009; Leiferman et al, 2011; Marshall, Bland & Melton, 2013; Santos et al, 2014). Additionally, household tasks, family responsibilities, and child care were cited as reasons for inactivity and lack of exercise (Cramp & Bray, 2009; Krans & Chang, 2012). Meanwhile, pregnant women felt that the exercise programme motivated them to overcome excuses in the first few weeks of exercise while increasing self-efficacy to get active and keep up with exercise until childbirth. The exercise programme itself offered benefits to promote broader healthy behaviours beyond exercise and to improve physical health as well as well-being in pregnant women. The current study reveals that the exercise programme assisted HCPs in achieving the goals of the antenatal care service based on the key performance indicators (KPIs) (Department of Health, Thailand, 2016).

In addition, the exercise programme, both educational and training sessions, has been designed in an attempt to overcome barriers to exercise in pregnancy. The support from the

exercise programme assisted women who are willing to change from their traditional lifestyles to healthy mothers during pregnancy. It enhanced their self-confidence and self-efficacy to continue exercise during pregnancy (Marquez et al, 2009; Krans & Chang, 2011; Muzigaba, Kolbe-Alexander & Wong, 2014; Put, Chuang & Chan, 2015). Importantly, this exercise programme was carried out under the protocol of safety for exercise during pregnancy, including screening for contraindications and warning signs under the observation of the researcher. Feedback which could be viewed as personalised care, was helpful for encouraging women to overcome a range of barriers and to solve their problems, including their family's traditional views. In traditional care, the evaluation process is measured by the level of satisfaction through a questionnaire in which pregnant women might feel constrained from giving details of their feedback. However, this kind of exercise programme could encourage pregnant women to give feedback and ask questions face to face and via the group chat to ensure safety of exercise during pregnancy. It also leads to self-confidence to continue exercise at home (Leiferman et al, 2011; Riberiro & Milanez, 2011; Melton et al, 2013; Fieril et al, 2014).

Noticeably, pregnant women also mentioned that the protocol of the exercise programme in terms of exercise classes should be adapted to fit in the usual antenatal visits. This comment is supported by the fact that around half of the women were absent after the fifth week. Pregnant women cited a waste of time, being busy, increasing transportation cost, and other personal duties for reasons of their absences from the exercise programme over ten weeks at the hospitals. This result is consistent with the previous studies that identified association between low level of exercise behaviour in pregnancy and such barriers as lack of time, higher cost of exercise (Cramp & Bray, 2009; Melton et al, 2013), lack of transportation, and adverse weather (Evenson et al, 2009; Leiferman et al, 2011; Santos et al, 2014).

Pregnant women also added that they wanted to participate in the exercise programme four to five times. They could continue exercise at home after having received guidance for exercise. Both HCPs and pregnant women suggested the integration of the exercise programme into the usual antenatal care. In this way, the number of exercise classes should be reduced from a weekly basis for ten weeks in a row to four prenatal education classes. Pregnant women also said that HCPs should emphasise taking simple exercise at home until childbirth with low risk pregnant women at antenatal care appointments as part of additional care. This research found that repeated exercise training may be unnecessary for women after they gain enough confidence to continue exercise at home. HCPs should consider on when and how to encourage them to continue exercise at home as personalised care at antenatal care visit and HCPs should make use of technology to motivate exercise such as sending short messages via a chat application.

However, the overall adherence rate to the exercise programme was still high. Around half of the women (17 of 31 women) adhered to the exercise programme at least 80%. Nearly one-fifth of the women participated in the programme less than 60%. The minimum number of attendances in the exercise programme was four times over ten weeks, which was less than 10% (2, 6.45%). Women in the exercise intervention also had higher total physical activity those in the control group as well as increased their physical activity from the baseline measurement to the end of the exercise programme. This result pointed that this exercise programme could support women in increasing total physical activity and exercise behaviour during pregnancy. Therefore, suggestions made by women and HCPs regarding the number of exercise classes should be taken into account, based on the context and evidence of improving exercise behaviour of pregnant women for future research.

Interestingly, materials (posters and leaflets), developed from the results of the workshops by the researcher, were practical to encourage pregnant women to continue

exercise at home. Pregnant women stated that the materials looked modern and were easy to use, especially an online version uploaded on the group chat application (Line application). The exercise information was delivered to pregnant women, including prescription for exercise, exercise schedule and reminders of appointments for the exercise class (as a motivator) on a weekly basis so that pregnant women recognised the importance of continued exercise. This is in line with previous studies about informational support which facilitates exercise in pregnancy (Krans & Chang, 2011; Melton et al, 2013). A chat application allowed pregnant women to communicate with others easily through such electronic devices as smartphones and tablets (Kujitjuerwong, 2012; Tansupong, 2015). HCPs also had a chance to communicate with pregnant women and created a clear understanding about exercise behaviour as well as the nature of exercise during pregnancy, including supporting pregnant women in solving problems or staying in exercise (Haakstad et al, 2009; Evenson & Bradley, 2010; Leiferman et al, 2011; Da Costa & Ireland, 2013). For example, some pregnant women asked such questions about exercise in the group chat as “I would like to confirm that it is ok if I skip some postions of exercise: pelvic rock and leg lift. I think, it’s quite difficult to do at home.” Then, the instructor (researcher) replied that “Yes, you can. And you should exercise at least 30 mimutes a day, ≥ 3 times a week. We will do pelvic rock position together at the next exercise classes.” Some women added photos of pregnant celebrities doing the same exercise positions as those in the exercise programme. As it is influenced by urbanisation and Western lifestyle, this communication channel seems to work well while gaining more popularity (Sitthi-amorn, Somrongthong, & Janjaroen, 2001; Chaipraditkul, 2013).

In order to improve the quality of healthcare and its related services, an exercise network is recommended for inclusion in the exercise programme. It was found useful to motivate exercise behaviour and deliver exercise information to pregnant women who participate in the exercise programme via a group chat application, including enhancing the

accessibility of the exercise informational and emotional supports. Several studies revealed that an exercise network was successful in creating an environmental facilitator for exercise in pregnant women (Marquez et al, 2009; Krans & Chang, 2011; Put, Chuang & Chan, 2015). In the current study, pregnant women reiterated that the exercise group chat helped them to gain positive experiences and improve accessibility of two way communication with HCPs.

An exercise network, as opposed to the traditional healthcare in terms of health communication, is thus an alternative way to communicate with HCPs. Such a network can make it easy for pregnant women to access exercise information when they are ready for taking information. It also helps pregnant women to pay more attention and gain a better understanding about exercise during pregnancy, and subsequently engage themselves in exercise (Evenson & Bradley, 2010; Leiferman et al, 2011; Da Costa & Ireland, 2013; Melton et al, 2013). In traditional healthcare, HCPs provide exercise information for low risk pregnant women in the prenatal education class and then HCPs advise them to continue exercise at home at least three days a week for at least 30 minute a day (3rd Regional Health Promoting Centre, Thailand, 2011). The prenatal education class usually has a nurse educator who conducts many sessions of prenatal care which include only a brief session on exercise information. Exercise information is brief in term of contraindications for exercise and exercise recommendations. In-depth discussion about safety issues and potential problems during exercise at home are not included. It is obvious that only one nurse educator cannot give in-depth advice in such limited time and resources (MoPH, 2013). The exercise network therefore has a supporting role for pregnant women to have a better notion of exercise in pregnancy as well as boost self-confidence and self-efficacy to continue exercise at home.

7.3 Trend of the exercise in pregnancy in Thailand as a ‘modern mum’

The current study discovered some new insights into experiences of exercise in Thai pregnant women. ‘Modern mum’ was identified by the interview respondents as congruent

with exercise during pregnancy. The modern mum plays a significant role of a healthy and trendy mother as well as an intrapersonal facilitator for the participating pregnant women (Leiferman et al, 2011; Krans & Chang, 2012; Supavititpatana, 2012). The finding indicated that pregnant women have developed broader healthy behaviours after engaging the exercise programme. This can be explained by the fact pregnant women who participated in the exercise programme recognised the benefits of exercise during pregnancy such as controlling gestational weight gain and increasing physical fitness, health outcomes and well-being (Horak & Osmam, 2012; Prather, Spitznagle & Hunt, 2012; Guszowska et al, 2013; Fieril et al, 2014). They also planned to continue exercise after childbirth, as a result of the benefits of exercise in terms of body shape and beauty. Meanwhile, the value of beauty in Thai women has been increasingly influenced by Westernisation (Montgomery et al, 2012; Chaipradikul, 2013). It is a new normal that pregnant women should care about their image, notably body shape and beauty during pregnancy as well as after childbirth. In an attempt to do so, they exercise during pregnancy so as to control gestational weight gain, increase firm muscles, as well as look young and beautiful.

This points to the fact that Thai women are concerned with beauty and body image, caused by the social media and celebrities as well as the advertisement and media on beauty that significantly influence women's attitude in terms of body image and beauty such as bright skin, long hair, skinny body (Sereetrakul, 2012; Chuenglertsiri, 2015). Meanwhile, some research indicated that the number of hours spent in watching television, susceptibility to peer influence, and imitation of media celebrities negatively influenced the body image satisfaction of undergraduate students in Bangkok (Sereetrakul, 2012). In other words, the media influence on Thai modern society is significantly linked to Thai women' attitude toward beauty and body image (Seewan & Benjarongkij, 2014), resulting in a change in their

perception and mindset, including health behaviour (Seewan & Benjarongkij, 2014; Chuenglertsiri, 2015).

Exercise during pregnancy is becoming a trend in Thailand, especially in rural areas. Previous research identified Western influence on the lifestyle of Thai pregnant women such as eating behaviour, working, and beauty notion (Lee, Yach, & Kamradt-Scott, 2005; Craven & Hawks, 2006; Chaipraditkul, 2013). The current findings indicated that pregnant women in Thai society are increasingly interested in exercise in pregnancy, but they may not know how to manage exercise during pregnancy and are concerned about the risks to their babies. They also want to develop healthy behaviour, but they lack information and feel unsure how to exercise properly.

Prior to their engagement in the exercise programme, the participating women had low levels of exercise behaviour and physical activity during pregnancy, which is consistent with a review of exercise patterns during pregnancy. That is, most pregnant women decrease exercise and occupational activities, but increase household activities (Blum, Beaudoin & Caton-Lemos, 2004; Treuth, Butte & Puyau, 2005). According to World Bank, although Thailand was classified and ranked as an upper middle income developing country in 2018 (World bank, 2018), compared to being a lower middle income developing country in 2014 (World bank, 2014), the country remains in a developing stage. Wealth distribution is still unequal as it can be clearly seen when comparing Bangkok to other areas (NSO, Thailand, 2016; 2017). For a better livelihood, Thai people tend to focus on work and family income, rather than physical activity or exercise in daily life (NSO, Thailand, 2012; 2016). Even so, the Thai socio-economy, especially in rural areas, has been influenced by Western lifestyle and thus more urbanised (Lee, Yach, & Kamradt-Scott, 2005; Craven & Hawks, 2006; Sittiamorn, Somrongthong, & Janjaroen, 2001; Chaipraditkul, 2013). This is confirmed by a

previous study that physical inactivity is associated with urbanisation, resulting in higher personal incomes, modern home appliances, and car ownership (L-Y Lim et al, 2009).

In contrast with the traditional view of exercise in pregnancy, exercise appears to be valuable for those in a high society, as observed by most pregnant women. This is because exercise during pregnancy tends to require special materials and equipment. Pregnant women also perceived that exercise during pregnancy was difficult to access through healthcare service as most of these services were solely provided in the urban areas and Bangkok city. The exercise programme in the current research made the pregnant women understand that they can take simple exercise during pregnancy at home or integrate it into daily routines, just like rich people or celebrities. After their engagement with the exercise programme, they realised that exercise is easy to access through public healthcare service at a public hospital as improvement of standard care for all pregnant women. In other words, pregnant women now have an impression that exercising women are trendy, which is a celebrity status they hope for.

In addition, intrapersonal, interpersonal, and environmental barriers of exercise in pregnancy were identified from the interviews and focus group. Pregnant women often made excuses for stopping exercise during pregnancy. Such excuses include lack of motivation, being tired, laziness, and/or personal reasons, which are non-health intrapersonal barriers. (Evenson et al, 2009; Leiferman et al, 2011; Krans & Chang, 2012; Marshall, Bland & Melton, 2013; Santos et al, 2014). Moreover, the older generation such as parents and grandparents have a negative view on exercise during pregnancy. It is evident that such a traditional view negatively impacts pregnant women by causing doubts and concerns with the benefits and safety of exercise, including its importance. These are examples of interpersonal barriers (Evenson et al, 2009; Krans & Chang, 2012; Marshall, Bland & Melton, 2013). In this study, the participating women managed to produce arguments against such views of

family members while being able to politely disagree with these views (Pimpa, 2012; Powell, Amsbary & Hickson, 2014). This means that the education provided by the exercise programme facilitators gave them confidence in the safety of the exercise.

Interestingly, the present findings demonstrated that exercise during pregnancy seems less important in the healthcare service. Exercise information has limited coverage in the usual care, as well as the mother and child health handbook, which poses an environmental barrier. However, posters and leaflets, particularly developed for the exercise programme, could be added to the handbook to promote exercise and display what is required. Further, other health messages such as nutrition and well-being are louder than exercise in pregnancy. This means that pregnant women receive inadequate information from HCPs, which constitutes another interpersonal barrier (Evenson et al, 2009; Haakstad et al, 2009; Krans & Chang, 2011; Melton et al, 2013). Pregnant women said that they received exercise information during pregnancy only once at 16-25 weeks of gestation for approximately 30 minutes. They felt that exercise information was not enough to encourage them to exercise during pregnancy. This is confirmed by the results from the focus group with HCPs. Rather than exercise, HCPs focused on their main Key Performance Indicators (KPIs) of antenatal care clinic that specify early booking before 12 weeks and receiving prenatal care at least four times during pregnancy in order to reduce the rate of neonatal and maternal death, as well as to monitor the rate of baby low birthweight (< 2,500 grams) (Department of Health, Thailand, 2016).

Additionally, the present research revealed the influence of modern society on changing diets and sedentary lifestyle of Thai women. The qualitative findings discovered that women wanted to be healthy mothers and looked as modern as the celebrities on social media. In order to become a modern healthy mother, they accept the benefits of the exercise programme, leading them to increase frequency and duration of exercise and self-awareness

on healthy behaviours such as healthy eating. The quantitative results also indicated that women in the exercise group had appropriate total gestational weight gain, according to the recommendations made by the Institute of Medicine (IOM, 2009) than the control group. The exercise programme thus encourages women to increase total physical activity and exercise behaviour. Women in the exercise group also had lower stress scores than the control group at the end of the exercise programme. In this regard, the healthcare system should shift from the traditional to modernised care to better support women who are willing to change their lifestyle. HCPs should well understand a transition to modern or Westernised lifestyle and keep updated with healthy trends in the Thai context. At the same time, HCPs have to change their attitude on health behaviour of women. Rather than the traditional one, personalised care should be promoted as part of health promotion for pregnant women based on KPIs in the healthcare service. This will enable pregnant women and their families to meet their demands and to decide on the exercise programme. The present study also indicated that the exercise programme has urged pregnant women to provide feedback and set a goal in exercise behaviour as well as healthy lifestyle with the researcher. HCPs should thus empower women for decision-making on their health and collaboration on care plan with HCPs.

The findings also revealed that pregnant women decided to get active and keep up with exercise until childbirth because they were inspired to be a modern mother. They also intended to engage the exercise programme and to continue exercise because they received guidance from the programme. In other words, pregnant women perceived facilitators for exercise from the exercise programme, which reduced their barriers to exercise. As a consequence, they decided to step out of comfort zone, or any fear and doubt, to exercise during pregnancy (Evenson et al, 2009; Leiferman et al, 2011; Santos et al, 2014). The motivation techniques include informational and emotional supports, feedback, goal setting,

and role model, which are used in the exercise programme. All these techniques are employed to support pregnant women in reducing barriers and increasing facilitators to exercise in pregnancy (Evenson et al, 2009; Cioffi et al, 2010; Evenson & Bradley, 2010; Da Costa & Ireland, 2013; Put, Chuang & Chan, 2015).

The guidance also promoted pregnant women to reduce uncertainty derived from their family's traditional belief and HCPs' inadequate provision of the exercise information (Haakstad et al, 2009; Evenson & Bradley, 2010; Marshall, Bland & Melton, 2013; Melton et al, 2013) while boosting their intrapersonal facilitators and removing their excuses for not continuing exercise (Marquez et al, 2009; Cioffi et al, 2010; Leiferman et al, 2011; Krans & Chang, 2012). These findings thus challenge HCPs to gain a better understanding of exercise value in pregnant women. In so doing, they should be aware of the nature of pregnant women and take a role for enhancing facilitators and reducing barriers to exercise in pregnancy. This is an opportunity for HCPs to promote healthy behaviour in pregnant women.

As previously mentioned, exercise information is briefly covered in the mother and child health handbook (MoPH, 2012). Plus, there remain intrapersonal barriers caused by receiving exercise information only once at the prenatal education class as part of the usual care (Evenson et al, 2009; Leiferman et al, 2011; Krans & Chang, 2012; Marshall, Bland & Melton, 2013; Santos et al, 2014). The existence of the exercise programme, therefore, tends to increase accessibility of exercise information during pregnancy (Evenson et al, 2009; Leiferman et al, 2011; Santos et al, 2014) The exercise education, both exercise information and training including the materials and group chat application, increases effective learning achievement (Lalley & Miller, 2007; Davis & Summers, 2015), thereby boosting self-confidence and opportunities for pregnant women to access information for exercise at home. This can improve inadequacy of the exercise information provided for pregnant women (Bauer, Broman & Pivarnik, 2010; Melton et al, 2013). When women experience such

undesirable conditions as fatigue and boredom for long waiting time during antenatal care (Sanklaleak, Boromtanarat & Tiautchasuwan, 2014), they can access exercise information more than once and also at their convenient time.

The focus group was conducted with HCPs whose work was related to the antenatal care clinic. This was a good representation of HCPs who deliver exercise information as part of the usual care. The exercise programme has changed HCPs' attitude on the benefits of exercise in pregnant women. That is, HCPs now accept that the exercise programme can encourage pregnant women to increase exercise behaviour as well as improve healthy behaviour. Such a change in their attitude has influenced their roles in usual healthcare service with respect to the promotion of health behaviour as a holistic care from physical, psychological, emotional, and spiritual aspects (Kunaviktikul, et al, 2001). Pregnant women also proposed that exercise information should be delivered to them adequately so as to motivate and reduce negative psychological mood and fear of harming their babies, including maintaining exercise behaviour (Marquez et al, 2009; Cioffi et al, 2010; Riberiro & Milanez, 2011; Muzigaba, Kolbe-Alexander & Wong, 2014; Put, Chuang & Chan, 2015). HCPs should pay more attention to their role in promoting healthy exercise behaviour for pregnant women, rather than just doing it as part of routine care.

The balance between HCPs' quality of care and workloads as well as clients' satisfaction with the healthcare service was identified in this study. HCPs still had some concerns on their workloads and responsibilities to meet KPIs. Although HCPs accept that the exercise programme offers more benefits to health and well-being of pregnant women, most of the participating HCPs with over ten-year experience in antenatal care worry that the exercise programme which takes over ten weeks might negatively affect their workloads. As a result, it might also affect their quality of care and satisfaction of clients. This is a factor that has become a barrier to deliver exercise information to pregnant women (Evenson et al,

2009; Haakstad et al, 2009). On the other hand, this exercise programme has been designed in the workshops, drawing on the evidence that the duration of the exercise intervention for improving exercise behaviour should be at least ten weeks (Kramer & McDonald, 2006; Gaston et al, 2013). This finding thus posed challenges for Thai HCPs to keep the balance between quality of care and their workloads. HCPs have to manage the way to deliver exercise information for improving exercise behaviour of pregnant women and make that fit in the usual antenatal care and workloads.

The present study also demonstrated that the new generation of pregnant Thai women can manage and design their health behaviour in compliance with their lifestyles, which means the transition from a traditional to modern mum. Pregnant women pointed out they can take simple exercise at home after having received adequate exercise information and guidance from healthcare professionals. This research result is confirmed by several studies that adequate information provided by HCPs can boost self-confidence and self-efficacy among pregnant women (Riberiro & Milanez, 2011; Fieril et al, 2014; Muzigaba, Kolbe-Alexander & Wong, 2014) as well as encourage them to continue exercise until childbirth (Marquez et al, 2009; Cioffi et al, 2010; Put, Chuang & Chan, 2015).

7.4 Workshops for designing the exercise programme

The collaboration with pregnant women and HCPs in the workshops was successful in designing an exercise programme suitable for pregnant women. This is the first exercise programme for pregnant women that has been designed with the collaboration between pregnant women and HCPs in the Thai context of healthcare service. According to the previous studies in Thailand, there has been limited collaboration models across healthcare teams and clients in designing healthcare activities or interventions (NHDPC, Thailand, 2011; Soakaew et al, 2012; Choosri et al, 2016). The collaboration in this study have introduced a transition, which remains at an early stage, to a partnership between clients and

healthcare service providers to improve the quality of care and health outcomes through health behaviour change (MoPH, Thailand, 2010). Pregnant women and HCPs have changed their roles from provider-receiver to partnerships so as to share experiences, including information in terms of both tacit and explicit knowledge (Himmelman, 2002; Pestronk et al, 2013; Prybil et al, 2015). This study is thus in support of achieving the goal of “Health for all Thai people” (MoPH, Thailand, 2010; Primary Health Care Division, Thailand, 2014).

It is clear that women respect the advice of the healthcare providers, but welcome the opportunity to receive guidance on health behaviour and want to be able to control how they apply this guidance to fit their lifestyle. They want to design health behaviour that would fit in their daily routines. That is, pregnant women who participated in the workshops had a standpoint to seek advice and to design health behaviour by themselves. This means that women are willing to transform the traditional Thai health care approach which can bring another key success to collaboration. A collaborative approach therefore challenges healthcare providers and professionals to develop their healthcare service and activities so as to empower and support clients for co-creation of the usual care.

This exercise programme has been designed based on the perspectives of both pregnant women and professionals with experience of the antenatal care service. The workshops encouraged pregnant women and professionals to work together to design an intervention that would fit in the existing service. The workshops empowered pregnant women to consider how to prioritise their health in pregnancy in a way that incorporates exercise activities. The key success of collaboration in this study is a partnership that gave an equal chance for pregnant women and HCPs to exchange their experiences and ideas (Pestronk et al, 2013; Spencer, Dineen & Phillips, 2013; Prybil et al, 2015). For this reason, technical terms were avoided in the workshops. Participants in the workshops said that the collaboration between clients and HCPs was a good start to share their experiences and ideas

in order to make decisions about the healthcare service. As pregnant women appreciated having a chance to communicate with HCPs about what they wanted for their health service, the empowerment of pregnant women enabled them to be equal partners of HCPs to co-design the exercise programme. The positive atmosphere in the workshops made the participating women relaxed while reducing power imbalance between HCPs and the women as well as enabling both parties to better express themselves for designing the programme.

Instead of a uniform, the researcher and the assistant researcher wore a formal dress which could reduce the feeling of power imbalance between healthcare providers and clients (Suksabai & Thongsuk, 2009). The characteristics of the researcher and the assistant researcher in the workshops created an empowering atmosphere. The researcher and the assistant researcher also maintained the autonomy of women and stressed on the unity of both pregnant women and HCPs to fully express themselves. This is consistent with a study about perception of patients on moral traits of nurses at Ramathibodi Hospital, Thailand, which identified moral traits of nurses such as equality, honouring, hospitality, and attention to listening. These traits are significantly associated with higher satisfaction with healthcare service among clients while reflecting patients' attitudes and their relationships with nurses (Suksabai & Thongsuk, 2009). The characteristics of facilitators in the workshops encouraged HCPs and the women to be open-minded and free to present their ideas and experiences equally.

This co-designed exercise programme appears to fit in the Thai government policy on empowering clients to work and decide cooperatively with healthcare professionals on their health care plan (MoPH, Thailand, 2010; Morley & Cashell, 2017). Nonetheless, the process of creating collaboration for co-design is not easy as long as some aspects of Thai culture are involved. As noted in the researcher's diary, the workshops reflected the hierarchy in the Thai context of healthcare. In Thai culture, clients are likely to respect their HCPs who attain

power through age, occupation and status in the healthcare setting (Burnard & Naiyapatana, 2004; Punyapiroje & Morrison, 2007; Pimpa, 2012). Although some pregnant women might develop close relationships with nurses and HCPs at the antenatal care clinic through their continued care during pregnancy, they experienced difference in power and status between themselves and HCPs. As Thai unique characteristics include respect, hospitality, sincerity, and respect on seniority (Punyapiroje & Morrison, 2007; Pimpa, 2012), pregnant women felt “*Kreng Jai*” to share experiences or ideas so as to design their healthcare (Wyatt & Promkandorn, 2012). “*Kreng Jai*” means to be considerate or afraid of doing or expressing something, including respect for someone (Naratpattanasai, 2002; Burnard & Naiyapatana, 2004). Some pregnant women expressed their being considerate through a well-known, non-verbal Thai traditional respect called “*Wai*” (Jones, 2003; Powell, Amsbary & Hickson, 2014; Kongprasert & Virutamasen, 2015) after sharing experiences and ideas about HCPs’ work.

Pregnant women, even with their intention to manage health behaviour on their own, had some concerns when sharing experiences and ideas. They were used to respect HCPs’ judgements and instructions in compliance with the Thai culture. For this reason, it is important for HCPs to be careful about not forcing opinions or judgements on their clients. The experience gained by the researcher and the assistant researcher from facilitating the discussion group is also useful in managing the discussions in compliance with the views from both pregnant women and professionals. The two facilitators drew on their skills as educators (both are instructors in nurse education) to bring about fruitful discussions and to ensure that all views were valued and welcomed. In addition, the environment for collaborative care should be created as a positive and flexible atmosphere to empower women and support HCPs in a partnership. It could reduce, to a certain extent, the hierarchy

in the Thai context of healthcare (Primary Health Care Division, Thailand, 2014). These strategies proved to be practical in creating the collaboration process in the workshops.

Remarkably, the experienced senior HCPs who have worked in the antenatal care clinic for long time, had quite a different view on the collaboration concept in healthcare service. These HCPs commented that collaboration may be difficult to apply in usual care. They felt the collaboration would be useful for some situations in healthcare service, but not for all healthcare activities or services as it requires more time to exchange, share, adjust, and make a commitment together, depending on clients' knowledge and skills of self-management. This process was thus perceived as complicating their workloads in healthcare service. This result indicated that senior HCPs seem concerned about clients' abilities in self-management as well as their workloads. This is congruent with a study conducted by Entwistle et al. (2018) that clinicians have concerns about patients' abilities to self-management (Entwistle et al, 2018). Meanwhile, it implied that the collaboration process may make HCPs lose their control of the quality of care and healthcare service because clients can manage their health, instead of depending on HCP's judgements. This point demonstrated misunderstanding and lack of experience of healthcare providers on the principle of collaboration.

On the other hand, other HCPs in the workshops felt that the collaboration would be useful to reduce the gap between women and HCPs. As a result, HCPs and women can communicate to promote the healthier behaviour of women. For example, most of the healthcare activities in the antenatal care clinic are designed by HCPs and experts from other sectors such as researchers or lecturers from universities. Channels to engage women or clients in designing or exchanging their experiences are limited. In the traditional care, the evaluation process is measured by the level of satisfaction with healthcare service and activities through a questionnaire. In this study, the workshops provided pregnant women

with a chance to express their desires and expectations based on their experiences and lifestyles prior to the service provision. This is in contrast with the traditional post hoc nature of evaluation. Given the issue of different attitudes of HCPs about collaboration, it remains a challenge for Thai healthcare system to deal with Thai traditional culture. It is also important to change HCP's views so that they will better understand their roles and those of the clients in healthcare service.

7.5 Reflexivity of the researcher

In this study, the researcher has learned the process of reflecting on her role as a researcher through a research diary. The reflection of the researcher should be recognised as it affected the study design, data collection, data analysis and discussion (Palaganas et al., 2017). I began this study as part of my journey to PhD. Throughout the study, I gained experience of learning in a higher degree in the field of my interest, which is the exercise behaviour of pregnant women in Thailand. The most important part of my learning is to acquire knowledge and skills for developing as a professional, including learning the nature of exercise behaviour of pregnant women and views of HCPs on the exercise behaviour during pregnancy in healthcare services. This has enhanced my understanding of research on improving the exercise behaviour and other healthy behaviours of pregnant women in Thailand.

After the literature review and the identification of research gap, I realised that the research questions needed answers based on philosophical assumptions and research paradigm of the mixed methods so these research methods were chosen to respond to the research objectives. The research design of multiphase mixed methods was a challenge to me as it might take more time, high cost and resources while the study itself appeared complicated. As an example, in the process of the feasibility study, the research complication was derived from the inclusion of the exercise intervention and qualitative components.

Along the process, however, I have developed skills and intellectual abilities for conducting research.

Further, ethical issues were a major challenge. The study took place at the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand, which was quite a different process for ethical approval than in United Kingdom (UK). In this case, the gatekeeper letter would be provided after the ethical process was approved in Thailand. I have learned the principles of ethical approval process, and legal requirements of the safety for the participants that are similar in both Thailand and UK. The ethical approval could ensure that this study would provide benefits, safety, fairness, and respect autonomy for all the participants. It also required the researcher who ran the study to act with integrity and transparency.

The researcher, assistant researcher, and physiotherapist wore informal dress during data collection at the hospital. From the researcher's diary, the recruitment process faced some difficulties, caused by wearing informal dress, instead of a uniform.

"I face difficulties recruiting women for the workshops. If women want to participate in the study, I will explain them in detail. When they saw me, they always showed some hesitation on their faces. I felt vulnerable. At that time, I wanted to wear a uniform because it was convenient for my research project. In fact, I did not do so." (Researcher's diary)

Most of the pregnant women were quite confused with the researcher's role at the hospital. In traditional Thai culture, the uniform of HCPs is a symbolic power of care, which affects pregnant women's feeling about healthcare service in a hospital (Suksabai & Thongsuk, 2009) . It was a challenge for the researcher to make it clear that she was a researcher and not part of the clinical care team at this hospital. However, such characteristics of Thai people as kindness, open mind, and smile opened a chance for the researcher to explain the role of researcher (Jones, 2003; National Statistical Office (NSO) , Thailand, 2011; Powell, Amsbary & Hickson, 2014).

“Pregnant women expressed their confusion and asked the researcher “Who are you? Are you working here? I have never seen you before. Why do you study at here? And what are you doing here?”

In response, I have changed my strategies for recruitment. I think I am Thai and they are also Thais, so it is easy to build a relationship. Further, I should explain them my role as a researcher here. I am not part of the clinical care team at this hospital. For this reason, I should not wear uniform. I will show my business card displaying my name and position. I also highlighted my name, position and contact details on the participant information sheet. Importantly, what I was wearing would not represent any symbol that invites or pressures them to join the study. Pregnant women can feel free to join in this study and express their experiences in the study. I believe that.” (Researcher’s diary)

After the data collection, all of the data were transcribed and translated from Thai into English. The translations were checked for accuracy by a professional translator.

“This stage made me stressed. When I translated the data from Thai to English, I thought that some Thai words were very difficult to find their English equivalents. I read and re-read several times. I discussed with my supervisors and got a lot of advice from them. I wrote several drafts, but some of the drafts seemed a waste to me. Ideally, I should keep the original meaning of the data, rather than translating word by word. Although I read the process and strategies for translation, I still worried that I might not do it well. I kept telling myself to be calm while going through the researching process. I asked myself: what I should do; what are the problems; what is the best solution in this situation; how I can go about it; and why is that?” (Researcher’s diary)

By reflecting on the research process and activity, I have gained better understanding of the findings from the workshops, the feasibility RCT, the qualitative interviews with pregnant women, including the focus group with HCPs. In addition, it has enhanced the understanding of the findings in the Thai context and also from the holistic perspective. I have learned how to apply the research findings in future research, education, and practice. The exercise programme encouraged pregnant women to understand exercise in pregnancy and increase their physical activity, including frequency and duration of their exercise behaviour. Frankly speaking, I was surprised to learn from the interviews that pregnant

women intended to continue exercise until childbirth and wanted to be a modern and healthy mum. This is because exercise in pregnant women was quite new and seemed less significant in Thai healthcare service based on the perspectives of pregnant women who participated in the exercise programme. Meanwhile, most of the HCPs focused more on the health of pregnant women and baby, nutrition and dietary needs, antenatal care appointment schedule, complications during pregnancy and delivery, and baby birth weight. The exercise intervention assisted HCPs in changing their views on exercise during pregnancy. They gained more awareness of the importance of exercise, which is one of the healthy behaviours in pregnant women. The exercise programme also led pregnant women to develop other healthy behaviours such as healthy eating and sleeping.

7.6 Strengths and limitations of the study

In this study, the mixed methods study comprised both quantitative and qualitative data that provided the broader range of practicalities to improve exercise behaviour in Thai pregnant women. The range of recruitment strategies, which approached women by inviting verbally with leaflets by the reception nurse, were more efficient to recruit women than just only posters and leaflets in the feasibility RCT. The randomisation blocking in groups of four and six were employed with women to either the control or the intervention group for reducing any selection bias and securing an equal sample size (Altman & Bland, 1999; Efird, 2011). Analysis of Covariance (ANCOVA) was utilised to analyse the difference and control any baseline imbalance between the intervention and control groups (Vickers & Altman, 2001). The significant parameters and process of the feasibility RCT is thus useful for conducting a larger trial with the exercise programme for pregnant women.

The interviews with pregnant women who participated in the exercise programme have led to the better understanding of their exercise behaviour, clarified their experiences on the exercise programme, including deeper insights into their views of exercise during

pregnancy. The focus group with HCPs whose work is related to antenatal care and healthy behaviour provided opportunities for discussions about the exercise programme. The focus group reinforced exercise behaviour of pregnant women and healthcare service while stimulating HCPs to address emerging issues and to generate views on exercise. In this way, pregnant women and healthcare service interacted with dynamics (Holloway & Wheeler, 2010; Creswell, 2014). However, this study was designed to interview the participants of the exercise programme (intervention group) only so it lacked interview data of the participants of the control group because this study focused on the acceptability of the exercise programme. In a larger trial, the qualitative interviews should be designed to collect both participants experiences in the exercise programme and control group. These data might lead to better understanding of barriers and facilitators to exercise behaviour of pregnant women in Thailand.

The exercise programme of this study has been designed by collaboration between pregnant women and HCPs who are stakeholders of an antenatal care based on the Thai government guidance for exercise in pregnancy. A physiotherapist was a consultant in designing the exercise programme and the exercise intervention to ensure the safety of the exercise programme for pregnant women. The adverse events protocol was carried out for exercise safety during the exercise intervention by the researcher under the supervision of the field supervisor and physiotherapist. All translated documents were checked for accuracy by a professional translator in terms of meaning, interpretation, and sociocultural context (Hatim & Munday, 2004; Regmi, Naidoo & Pilkington, 2010).

The small sample size and characteristics of pregnant women who participated in the feasibility randomised controlled trial (RCT) has limited the generalisability of the study findings. Most of the participants represented a medium to high level in education and family income. Nearly every participant had higher education than compulsory level. Pregnant

women had monthly income per household slightly higher than average of Thai people, with an average monthly income of 23,933.33±9,303.07 baht for the control group and 30,258.06±9,332.13 baht for the intervention group (approximately from 535±200 GBP to 685±200 GBP) (NSO, Thailand, 2011; 2012). These issues need to be addressed for consideration on the target population and such sampling techniques as stratified sampling in the future trial (Sharma, 2017). The Asian criteria used in this study for body mass index (BMI) classification (WHO, Western Pacific Region (WPRO), 2000) is suitable for Asian pregnant women. Since the exercise intervention has been designed for low risk pregnant women or healthy pregnant women, high-risk pregnant women and women with complications were excluded from the study.

In addition, the researcher and assistant researcher wore informal dress to reduce a symbolic power in Thailand context during the study both the workshops, the feasibility study, and qualitative interviews and focus group. This strategy helped to confirm the researcher and assistant researcher did not part of the clinical care team at this hospital. The Global Physical Activity Questionnaire (GPAQ) was used to assess total physical activity of pregnant women in four domains: work, transport, recreation activity, and sedentary behaviour because the GPAQ Thai version was employed for a national survey among Thai people aged at least 15 years old including pregnant women (Division of Physical Activity & Health, Thailand, 2009). The Pregnancy Physical Activity Questionnaire (PPAQ) has limited to use in this study because it is not available in Thai language (Chasan-Taber et al., 2004) and thus it should be developed and validated in Thai version before being used for assessing physical activity of pregnant women in the future research.

CHAPTER 8

CONCLUSION

This chapter is the conclusion of the study, comprising its contribution to knowledge, the researcher's reflection on personal attitude, knowledge, research process and skills, and research-conducive environments, including recommendations for policy, practice, education and future work.

The purpose of the study was to conduct a mixed methods feasibility randomised controlled trial (RCT) of an exercise programme for Thai pregnant women. The objectives were to determine the acceptability of the exercise programme based on the Thai Government guidance for exercise in pregnancy, to assess preliminary effects and to explore the experiences of participants engaged in the programme and their healthcare professionals' opinions about the programme at the Health Promoting Hospital, 3rd Regional Health centre, Nakhon Sawan, Thailand.

A multiphase mixed methods approach was used in this study. In the first phase, the exercise programme for pregnant women was designed in the two workshops with thirteen participants: seven pregnant women and six healthcare professionals (HCPs). In the second phase, a total of 61 pregnant women participated in the feasibility RCT. They were randomly allocated to the exercise intervention (n = 31) or control group (n = 30) over ten weeks. Baseline measures were collected before the intervention whereas the data of preliminary effects were compiled after the completion of the intervention and two weeks after the childbirth. Ten women who participated in the exercise intervention were interviewed by telephone and four healthcare professionals attended a focus group two weeks after completion of the intervention.

Analysis of Covariance (ANCOVA) was used to analyse the difference between intervention and control groups for total gestational weight gain (TGWG), and baby birth weight. A repeated ANCOVA using a linear model was conducted to compare the effects of group allocation (intervention and control groups), time (baseline at 16-18 weeks of gestation and 30-32 weeks of gestation) and their interaction in total physical activity, blood pressure and stress score. The study found that the exercise group had significantly lower gestational weight gain than that of control group after controlling for maternal age, pre-pregnancy body mass index (BMI), gestational age at delivery, and baby birth weight ($p <.001$). The study indicated a significant increase over time in physical activity of pregnant women in the intervention group after controlling for maternal age, and pre-pregnancy BMI ($p <.001$). However, there was no significant effect of exercise intervention on baby birth weight after controlling for maternal age, pre-pregnancy BMI, gestational age at delivery, and gestational weight gain ($p =.054$).

Thematic analysis was conducted on qualitative data gained from interviews and focus group. Four main themes emerged from the interviews with pregnant women as follows: 1) exercise is easier than I think; 2) I want to become a modern mum; 3) doubts and concerns at the beginning of exercise; and 4) I get active and keep up with exercise until childbirth. Three themes emerged from the focus group with HCPs as follows: 1) more benefits of the exercise programme than expected; 2) concerns with workloads of HCPs; and 3) tailoring of the exercise programme to fit in the usual care.

The findings reveal that pregnant women and HCPs accepted the exercise programme as part of the usual care. The exercise programme had a significant impact over time on increased physical activity of pregnant women in the intervention group, including frequency and duration of exercise behaviour. In this study, pregnant women developed a better healthy behaviour during pregnancy after engaging the exercise programme. Pregnant women in the

exercise group successfully controlled gestational weight gain in compliance with their pre-pregnancy body mass index (BMI). There was no report on any adverse events or low birth weight related to pregnant women who participated in the exercise programme. According to the current research, it is feasible to conduct a larger scale trial with an exercise programme for pregnant women. Recruitment and retention rates demonstrated a good likelihood of implementing such a programme in a larger trial. Preliminary effects of the exercise intervention were noted for a future trial. Finally, the study suggests that pregnant women showed high fidelity in the intervention.

8.1 Contribution to knowledge

The findings from the feasibility study illustrated several factors that need to be considered before conducting a larger scale of intervention as a randomised controlled trial (RCT) with an exercise programme to improve exercise behaviour of pregnant women. The significant parameters from the feasibility RCT can be used to calculate an appropriate sample size and prepare processes for conducting a larger scale of a trial. The exercise programme was helpful to improve health outcomes, exercise and health behaviours, and quality of the healthcare service. The qualitative findings are applicable to gain better understanding of the nature of exercise behaviour in Thai pregnant women that, in turn, supports women for healthy behaviour. Healthcare professional's views have led to the knowledge about how this level of personalised care in promoting health may impact on workloads. In other words, this study is useful to enhance a better understanding of the nature of pregnant women and that of HCPs, including their roles in the Thai context of healthcare service.

Westernisation was found to influence health behaviour in Thailand. The new generation of Thai pregnant women wanted to be a modern and healthy mother. The exercise programme supported pregnant women to explore the value of exercise in pregnancy.

Pregnant women perceived that exercise during pregnancy assisted them in achieving such benefits as increasing physical fitness, reducing discomfort during pregnancy, feeling fresh and relaxed, being able to sleep well, especially getting a better body shape and beauty during pregnancy and after childbirth. In addition, the exercise programme helped HCPs gain better understanding of exercise and healthy behaviour of women during pregnancy. These research results were beneficial for HCPs in order to change a mind-set of clients on exercise in pregnancy while boosting healthy behaviour of pregnant women as holistic care. Furthermore, the study demonstrated the use of group exercise network through group chat application becoming a new channel in Thai healthcare service that was useful to motivate pregnant women to continue exercise, and improve the accessibility of the exercise and health information including enhancing the accessibility of communication with healthcare providers as a form of two-way communication. Materials of the exercise information (poster and leaflet) were helpful for pregnant women to continue with exercise at home and improve accessibility of the exercise information especially through group chat application.

Results from the workshops were useful for developing collaboration between healthcare professionals (HCPs) and clients (pregnant women). Collaboration proved helpful for improving quality of healthcare service, reducing gap in healthcare, gaining better communication and understanding between HCPs and clients. It also boosted satisfaction of clients with healthcare service, including developing self-confidence and self-management in their health and healthcare. The workshops were successful to change HCPs views of healthcare service and to gain deeper insights into collaboration with clients as equal partners that supports them in reinventing their role for promoting healthy behaviour. Meanwhile, clients (pregnant women) gained their power to care for themselves and raised awareness in their health and health care, including healthy behaviour as part of the client empowerment in the Thai culture and healthcare setting (Burnard & Naiyapatana, 2004).

8.2 Recommendations for future research

The present feasibility study illustrated several factors that need to be considered before conducting a larger scale of RCT with an exercise programme to improve exercise behaviour in pregnant women. The important parameters gained from this present study can be used to calculate an appropriate the sample size and prepare processes in designing a full-scale of study in terms of recruitment, exercise intervention, data collection, and outcome measures. Total gestational weight gain and baby birth weight including total physical activity and maternal outcomes on blood pressure and stress score would be important outcome measures of the effects of the exercise intervention during pregnancy in a larger trial. As an example, the suggestions of pregnant women and HCPs who participated in this study about time and the number of the exercise class should be taken into consideration when designing an exercise programme to fit in the antenatal care. Moreover, pregnant women who participated in the feasibility study were homogeneous in terms of education and family income. That is, the participants represented those of medium to high socio-economic status. It is thus recommended that participants from diverse backgrounds such as those of low socio-economic society should be included in the future research.

Further, the principle of collaboration between HCPs and clients is quite new in Thai healthcare service. HCPs views and experience of collaboration should be further explored to enhance the quality of care as a modern care. According to the current findings, collaboration was useful in the healthcare service as it could promote clients to raise self-awareness and self-management of their health and health care. In other words, it positively affects health outcomes. While a collaborative approach was useful in this study, it is noteworthy that HCP' views and experiences of the healthcare service were quite contradictory on the importance and benefits of collaboration with clients. Some HCPs had concerns on their workloads and quality of care, including the KPIs of antenatal care clinic. Therefore, HCP' views of

traditional and modern care should be examined to better understand barriers and facilitators in the quality of healthcare. Outcomes to be gained from such studies are expected to apply to the healthcare service for improving the quality of care and satisfaction of clients.

8.3 Recommendations for healthcare policy

In Thailand, the Department of Health (DoH), Thailand creates the national policy that promotes all population performing regular exercise, including pregnant women (DoH, Thailand, 2014). The current Thai national policy has not made clear how to promote exercise behaviour in Thai pregnant women. It is necessary to develop a clear exercise promotion policy so that promotion of exercise behaviour in pregnant women should become an important part of healthcare service in antenatal care clinic. From the qualitative findings, pregnant women stated that social media and lifestyle of pregnant celebrities on exercise affected their mind-set, attitude, and exercise behaviour during pregnancy more than health policy. Therefore, media campaigns with pregnant celebrities need to be considered as a health policy to promote and provide exercise information for pregnant women. In addition, this study demonstrated the usefulness of group chat application and materials of the exercise information through online service on improving the exercise behaviour of pregnant women. Thus, social media needs to be considered in healthcare policy to improve accessibility of health information including enhancing communication channels between people and healthcare providers.

8.4 Recommendations for practice

According to the findings, the exercise programme helped pregnant women to increase their physical activity, including frequency and duration of exercise while leading them to achieve other healthy behaviours. The promotion of exercise in pregnancy should be applied to the usual antenatal care clinic to improve exercise behaviour and other healthy behaviours by healthcare providers. HCPs should promote holistic healthy behaviour to

continue to motivate women in every antenatal visit. Their views of the workloads and key performance indicators (KPIs) should be adjusted. HCPs should focus on client-centred care as a personalised care, rather than healthcare providers or duty of organisation. In this way, HCPs can support clients to improve health behaviour and health outcomes, which also positively affects HCP' workloads and KPIs. In addition, social media and online information about health and exercise promotion should be considered to integrate in healthcare service for improving the accessibility of healthcare information and communication between healthcare providers and clients. This requires some input into educational and continuing professional development for healthcare professionals.

This study demonstrated that collaboration proved to be a successful approach for designing the exercise programme as reflected in the workshops with pregnant women and HCPs. It indicated that the exercise programme helped to improve both the exercise behaviour of pregnant women as well as the quality of healthcare. In healthcare practice, a collaborative approach should be promoted in HCPs so that they can gain better knowledge, skills and practice with clients in healthcare service. This approach would help HCPs to be aware of their role as a partner with pregnant women, to reduce their domination in healthcare service and to empower clients in self-management of health and health care. Also, HCPs should support clients to change their role to become an equal partners in order to exchange experience as well as manage their health behaviour and healthcare service properly based on Thai context. This strategy will increase opportunities for clients to communicate with HCPs, which in turn, will promote both clients and HCPs to gain better understanding on health behaviour and healthcare service, including the nature of clients in different contexts.

8.5 Recommendations for education

Regarding nursing education, holistic care including personalised care should be emphasised and implemented in nursing education (The National Maternity Review, 2016). Nursing instructors should raise awareness and focus on client-centred care as a personalised care in nursing education, rather than KPIs and workloads. Nursing instructors should encourage nursing students to be aware of the importance of holistic care and personalised care for clients on promoting healthy behaviour. All activities of nursing students should be integrated into a holistic care and client-centred on health and healthcare service.

Collaboration between healthcare providers and clients should be included in the curriculum for enhancing the understanding of nursing students as a partner with clients, including dealing with senior HCPs in healthcare service. Collaboration, quite a new approach in healthcare service, should be cultivated in nursing students for a smooth transition from the traditional health provider model to a shared approach. Further, the principles of collaboration should be applied to the nursing practicum for understanding the roles of HCPs in healthcare service and empowering self-management of clients on health and health care. In addition, the knowledge gained from this study about social media and latest technology of online information and communication should be considered to use for teaching nursing students. The topics should be focused on healthcare information and communication between HCPs and clients including nurse' roles for promoting health behaviour in healthcare service.

Conclusion remark:

To summary, I have listed the research questions with brief answers as follows:

1. Can workshops with pregnant women and HCPs be used to design an exercise programme suitable for pregnant women in the context of Thai healthcare service?

Yes with support and good facilitation workshops can be used to collaboratively design an exercise intervention using the experiences of women and healthcare professionals.

2. Is an exercise programme based on the Thai Government's guidance for exercise in pregnancy feasible and acceptable?

Yes, however more work is required to refine this and incorporate it to fit into usual antenatal care. The ten sessions model was had issues but women generally adhered to the first five sessions. The exercise programme was supported by online materials and a chat application to enable communication between women and healthcare professionals.

3. Is it feasible to recruit to a randomised controlled trial (RCT) for exercise and measure its effects on exercise intervention?

Yes, the recruitment required face-to-face as well leaflet and poster advertising to increase the recruitment rate. Body mass index (BMI) categories should be added into the screening questions that would be possible to measure effects of the exercise intervention in each group. A close collaboration in a research team would be useful to monitor a safety protocol for pregnant women in a larger trial of the exercise intervention.

4. What experiences have pregnant women and healthcare professionals (HCPs) had in this exercise programme?

Experiences are mostly positive and there is support for the programme. The importance of exercise needs to be emphasised by healthcare professionals alongside other health message which at present appear louder.

8.6 Dissemination

The study findings were disseminated through a presentation at the Faculty of Medicine and Health Science Postgraduate Research Student Conference 2018, University of East Anglia, the United Kingdom. In addition, the study has been submitted to present at conferences in 2019, in Bangkok, Thailand and submission for publication is planned for Nursing Journals of Thailand and Region of Asia.

REFERENCES

- Adachi-Mejia, A.M., et al. (2010). Perceived intrinsic barriers to physical activity among rural mothers. *Journal of Women's Health*, 19(12), pp.2197-2202.
- Aekplakorn, W. & Mo-Suwan, L. (2009). Prevalence of obesity in Thailand. *Obesity Review*, 10(6), pp.589-592. doi: 10.1111/j.1467-789X.2009.00626.x.
- The Albert Einstein College of Medicine of Yeshiva University, New York. (2002). *11 questions to help you make sense of descriptive/cross-sectional studies*. [Pdf, Online]. Available at: <http://www.yu.edu/aecomdb/dfsml/Uploads/ugclerkshipinfo/cross-sectional%20study%20appraisal%20tool.pdf>. [Assessed 10 March 2015].
- Alikhani, A.H., Molaie, M., & Amiri, S. (2015). The Effects of Exercise on the Mental Health. *International Journal of Advanced Biological and Biomedical Research*, 3(3), pp.244-250.
- Allmark, P.J., et al. (2009). Ethical issues in the use of in-depth interviews: literature review and discussion. *Research Ethics Review*, 5(2), pp.48-54.
- Altman, D.G. & Bland, J.M. (1999). Statistics notes: Variables and parameters. *BMJ*, 318: 1667. doi: <https://doi.org/10.1136/bmj.318.7199.1667>.
- The American College of Obstetricians and Gynecologists (ACOG). (2002). Exercise during pregnancy and the postpartum period. *Journal of Gynecology and Obstetrics*, 77(1), pp.79-81.
- The American College of Obstetricians and Gynecologists (ACOG). (2013). *Committee opinion number 548: Weight gain during pregnancy*. [Pdf, Online]. Available at: <https://www.acog.org/-/media/Committee-Opinions/Committee-on-Obstetric-Practice/co548.pdf?dmc=1>. [Assessed 20 January 2016].
- The American College of Obstetricians and Gynecologists (ACOG). (2015). *Committee opinion number 650: Physical activity and exercise during pregnancy and the postpartum period*. [Pdf, Online]. Available at: <http://www.acog.org/-/media/Committee-Opinions/Committee-on-Obstetric-Practice/co650.pdf?dmc=1>. [Assessed 20 January 2016].
- The American College of Obstetricians and Gynecologists (ACOG). (2018). *Frequently Asked Questions. FAQ 156: How your fetus grows during pregnancy*. [Pdf, Online]. Available at: <file://ueahome4/stuext1/pth14nda/data/NTPProfile/Desktop/NAN%20work%20@UEA%20MAR%202018/REF%20fron%20Endnote/faq156.pdf>.

[Assessed 4 September 2018].

The American College of Sports Medicine (ACSM). (2014). *Exercise during pregnancy*.

[Pdf, Online]. Available at: <http://www.acsm.org/docs/current-comments/exerciseduringpregnancy.pdf>. [Assessed 15 October 2014].

The American College of Sports Medicine (ACSM). (2014). *ACSM's Guidelines for exercise testing and prescription*. (Ninth edition). USA: Lippincott Williams & Wilkins.

Andrew, S. & Halcomb, E. (Editor). (2009). *Mixed methods research for nursing and health sciences*. London: Blackwell.

Anney, V.N. (2014). Ensuring the Quality of the Findings of Qualitative Research: Looking at Trustworthiness Criteria. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS)*, 5(2), pp.272-281.

Araim, M., et al. (2010). What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC Medical Research Methodology*, 67(10), pp.1-7.
doi: 10.1186/1471-2288-10-67.

Arksey, H. & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), pp.19-32. [Online]. Available at:

<http://www.journalonline.tandf.co.uk/openurl.asp@?genre=article&eissn=14645300&volume=8&issue=1&spage=19>. [Assessed 25 July 2017].

Armijo-Olivo, S., Warren, S., & Magee, D. (2009). Intention to treat analysis, compliance, drop-outs and how to deal with missing data in clinical research: a review. *Physical Therapy Reviews*, 14(1), pp.36–49. doi: 10.1179/174328809x405928.

Armstrong, T. & Bull, F. (2006). Development of the World Health Organization Global Physical Activity Questionnaire (GPAQ). *Journal of Public Health*, 14(2), pp.66-70.

Armstrong, R., Hall, B.J., Doyle, J., & Waters, E. (2011). Cochrane update: 'Scoping the scope' of a Cochrane review. *Journal of Public Health*, 33(1), pp.147-150.
doi: 10.1093/pubmed/fdr015. [Pdf, Online]. Available at:
<http://academic.oup.com/jpubhealth/article-abstract/33/1/147/1549781>.

[Assessed 25 July 2017].

Artal, R., Toole, M.O., & White, S. (2003). Guidelines of the American College of Obstetrics and Gynecologists for exercise during pregnancy and the postpartum period/commentary. *British Journal of Sports Medicine*, 37(1), pp.6-12.

The Asia/Pacific Cultural Centre for UNESCO Japan (ACCU) & UNESCO Principal

- Regional Office for Asia and the Pacific (PROAP). (2001). *Handbook, Adult learning materials development as community level*. Japan: UNESCO and Asia/Pacific Cultural Centre for UNESCO.
- Avsar, A.F. & Keskin, H.L. (2010). Haemorrhoids during pregnancy. *Journal of Obstetrics and Gynaecology*, 30(3), pp.231-237.
- Baillie, L. (2015). Promoting and evaluating scientific rigour in qualitative research. *Nursing Standard*, 29(46), pp.36-42. doi: 10.7748/ns.29.46.36.e8830.
- Baker, C. & Phongpaichit, P. (2017). Early modern Siam as a mainly urban society. *Modern Asian Studies*, 51(2), pp.235-267. doi: 10.1017/S0026749X16000123.
- Bandholm, T., Christensen, R., Thorborg, k., et al. (2017). Preparing for what the reporting checklists will not tell you: the PREPARE Trial guide for planning clinical research to avoid research waste. *Br J Sports Med Published Online*. doi: 10.1136/bjsports-2017-097527.
- Bandura, A. (1997). Self-efficacy and health behaviour. In A. Baum, S. Newman, J. Wienman, R. West, & C. McManus (Editor), *Cambridge handbook of psychology, health and medicine*, pp.160-162. Cambridge: Cambridge University Press.
- Bang, S.W. & Lee, S.S. (2009). The factors affecting pregnancy outcomes in the second trimester pregnant women. *Nutrition Research and Practice*, 3(2), pp.134–140.
- Barakat, R., et al. (2014). A programme of exercise throughout pregnancy. Is it safe to mother and newborn?. *American Journal of Health Promotion*, 29(1), pp.1-8.
- Barbour, R.S. (2001). Checklists for improving rigour in qualitative research: a case of the tail wagging the dog? *BMJ*, 322(7294), pp.1115–1117. doi:10.1136/bmj.322.7294.1115.
- Bastable, S.B. (2007). Chapter 7: literacy in adult client population. In *Nurse as Educator*. (Third edition). United Kingdom: Jones and Bartlett Publishers International.
- Bartsch, E., Medcalf, K.E., Park, A.L., & Ray, J.G. (2016). High Risk of Pre-eclampsia Identification Group Clinical risk factors for pre-eclampsia determined in early pregnancy: systematic review and meta-analysis of large cohort studies. *BMJ*, 353, i1753. doi: 10.1136/bmj.i1753.
- Bauer, P.W., Broman, C.L., & Pivarnik, J.M. (2010). Exercise and pregnancy knowledge among healthcare providers. *Journal of Women's Health*, 19(2), pp.335-341. doi: 10.1089/jwh.2008.1295.
- Bazeley, P. (2004). Issue in mixing qualitative and quantitative approaches to research.

- In Buber, R., Gadner, J. & Richards, L. (Editor). *Applying qualitative methods to marketing management research*, pp.141-156. *United Kingdom (UK)*: Palgrave Macmillan.
- Bazyar, J., Daliri, S., Sayehmiri, K., Karimi, A., & Delpisheh, A. (2015). Assessing the relationship between maternal and neonatal factors and low birth weight in Iran; a systematic review and meta-analysis. *Journal of Medicine and Life*, 8(Special Issue 4), pp.23–31.
- Bennett, E.V., McEwen, C.E., larke, L.H., Tamminen, K.A., & Crocker, P.R.E. (2013). ‘It’s all about modifying your expectations’: women’s experiences with physical activity during pregnancy. *Research in Sport, Exercise and Health*, 5(2), pp.267-286. doi: 10.1080/2159676X.2013.766812.
- Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, 2(2016), pp.8-14.
- Billingham, S.A., Whitehead, A.L., & Julious, S.A. (2013). An audit of sample sizes for pilot and feasibility trials being undertaken in the United Kingdom registered in the United Kingdom Clinical Research Network database. *BMC Medical Research Methodology*, 13:104. doi: 10.1186/1471-2288-13-104.
- Birdsong, A., Byrd, M., Holcomb, H.N., Ticer, T.M., & Weatherspoon, D.L. (2014). Excessive Gestational weight gain: Long-term health risks. *International Journal of Childbirth Education*, 29(2), pp.51-57.
- Blum, J., Beaudoin, C., & Canton-Lemos, L. (2004). Physical activity and maternal well-being in postpartum women. *Maternal and Child Health Journal*, 8(3), pp.163–169. doi: 10.1023/B:MACI.0000037649.24025.2c.
- Borodulin, K., Evenson, K., Wen, F., Herring, A., & Benson, A. (2008). Physical activity patterns during pregnancy. *Medicine Science in Sports and exercise*, 40(11), pp.1901-1908. doi: 10.1249/MSS.0b013e31817f1957.
- Bowen, D.J. et al. (2009). How we design feasibility studies. *American Journal of Preventive Medicine*, 36(5), pp.452-457. doi: 10.1016/j.amepre.2009.02.002.
- Boyce, C. & Neale, P. (2006). Conducting in-depth interviews: a guide for designing and conducting in-depth interviews for evaluation input. *Pathfinder International Tool Series: Monitoring and evaluation-2*. USA: Pathfinder International.
- Boyd, A., et al. (2013). Cohort profile: The ‘Children of the 90s’ the index offspring of the AVON Longitudinal Study of Parents and Children. *International Journal of Epidemiology*, 42(1), pp.111-127.

- Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), pp.77-101. ISSN 1478-0887. Available at: <http://eprints.uwe.ac.uk/11735>. [Assessed 20 July 2015].
- Bredin, S.S., Foulds, H.J., Burr, J.F., & Charlesworth, S.A. (2013). Risk assessment for physical activity and exercise clearance: in pregnant women without contraindications. *The Official Publication of The College of Family Physicians of Canada*, 59(5), pp.515-517.
- Brislin R.W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), pp.185–216.
- Brown, A. & Avery, A. (2012). Healthy weight management during pregnancy: what advice and information is being provided. *Journal of Human Nutrition and Dietetics*, 25(4), pp.378-388.
- Browne, R.H. (1995). On the use of a pilot sample for sample size determination. *Statistics in Medicine*, 14(17), pp.1933– 1940.
- Burnard, P. & Naiyapatana, W. (2004). Culture and Communication in Thai Nursing: A Report of an Ethnographic Study. *International Journal of Nursing Studies*, 41(7), pp.755-765.
- Cameron, R. (2009). A sequential mixed model research design: design, analytical and display issues. *International Journal of Multiple Research Approaches*, 3(2), pp.140-152.
- Cameron, R. (2011). Mixed methods research: The five Ps framework. *The Electronic Journal of Business Research Methods*, 9(2), pp 96-108. [Online]. Available at: www.ejbrm.com. [Assessed 20 July 2015].
- Campbell, M., Vittal Katikireddi, S., Hoffmann, T., Armstrong, R., Waters, E., & Craig, P. (2018). TIDieR-PHP: a reporting guideline for population health and policy interventions. *BMJ*, 361(k1079). doi: 10.1136/bmj.k1079.
- Casagrande, J.B. (1954). The Ends of Translation. *International Journal of American Linguistics*, 20(4), pp.335-340. doi: 10.1086/464296.
- Caspersen, C.J., Powell, K.E., & Christenson, G.M. (1985). Physical activity, Exercise, and Physical fitness: definitions and Distinctions for health-related research. *Public Health Reports*, 100(2), pp.126-131.
- The Centers for Disease Control and Prevention (CDC). (2012). *Adults overweight and obesity*. [Online]. Available at: <http://www.cdc.gov/obesity/adult/causes/>.

[Assessed 15 March 2015].

The Centers for Disease Control and Prevention (CDC). (2014). *State Indicator Report on Physical Activity, 2014*. [Online]. Available at: file://ueahome4/stuext1/pth14nda/data/NTPProfile/Desktop/NAN%20work%20@UEA%20MAR%202018/REF%20fron%20Endnote/0716306905/pa_state_indicator_report_2014.pdf. [Assessed 15 March 2015].

The Central Intelligence Agency (CIA). (2015). *The World fact book, field listing: literacy*. [Online]. Available at: <https://www.cia.gov/library/publications/resources/the-world-factbook/fields/2103.html#139>. [Assessed 10 May 2016].

The Central Intelligence Agency (CIA). (2015). *The World fact book, East & Southeast Asia: Thailand*. [Online]. Available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/th.html>. [Assessed 10 May 2016].

Ceysens, G., Rouiller, D., & Boulvain, M. (2006). *Exercise for diabetic pregnant women (Review)*. [Pdf, Online]. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004225.pub2/pdf>. [Assessed 15 October 2014].

Chaipraditkul, N. (2013). Thailand: beauty and globalized self-identity through cosmetic therapy and skin lightening. *Ethics in Science and Environmental Politics*, 13(1), pp.27-37. doi: 10.3354/esep00134.

Cioffi, J., et al. (2010). Physical activity in pregnancy: women's perceptions, practice, and influencing factors. *Journal of Midwifery & Women's Health*, 55(5), pp.455-461. doi: 10.1016/j.jmwh.2009.12.003.

Clapp III, J.F. (2008). Long-term outcome after exercising throughout pregnancy: fitness and cardiovascular risk. *American Journal of Obstetrics and Gynecology (AJOG)*, 199(5): 489.e1-489.e6. doi: 10.1016/j.ajog.2008.05.006.

Claydon, L.S. (2015). Rigour in quantitative research. *Nursing Standard (Royal College of Nursing (Great Britain): 1987)*, 29(47), pp.43-48. doi: 10.7748/ns.29.47.43.e8820.

Clinical Research Network (CRN), National Institute for Health Research (NIHR). (2011). *A pocket guide to good clinical practice, including the declaration of Helsinki Version 2.1*. NIHR CRN Workforce Development. United Kingdom: Leeds.

Charlesworth, S., Foulds, H.J., Burr, J.F., Bredin, S.S. (2011). Evidence-based risk assessment and recommendations for physical activity clearance: pregnancy. *Applied Physiology, Nutrition, and Metabolism*, 36(S1), pp.S33-S48.

- Chasan-Taber, L., Schmidt, M.D., Roberts, D.E., Hosmer, D., Markenson, G., Freedson, P.S. (2004). Development and Validation of a Pregnancy Physical Activity Questionnaire. *Medicine and Science in Sports and Exercise*, 36(10), pp.1750-1760.
- Chinnawong, T. (2007). *The influences of Thai Buddhist culture on cultivating compassionate relationships with equanimity between nurses, patients and relatives: a grounded theory approach*. PhD thesis. Australia, New South Wales (NSW): Southern Cross University.
- Choosri, N., et al. (2016). ICT framework for collaboration healthcare services: A case study of Cleft Lip/Palate treatment network in northern Thailand. *10th International Conference on Software, Knowledge, Information Management & Applications (SKIMA)*. [Pdf, Online]. Available at: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7916204>. [Assessed 20 August 2017].
- Christ, T.W. (2013). The worldview matrix as a strategy when designing mixed methods research. *International Journal of Multiple Research Approaches*, 7(1), pp.110-118. doi: 10.5172/mra.2013.7.1.110.
- Chuenglertsiri, K. (2015). *Discourse on Thai women's Aesthetic*. Thesis of Bachelor degree of Fine Arts, Programme in Visual Arts, Department of Painting, The Faculty of Painting Sculpture and Graphic Arts. Bangkok: Silpakorn University, Thailand.
- Cojocar, S. (2010). Challenges in using Mix Methods in evaluation. *Editura Lumen, lasi*, 3(sept), pp.35-47. [Pdf, Online]. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.711.4611&rep=rep1&type=pdf>. [Assessed 20 August 2017].
- Cohen, T.R., Plourde, H., & Koski, K.G. (2010). Are Canadian women achieving a fit pregnancy? A pilot study. *Canadian Journal of Public Health*, 101(1), pp.87-91.
- Connolly, C.P., Feltz, D.L., & Pivarnik, J.M. (2014). Overcoming barriers to physical activity during pregnancy and the postpartum period: The potential impact of social support. *Kinesiology Review*, 3(2), pp.135-148.
- Cramp, A.G. & Bray, S.R. (2009). A prospective examination of exercise and barrier self-efficacy to engage in leisure-time physical activity during pregnancy. *Annals of Behavioural Medicine*, 37(3), pp.325-334.
- Crane, J.M., Murphy, P., Burrage, L., & Hutchens, D. (2013). Maternal and perinatal outcomes of extreme obesity in pregnancy. *Journal of Obstetrics and Gynaecology Canada*, 35(7), pp.606-611.

- Craven, K.L. & Hawks, S.R. (2006). Cultural and Western Influences on the Nutrition Transition in Thailand. *International Union for Health Promotion and Education*, 13(1), pp.14-20. [Pdf, Online]. Available at: <http://journals.sagepub.com/doi/pdf/10.1177/175797590601300102>. [Assessed 10 May 2016].
- The Critical Appraisal Skills Programme (CASP). (2017). *CASP 10 questions to help you make sense of qualitative research checklist*. [Pdf, Online]. Available at: <https://casp-uk.net/wp-content/uploads/2018/01/CASP-Qualitative-Checklist.pdf>. [Assessed 10 November 2017].
- Creswell, J.W. (2009). *Research design: qualitative, quantitative and mixed methods approaches*. (Third edition). Los Angeles: SAGE Publications.
- Creswell, J.W. & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research*. (Second edition). Los Angeles: SAGE Publications.
- Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. (Forth edition). Thousand Oaks, CA: SAGE Publications.
- Currie, S., Sinclair, M., Murphy, M.H., Madden, E., Dunwoody, L., & Liddle, D. (2013). *Reducing the decline in physical activity during pregnancy: A systematic review of behaviour change intervention*. [Pdf, Online]. Available at: <http://www.plosone.org/article/fetchObject.action?uri=info%3Adoi%2F10.1371%2Fjournal.pone.0066385&representation=PDF>. [Assessed 20 November 2014].
- Curry, L.A., Nembhard, I.M., & Bradley, E.H. (2009). Qualitative and mixed methods provide unique contributions to outcomes research. *Circulation*, 119(10), pp.1442-1452. doi: 10.1161/CIRCULATIONAHA.107.742775.
- Da Costa, D. & Ireland, K. (2013). Perceived benefits and barriers to leisure-time physical activity during pregnancy in previously inactive and active women. *Women and Health*, 53(2), pp.185-202.
- Danielsen, I. et al. (2013). Does physical activity during pregnancy adversely influence markers of the metabolic syndrome in adult offsprings? A prospective study over two decades. *Journal of Epidemiology Community Health*, 67(8), pp.648-654.
- Davies, G.A.L., Wolfe, L.A., Mottola, M.F. & MacKinnon, C. (2003). Exercise in pregnancy and the postpartum period. *Journal of Obstetrics and gynaecology Canada (JOGC)*, 25(6), pp.516-529.
- Davies, G.A.L., et al. (2010). SOGC clinical practice guideline No.239, February 2010:

- Obesity in pregnancy. *Journal of Obstetrics and Gynaecology Canada (JOGC)*, 110(2), pp.165-173.
- Davis, B. & Summers, M. (2015). *Applying Dale's Cone of Experience to increase learning and retention: A study of student learning in a foundational leadership course*. QScience Proceedings: Engineering Leaders Conference 2014. doi: 10.5339/qproc.2015.elc2014.6.
- De Lisle, J. (2011). The benefits and challenges of mixing methods and methodologies: Lessons learnt from implementing qualitatively led mixed methods research designs in Trinidad and Tobago. *Caribbean Curriculum*, 18, pp.87-120.
- Deierlein, A.L, Siega-Riz, A.M., & Evenson, K.R. (2012). Physical activity during pregnancy and risk of hyperglycemia. *Journal of Women's Health*, 21(7), pp.769-775.
- Deklava, L., Lubina, K., Circenis, K., Sudraba, V., & Millere, I. (2015). Causes of anxiety during pregnancy. *Procedia-Social and Behavioural Sciences*, 205(2015), pp.623-626.
- Denison, F.C., Norwood, P., Bhattacharya, S., Duffy, A., Mahmood, T., Morris, C., et al. (2014). Association between maternal body mass index during pregnancy, short-term morbidity, and increased health service costs: a population-based study. *BJOG: An International of Obstetrics and Gynaecology*, 121(1), pp.72–82. doi: [10.1111/1471-0528.12443](https://doi.org/10.1111/1471-0528.12443).
- The Department of Health (DoH), Thailand. (2014). *Annual action plan 2014*. Bangkok: Department of Health, Ministry of Public Health (MoPH), Thailand.
- Derbyshire, E., Davies, J., Costarelli, V., & Dettmar, P. (2006). Diet, Physical activity and the prevalence of constipation throughout and after pregnancy. *Maternal and Child Nutrition*, 2(3), pp.127-134.
- De Silva, D. (2011). *Helping people help themselves*. London: The Health Foundation. [Pdf, Online]. Available at: <https://www.health.org.uk/sites/health/files/HelpingPeopleHelpThemselves.pdf>. [Assessed 18 January 2017].
- De Silva, D. (2012). *Evidence: Helping people share decision making*. London: The Health Foundation. [Pdf, Online]. Available at: <https://www.health.org.uk/sites/health/files/HelpingPeopleShareDecisionMaking.pdf>. [Assessed 18 January 2017].
- De Silva, D. (2014). *Helping measure person-centred care*. London: The Health Foundation. [Pdf, Online]. Available at:

<https://www.health.org.uk/sites/health/files/HelpingMeasurePersonCentredCare.pdf>.

[Assessed 18 January 2017].

The Division of Physical Activity and Health, Thailand. (2009). *Manual for Global Physical Activity Surveillance among general population in Province by cross-sectional survey version 1.1 March 2009*. Nonthaburi: Department of Health, Ministry of Public Health (MoPH), Thailand.

Dhurup, M. (2012). A dimensional analysis of the benefits derived from physical activity participation among university students and variation in term of gender. *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*, 18(3), pp.614-627.

Dornan, L., et al. (2015). Thai cultural influences on breastfeeding behaviour. *Evidence Based Midwifery*, 13(3), pp.84-91.

Doustan, M., Seifourian, M., Zarghami, M., & Azmsha, T. (2012). Relationship between physical activity of mothers before and during pregnancy with the newborn health and pregnancy outcome. *Journal of Physical Education and Sport (JPES)*, 12(2), pp.222-229.

Doyle, J. (2014). Trends in global obesity. *International Journal of Childbirth Education*, 29(2), pp.16-20.

Duncombe, D., Wertheim, E.H., Skouteris, H., Paxton, S.J., & Kelly, L. (2009). Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery*, 25(4), pp.430-438.
doi: 10.1016/j.midw.2007.03.002.

Eckhardt, A.L. & DeVon, H.A. (2017). The MIXED framework: A novel approach to evaluating mixed- methods rigor. *Nursing Inquiry*, 24(4), e12189.
doi: 10.1111/nin.12189.

Efird J. (2011). Blocked randomization with randomly selected block sizes. *International Journal of Environmental Research and Public Health*, 8(1), pp.15-20.
doi: 10.3390/ijerph8010015.

Eldridge, S.M., Lancaster, G.A., Campbell, M.J., Thabane, L., Hopewell, S., Coleman, C.L., et al. (2016). Defining Feasibility and Pilot Studies in Preparation for Randomised Controlled Trials: Development of a Conceptual Framework. *PloS ONE*, 11(3), e0150205. doi:10.1371/journal.pone.0150205.

Eldridge, S.M., Chan, C.L., Campbell, M.J., Bond, C.M., Hopewell, S., Thabane, L., et al.

- (2010). CONSORT 2010 statement: extension to randomised pilot and feasibility trials. *BMJ*, 355, i5239. doi: 10.1136/bmj.i5239.
- Engberg, E., Alen, M., Kukkonen-Harjula, K., Peltonen, J.E., Tikkanen, H.O., & Pekkarinen, H. (2012). Life events and change in leisure time physical activity: a systematic review. *Sports Medicine*, 42(5), pp.433–47.
doi: 10.2165/11597610-000000000-00000.
- Entwistle, V.A., et al. (2018). “The more you know, the more you realise it is really challenging to do”: Tensions and uncertainties in person-centred support for people with long-term conditions. *Patient Education and Counselling*, 101(8), pp.1460-1467. [Online]. Available at:
<https://www.sciencedirect.com/science/article/pii/S0738399118301538?via%3Dihub>. [Assessed 25 October 2014].
- The Ethics Committee, Naresuan University, Thailand. (2014). *Preparation of standard operating procedures (SOPs), Naresuan University (NU-IRB 01/03)*. [Pdf, Online]. Available at: http://www.researchhuman.nu.ac.th/sop/SOPs_V3.0.pdf. [Assessed 10 June 2016].
- Evenson, K.R. & Bradley, C.B. (2010). Beliefs about exercise and physical activity among pregnant women. *Patient Education and Counselling*, 79(1), pp.124-129.
- Evenson, K.R., Savitz, D.A., & Huston, S.L. (2004). Leisure-time physical activity among pregnant women in the US. *Paediatric and Perinatal Epidemiology*, 18 (6), pp.400–407.
- Evenson, K.R., Moos, M.K., Carrier, K., & Siega-Riz, A.M. (2009). Perceived barriers to physical activity among pregnant women. *Maternal and Child Health Journal*, 13(3), pp.364-375.
- Evenson, K.R., Mottola, M.F., Owe, K.M., Rousham, E.K., & Brown, W.J. (2014). Summary of international guidelines for physical activity after pregnancy. *Obstetrical & Gynecological Survey*, 69(7), pp.407–414. doi: 10.1097/ogx.0000000000000077.
- Fan, Q., et al. (2015). The association between psychological stress and miscarriage: A systematic review and meta-analysis. *Scientific Reports*, 7(1), 1731.
doi: 10.1038/s41598-017-01792-3.
- Ferrara, A., Hedderson, M.M., Albright, C.L., Ehrlich, S.F., Quesenberry, C.P.Jr., Peng, T., Feng, J., Ching, J. & Crites, Y. (2011). A pregnancy and postpartum lifestyle intervention in women with gestational diabetes mellitus reduces diabetes risk factors: a feasibility randomized control trial. *Diabetes Care*, 34(7), pp.1519-1525.

doi: 10.2337/dc10-2221.

- Fetters, M.D., Curry, L.A., & Creswell, J.W. (2013). Achieving integration in mixed methods designs-principles and practices. *Health Services Research*, 48(6 Pt 2), pp.2134–2156. doi: 10.1111/1475-6773.12117.
- Field, T. (2011). Yoga clinical research review. *Complementary Therapies in Clinical Practice*, 17(1), pp.1-8.
- Field, T., et al. (2012). Yoga and massage therapy reduce prenatal depression and prematurity. *Journal of Bodywork and Movement Therapies*, 16(2), pp.204-209.
- Field, A. (2015). *Discovering Statistics Using IBM SPSS Statistics IBM book*. Thousand Oaks, CA: SAGE Publications.
- Fielding, N. (2010). Mixed methods research in the real world. *International Journal of Social Research Methodology*, 13(2), pp.127-138, doi: 10.1080/13645570902996186.
- Fieril, K.P., Olsen, M.F., Glantz, A., & Larsson, M. (2014). Experiences of exercise during pregnancy among women who perform regular resistance training: A qualitative study. *Physical Therapy*, 94(8). pp.1135-1143.
- Frankie, P. (2012). Obesity in pregnancy. *Practice Nurse*, 42(6), pp.32-37.
- Furber, C.M., McGowan, L., Bower, P., Kontopantelis, E., Quenby, S., & Lavender, T. (2013). Antenatal interventions for reducing weight in obese women for improving pregnancy outcome (Review). *The Cochrane Library, Issue 1*. [Pdf, Online]. Available at: <http://www.update-software.com/BCP/WileyPDF/EN/CD009334.pdf>. [Assessed 25 October 2014].
- Gaston, A., Cramp, A.G., & Prapavessis, H. (2012). Pregnancy-should women put up their feet or lace up their running shoes?: Self-presentation and the exercise stereotype phenomenon during pregnancy. *Journal of Sport and Exercise Psychology*, 34(2), pp.223-237.
- Gaston, A. & Cramp, A. (2011). Exercise during pregnancy: a review of patterns and determinants. *Journal of Science and Medicine in Sport*, 14(4), pp.299-305. doi: 10.1016/j.jsams.2011.02.006.
- Gaston, A., et al. (2013). Understanding physical activity behaviour and cognitions in pregnant women: An application of self-determination theory. *The Psychology of Sport and Exercise*, 14(3), pp. 405-412.
- Gatineau, M. & Mathrani, S. (2011). *Obesity and Ethnicity*. Oxford: National Obesity Observatory.

- Garbers, S. & Chiasson, M.A. (2013). Class III obesity and unwanted pregnancy among women with live birth in New York City, 2004-2007. *Maternal and Child Health Journal*, 17(8), pp.1459-1467.
- Giddings, L.S. & Grant, B.M. (2009). From rigour to trustworthiness: validating mixed methods. In Andrew, S., Halcomb, E.J. (Editor). *Mixed Methods Research for Nursing and the Health Sciences*, pp. 119–134. Oxford: Wiley-Blackwell.
- Gjestland, K., et al. (2012). Do pregnant women follow exercise guidelines? Prevalence data among 3482 women, and prediction of low-back pain, pelvic girdle pain and depression. *British Journal of Sports Medicine*, 47(8), pp.515-520.
- Golden, S.D. & Earp, J.A. (2012). Social ecological approaches to individuals and their contexts: twenty years of health education & behaviour health promotion interventions. *Health Education & Behaviour*, 39(3), pp.364-372. doi: 10.1177/1090198111418634.
- Grace, S.L., Williams, A., Stewart, D.E., & Franche, R.L. (2006). Health-promoting behaviours through pregnancy, maternity leave, and return to work: Effects of role spill over and other correlates. *Women & Health*, 43(2), pp.51–72.
- Groth, S.W. & Morrison-Beedy, D. (2013). Low-income, pregnant, African American women's views on physical activity and diet. *Journal of Midwifery & Women's Health*, 58(2), pp.15-202. doi: 10.1111/j.1542-2011.2012.00203.x.
- Guelinckx, I., Devlieger, R., Mullie, P., & Vansant, G. (2010). Effect of lifestyle intervention on dietary habits, physical activity, and gestational weight gain in obese pregnant women: a randomized controlled trial. *The American Journal of Clinical Nutrition*, 91(2), pp.373-380. doi: 10.3945/ajcn.2009.28166.
- Guelfi, K.J., et al. (2015). A comparison of beliefs about exercise during pregnancy between Chinese and Australian pregnant women. *BMC Pregnancy and Childbirth*, 15: 345. doi: 10.1186/s12884-015-0734-6.
- Guendelman, S., et al. (2013). Association between preterm delivery and pre-pregnancy body mass (BMI), exercise and sleep during pregnancy among working women in Southern California. *Maternal and Child Health Journal*, 17(4), pp.723-731.
- Gupta, S.K. (2011). Intention-to-treat concept: a review. *Perspective in Clinical Research*, 2(3), pp.109–112. doi: [10.4103/2229-3485.83221](https://doi.org/10.4103/2229-3485.83221).
- Guszkowska, M., Langwald, M., & Sempolska, K. (2013). Influence of a relaxation session and an exercise class on emotional states in pregnant women. *Journal of Reproductive and Infant Psychology*, 31(2), pp.121-133.

- Guszkowska, M., Sempolska, K., Zaremba, A., & Langwald, M. (2013). Exercise or relaxation? which is more effective in improving the emotional state of pregnant women?. *Human Movement*, 14(2), pp.168-174.
- Haakstad, L.A.H., et al. (2009). Why do pregnant women stop exercising in the third trimester?. *Acta Obstetrica et Gynecologica Scandinavica*, 88(11), pp.1267-1275.
- Halcomb, E. & Hickman, L. (2015). Mixed methods research. *Nursing Standard*. 29(32), pp.41-47.
- Han, S., Middleton, P., & Crowther, C.A. (2012). *Exercise for pregnant women for preventing gestational diabetes mellitus (Review)*. [Pdf, Online]. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009021.pub2/pdf>. [Assessed 15 October 2014].
- Hawkins, M., et al. (2014). Impact of an Exercise Intervention on Physical Activity During Pregnancy: The Behaviors Affecting Baby and You Study. *American Journal of Public Health*, 104(10), pp.e74-e81.
- Hawks, S.R., et al. (2004). Intuitive eating and the nutrition transition in Asia. *Asia Pacific Journal of Clinical Nutrition*, 13(2), pp.194-203.
- Hatim, B.A. & Munday, J. (2004). *Translation: An advanced resource book*. London: Taylor & Francis.
- Hay-Smith, E.J.C. (2013). Maternity exercise 75 years on: what has changed and what does experimental evidence tell us. *New Zealand Journal of Physiotherapy*, 41(1), pp.16-19.
- He, W., et al. (2013). Greater abdominal fat accumulation is associated with higher metabolic risk in Chinese than in White people: an Ethnicity study. Ethnicity, Fat and Fat Distribution, Metabolic Risk. *PLOS ONE*, 8(3), e58688.
- The Health Foundation. (2008). *Briefing May 2008: co-creating health*. London: The Health Foundation. [Pdf, Online]. Available at: <https://www.whittington.nhs.uk/document.ashx?id=1428>. [Assessed 15 June 2015].
- The Health Foundation. (2014). *Person-centred care made simple*. London: The Health Foundation. [Pdf, Online]. Available at: <https://www.health.org.uk/sites/health/files/PersonCentredCareMadeSimple.pdf>. [Assessed 18 June 2017].
- The Health Research Authority (HRA). (2014). Consent and participant information sheet

preparation guidance. [Pdf, Online]. Available at: <http://www.hra-decisiontools.org.uk/consent/docs/Consent%20and%20PIS%20Guidance%20Mar3rd2014.pdf>. [Assessed 10 October 2015].

- The Health and Social Care Information Centre, United Kingdom (UK). (2014). *Health Survey for England 2013: Health, social care and lifestyles Summary of key findings*. United Kingdom: The Health and Social Care Information Centre.
- Hegaard, H.K., Damm, P., Hedegaard, M., Henriksen, T.B., Ottesen, B., Dykes, A- K., et al. (2011). Sports and leisure time physical activity during pregnancy in nulliparous women. *Maternal and Child Health Journal*, 15(6), pp.806-813. doi: [10.1007/s10995-010-0647-y](https://doi.org/10.1007/s10995-010-0647-y).
- Herrmann, S.D., Heumann, K.J., Der Ananian, C.A., & Ainsworth, B.E. (2013). Validity and Reliability of the Global Physical Activity Questionnaire (GPAQ). *Measurement in Physical Education and Exercise Science*, 17(3), pp.221-235. doi: [10.1080/1091367X.2013.805139](https://doi.org/10.1080/1091367X.2013.805139).
- Hertzog, M.A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing and Health*, 31(2), pp.180-191. doi: [10.1002/nur.20247](https://doi.org/10.1002/nur.20247).
- Heslehurst, N., et al. (2008). The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a metaanalysis. *Obesity Reviews*, 9(6), pp.635-683.
- Hollis, S. & Campbell, F. (1999). What is meant by intention to treat analysis? Survey of published randomised controlled trails. *BMJ*, 319, pp.670-674. doi: <http://dx.doi.org/10.1136/bmj.319.7211.670>
- Holloway, I., Wheeler, S., & Holloway, I. (2010). *Qualitative research in nursing and healthcare*: Chichester. (Third edition). Wiley-Blackwell, 2010.
- Horak, T.A. & Osman, A. (2012). Exercise in pregnancy. *American Obstetrics and Gynaecology Forum*, 22(4), pp.13-16.
- House, J. S. (1981). *Work Stress and Social Support*. Reading, Mass: Addison-Wesley.
- Huisman, C.M., Zwart, J.J., Roos-Hesselink, J.W., Duvekot. J.J., & van Roosmalen, J. (2013). Incidence and predictors of maternal cardiovascular mortality and severe morbidity in the Netherlands: a prospective cohort study. *Plos One*, 8(2), e56494.
- Huynen, M.M., Martens, P., & Hilderink, H.B. (2005). The health impacts of globalization: a conceptual framework. *Global Health*, 1:14. doi: [10.1186/1744-8603-1-14](https://doi.org/10.1186/1744-8603-1-14).
- IBM Corp. (Released 2016). *IBM SPSS Statistics for Windows, Version 24.0*. Armonk, NY: IBM Corp.

- Im, E.O., Page, R., Lin, L.C., Tsai, H.M., & Cheng, C.Y. (2004). Rigor in cross-cultural nursing research. *International Journal of Nursing Studies*, 41(8), pp.891-899.
- The Institute of Medicine (IOM) (US) and National Research Council (US). (2009). Committee to Reexamine IOM Pregnancy Weight Guidelines. In Rasmussen, K.M., Yaktine, A.L. (Editor). *Weight gain during pregnancy: Reexamining the Guidelines*. Washington (DC): National Academies Press (US).
- Ireland, B. (2006). Pregnancy-induced constipation. *Professional Nursing Today*, 10(3), pp.58-60.
- Isaranurug, S., Mo-suwan, L., & Choprapawon, C. (2007). A population based cohort study of effect of maternal risk factors on low birth weight in Thailand. *Journal of the Medical Association of Thailand*, 90(12), pp.2559–2564.
- Jadad, A. R. & Enkin, M. W. (2007). Bias in Randomized Controlled Trials, in *Randomized Controlled Trials: Questions, Answers, and Musings*. (Second edition). UK: Blackwell Publishing Ltd. doi: 10.1002/9780470691922.ch3.
- Jenkins, C., et al. (2006). Exercise barriers faced by first-time mothers. *The New Zealand College of Midwives Journal*, 35(1), pp.6-11.
- Jiang, H., et al. (2012). Can physical activity reduce excessive gestational weight gain? Findings from a Chinese urban pregnant women cohort study. *International Journal of Behavioural Nutrition and Physical Activity*, 9(1), pp.12-18.
- Jitnarin, N., et al. (2011). Prevalence of overweight and obesity in Thai population: Results of the National Thai Food Consumption Survey. *Eating and Weight Disorders Journal*, 16(4), pp.e242-e249.
- Johnson, J.K., Barach, P., Vemooij-Dasses, M. on behalf of the HANDOVER Research Collaboration. (2012). Conducting a multicentre and multinational qualitative study on patient transitions. *BMJ Quality Safety*, 21: pp.i22-i28. doi: 10.1136/bmjqs-2012-001197.
- Johnson, R.B. & Onwuegbuzie, A.J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), pp.14-26. doi:10.3102/0013189X033007014.
- Johnson, R. B., Onwuegbuzie, A.J. & Turner, L.A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), pp.112-133. doi:10.1177/1558689806298224.
- Jones, P.S., Lee, J.W., Philips, L.R., Zhang, X., & Jaceldo, K. (2001). An adaptation of Brislin's translation model for cross-cultural research. *Nursing Research*, 50(5),

- pp.300–304. doi: 10.1097/00006199-200109000-00008.
- Jones, J., Housman, J., & McAleese, W. (2010). Exercise, nutrition, and weight management during pregnancy. *American Journal of Health Studies*, 25(3), pp.120-128.
- Jones, R. (2003). *Culture smart: Thailand*. London: Kuperard.
- Jongudomsuk, P., et al. (2015). The Kingdom of Thailand health system review. *Health Systems in Transition*, 5(5). [Online]. Available at: http://iris.wpro.who.int/bitstream/handle/10665.1/11359/9789290617136_eng.pdf. [Assessed 17 May 2016].
- Kader, M. & Naim-Shuchana, S. (2014). Physical activity and exercise during pregnancy. *European Journal of Physiotherapy*, 16(1), pp.2-9.
- Kawabata, I., et al. (2012). The effect of regular exercise training during pregnancy on postpartum brachial-ankle pulse wave velocity, a measure of arterial stiffness. *Journal of Sports Science and Medicine*, 11(3), pp.489-494.
- Keeley, A., Gunning, M., & Denison, F. (2011). Maternal obesity in pregnancy: Women's understanding of risks. *British Journal of Midwifery*, 19(6), pp.364-369.
- Khan, M. E. & Manderson, L. (1992). Focus groups in tropical diseases research. *Health Policy and Planning*, 7(1), pp.56-66.
- Kihlstrand, M., Stenman, B., Nilsson, S., & Axelsson, O. (1999). Water-gymnastics reduced the intensity of back/low back pain in pregnant women. *Acta Obstetricia et Gynecologica Scandinavica*, 78(3), pp.180-185.
- Kim, M. & Lennon, S. (2008). The effects of visual and verbal information on attitudes and purchase intentions in internet shopping. *Psychology and Marketing*, 25(2), pp.146-178. doi: 10.1002/mar.20204.
- King, L.J. (2008). Collaboration in Public Health: a new global imperative. *Public Health Reports*, 123(3), pp.264-265.
- Knight, M., Nair, M., Tuffnell, D., Kenyon, S., Shakespeare, J., Brocklehurst, P., Kurinczuk, J.J. (Eds.) on behalf of MBRRACE-UK. (2016). *Saving Lives, Improving Mothers' Care - Surveillance of maternal deaths in the UK 2012-14 and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009-14*. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2016.
- Kongprasert, N. & Virutamasen, P. (2015). Tourist perceptions to cultural identity: The case of Thai experience. *Procedia: Social and Behavioural Sciences*, 195(1), pp.167-174. doi: 10.1016/j.sbspro.2015.06.428.

- Kordi, R., et al. (2013). Comparison between the effect of lumbopelvic belt and home based pelvic stabilizing exercise on pregnant women with pelvic girdle pain; a randomized controlled trial. *Journal of Back and Musculoskeletal Rehabilitation*, 26(2), pp.133-139.
- Kramer, M.S. (2003). Aerobic exercise for women during pregnancy. *Birth*, 30(4), pp.278-279.
- Kramer, M.S. & McDonald, S.W. (2006). *Aerobic exercise for women during pregnancy (Review)*. [Pdf, Online]. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000180.pub2/pdf>. [Assessed 15 October 2014].
- Krans, E.E. & Chang, J.C. (2011). A will without a way: barriers and facilitators to exercise during pregnancy of low-income, African American Women. *Women and Health*, 51(8), pp.777-794.
- Krans, E.E. & Chang, J.C. (2012). Low-income African American women's beliefs regarding exercise during pregnancy. *Maternal and Child Health Journal*, 16(6), pp.1180-1187.
- Krishna, A., Lazarus, D., & Dhaka, S. (2013). Co-creation channel: A concept for paradigm shift in value creation. *Journal of Management*, 1(1), pp.14-21.
- Kujitjuewong, S. (2012). LINE-Communicating format on the creativity of Smartphone: Benefits and limits of application. *Executive Journal*, 33(4), pp.42-54.
- Lalley, J.P. & Miller, R.H. (2007). The learning pyramid: does it point teachers in the right direction? *Education*, 128(1), pp. 64-79.
- Lancaster, C.A., Gold, K.J., Flynn, H.A., Yoo, H., Marcus, S.M., & Davis, M.M. (2010). Risk factors for depressive symptoms during pregnancy: a systematic review. *American Journal of Obstetrics and Gynecology*, 202(1), pp.5-14. doi: 10.1016/j.ajog.2009.09.007.
- Lancaster, G.A., Dodd, S., & Williamson, P.R. (2004). Design and analysis of pilot studies: recommendations for good practice. *Journal of Evaluation in Clinical Practice*, 10(12), pp.307-312.
- Leddy, M.A., Power, M.L., & Schulkin, J. (2008). The impact of maternal obesity on maternal and fetal health. *Reviews in Obstetrics and Gynecology*, 1(4), pp.170-178.
- Lee, C.C., Li, D., Arai, S., & Puntillo, K. (2009). Ensuring cross-cultural equivalence in translation of research consents and clinical documents: A systematic process for translating English to Chinese. *Journal of Transcultural Nursing*, 20(1), pp.77-82.
- Lee, K., Yach, D., & Kamradt-Scott, A. (2011). Chapter 18: Globalization and Health. In

- Merson, M., Black, R. and Mills, A. (Editor). *Global Public Health: Diseases, Programs, Systems and Policies*. (Third edition). New York: Jones & Bartlett: pp.885-913.
- Leiferman, J., et al. (2011). My baby, My move: Examination of perceived barriers and motivating factors related to antenatal physical activity. *Journal of Midwifery & Women's Health*, 56(1), pp.33-40.
- Leventon, M. & Gluckman, C.D. (2013). Modernity Through the Lens: The Westernization of Thai Women's Court Dress. *Costume*, 47(2), pp.216-233.
doi: 10.1179/0590887613Z.00000000025.
- Liabsuetrakul, T., for Southern Soil-transmitted Helminths and Maternal Health Working Group. (2011). Is international or Asian criteria-based body mass index associated with maternal anaemia, low birthweight, and preterm births among Thai population?- An observational study. *Journal of Health, Population, and Nutrition*, 29(3), pp.218-28.
- Liamputtong, P., et al. (2005). Traditional beliefs about pregnancy and child birth among women from Chiang Mai, Northern, Thailand. *Midwifery Journal*, 21(1), pp.139-153.
doi: 10.1016/j.midw.2004.05.002.
- The Literacy foundation. (2014). *Literacy foundation: surveys and statistics*. [Online]. Available at: <https://www.fondationalphabetisation.org/en/foundation/causes-of-illiteracy/surveys-and-statistics/>. [Assessed 17 May 2016].
- The Literacy foundation. (2016). *Literacy foundation: causes and consequences of illiteracy*. [Online]. Available at: <https://www.fondationalphabetisation.org/en/foundation/causes-of-illiteracy/consequences-of-illiteracy/>. [Assessed 17 May 2016].
- Liu, J., Blair, S. N., Teng, Y., Ness, A.R., Lawlor, D.A., & Riddoch, C. (2011). Physical activity during pregnancy in a prospective cohort of British women: Results From The Avon Longitudinal Study of Parents and Children. *European Journal of Epidemiology*, 26(3), pp.237-247. doi: 10.1007/s10654-010-9538-1.
- Levac, D., Colquhoun, H., & O'Brien. (2010). Scoping studies: advancing the methodology. *Implementation Science*, 5(1): 69. [Pdf, Online]. Available at: <http://www.implementationscience.com/content/5/1/69>. [Assessed 25 July 2017].
- L-Y. Lim, L., et al. (2009). Associations between urbanization and components of the health-risk transition in Thailand. A descriptive study of 87,000 Thai adults.

- Global Health Action*, 2(1). doi: [10.3402/gha.v2i0.1914](https://doi.org/10.3402/gha.v2i0.1914).
- Magann, E.F., Evans, S.F., Weitz, B., & Newnham, J. (2002). Antepartum, intrapartum, and neonatal significance of exercise on healthy low-risk pregnant working women. *Obstetrics and Gynecology*, 99(3), pp.466–472.
- Maher, S. & Duley, L. (2006). *Exercise or other physical activity for preventing pre-eclampsia and its complications (Review)*. [Pdf, Online]. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005942/pdf>. [Assessed 15 October 2014].
- Mahmood, T. & Arulkumaran, S. (Editor). (2013). *Obesity: A ticking time bomb for reproductive health*. (First edition). USA: Elsevier Inc.
- Makinde, O., Adeyemo, F., & Ogeunle, B. (2014). Perception of pregnant mothers attending antenatal clinic on usefulness of prenatal exercise in Osogbo, Osun state, Nigeria. *Health Science Journal*, 8(2), pp.229-239.
- Mamun, A.A., Callaway, L.K., O’Callaghan, M.J., et al. (2011). Associations of maternal pre-pregnancy obesity and excess pregnancy weight gains with adverse pregnancy outcomes and length of hospital stay. *BMC Pregnancy and Childbirth*, 11(62). doi: 10.1186/1471-2393-11-62.
- Maneesriwongkul, W. & Dixon, J. K. (2004). Instrument translation process: a methods Review. *Methodological Issues in Nursing Research*, 48(2), pp.175-186.
- Marquez, D.X., et al. (2009). Perspectives of Latina and Non-Latina White women on barriers and facilitators to exercise in pregnancy. *Women Health*, 49(6), pp.505-521.
- Marchi, J., Berg, M., Dencker, A., Olander, E.K., & Begley, C. (2015). Risk associated with obesity in pregnancy, for the mother and baby: a systematic review of reviews. *Obesity Reviews*, 16, pp.621-638. doi: 10.1111/obr.12288.
- Marshall, E.S., Bland, H., & Melton, B. (2013). Perceived barriers to physical activity among pregnant women living in a rural community. *Public Health Nursing*, 30(4), pp.361-369.
- Martin, J. S, Duxbury, A.M.S., & Soltani, H. (2014). An overview of evidence on diet and physical activity based interventions for gestational weight management. *Evidence Based Midwifery*, 12(2), pp.40-45.
- May, L.E., Suminski, R.R., Linklater, E.R., Jahnke, S., et al. (2013). Exercise during pregnancy: the role of obstetric providers. *The Journal of the American Osteopathic Association*, 113(8), pp.612–619. doi: 10.7556/jaoa.2013.022.
- McCall, S., Nair, M., Knight, M. (2016). Factors associated with maternal mortality at

- advanced maternal age: a population-based case-control study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 124(8), pp.1225–1233. doi: 10.1111/1471-0528.14216.
- Melton, B., Marshall, E., Bland, H., Schmidt, M., & Guion, W.K. (2013). American rural women's exercise self-efficacy and awareness of exercise benefits and safety during pregnancy. *Nursing and Health Sciences*, 15(4), pp.468-473. doi: 10.1111/nhs.12057.
- Melzer, K., Schutz, Y., Boulvain, M., & Kayser, B. (2010). Physical activity and Pregnancy. *Sports Medicine*, 40(6), pp.493-507.
- Mendez, M.A. & Popkin, B.M. (2004). Globalization, urbanization and nutritional change in the developing world. *The Electronic Journal of Agricultural and Development Economics*, 1(2), pp.220-241.
- Mercer, R.T. (2004). Becoming a mother versus maternal role attainment. *Journal of Nursing Scholarship*, 36(3), pp.226–232.
- Merkx, A., Ausems, M., Bude, L., De Vries, R., & Nieuwenhuijze, M.J. (2017). Factors affecting perceived change in physical activity in pregnancy. *Midwifery*, 51, pp.16.-23. doi: 10.1016/j.midw.2017.05.007.
- Metgud, C.S., Naik, V.A., & Mallapur, M.D. (2012). Factors Affecting Birth Weight of a newborn - A community Based Study in Rural Karnataka, India. *PLoS One*, 7(7), e40040. doi: 10.1371/journal.pone.0040040.
- Mikami, Y., Takagi, K., Itaya, Y., Ono, Y., Matsumura, H., Takai, Y., & Seki, H. (2014). Post-partum recovery course in patients with gestational hypertension and pre-eclampsia. *The Journal of Obstetrics and Gynaecology Research*, 40(4), pp.919–925. doi: 10.1111/jog.12280.
- Millard, L.A.C, Lawlor, D.A, Fraser, A., & Hiowe, L.D. (2013). *Physical activity during pregnancy and offspring cardiovascular risk factors: finding from a prospective cohort study*. [Pdf, Online]. Available at: <http://bmjopen.bmj.com/content/3/9/e003574.full.pdf+html>. [Assessed 7 November 2014].
- The Ministry of Public Health (MoPH), Thailand. (2010). *The implementation of strategic issues for solving the problem of obesity in Thailand in 2010*. Thailand: Bureau of Nutrition, Ministry of Public Health (MoPH).
- The Ministry of Public Health, Thailand (MoPH). (2012). *Maternal and child health handbook*. Thailand: Bureau of Health Promotion, Department of Health, Ministry of Public Health (MoPH).

- The Ministry of Public Health (MoPH), Thailand. (2013). *Statistics Thailand 2013*. [Pdf, Online]. Available at: http://www.hiso.or.th/hiso/picture/reportHealth/ThaiHealth2009/thai2009_3.pdf. [Assessed 16 August 2014].
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., the PRISMA Group. (2008). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *PLoS Medicine*, 6(7), e1000097. doi: 10.1371/journal.pmed.1000097.
- Molina-Azorin, J. & Cameron, R.A. (2010). The application of mixed methods in organisational research: a literature review. *Electronic Journal of Business Research Methods*, 8(2), pp.95-105.
- Molyneaux, E., Pasupathy, D., Kenny, L. C., McCowan, L. M., North, R.A., Dekker, G.A., et al. (2016). Socio-economic status influences the relationship between obesity and antenatal depression: data from a prospective cohort study. *Journal of Affective Disorders*, 202(2016), pp.124–127. doi: 10.1016/j.jad.2016.05.061.
- Montori, V. M. & Guyatt, G. H. (2001). Intention-to-treat principle. *Canadian Medical Association Journal*, 165(10), pp.1339–1341.
- Montgomery, K.S., et al. (2012). Men’s perceptions of pregnancy-related weight gain: a psychological firestorm (upheaval) intertwined with supportive intentions. *The Journal of Perinatal Education*, 21(4), pp.219-228.
- Mottola, M.F. (2013). Physical activity and maternal obesity: cardiovascular adaptations, exercise recommendations, and pregnancy outcomes. *Nutrition Reviews*, 71(1), pp.s31-s36.
- Morley, L. & Cashell, A. (2017). Collaboration in Health Care. *Journal of Medical Imaging and Radiation Sciences*, 48(2017), pp.207-216. doi: 10.1016/j.jmir.2017.02.071.
- Mornsang, I. (2009). *Effect of self-efficacy enhancement programme on exercise behaviour among pregnant women*. Thesis of Master degree in Nursing Science (Advanced Midwifery). Chiang Mai: Graduate School, Chiang Mai University, Thailand.
- Mudd, L.M., Nechuta, S., Pivarnik, J.M., et al. (2009). Factors associated with women's perceptions of physical activity safety during pregnancy. *Preventive Medicine*, 49(2–3), pp.194–199.
- Mudd, L.M., Owe, K.M., Mottola, M.F., & Pivarnik, J.M. (2013). Health benefits of physical activity during pregnancy: An international perspective. *Journal of the American College of Sports Medicine*, 45(2), pp.268-277.

- Mulley, A.G., Trimble, C., & Elwyn, G. (2012). Stop the silent misdiagnosis: patient preferences matter. *BMJ*, 345, e6572. doi: <https://doi.org/10.1136/bmj.e6572>.
- Mullock, J. & Leigh-Pollitt, P. (2005). *The Data Protection Act 1998*. Chapter 29 (reprinted incorporating corrections). [Pdf, Online]. Available at: http://www.legislation.gov.uk/ukpga/1998/29/pdfs/ukpga_19980029_en.pdf. [Assessed 16 January 2016].
- Muktabhant, B., Lumbiganon, P., Ngamjarus, C., & Dowswell, T. (2012). *Interventions for preventing excessive weight gain during pregnancy (Review)*. [Pdf, Online]. Available at: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007145.pub2/pdf>. [Assessed 15 October 2014].
- Muncey, T. (2009). Chapter 2: Does mixed methods constitute a change in paradigm. In Andrew, S. & Halcomb, E. (Editor). (2009). *Mixed methods research for nursing and health sciences*. London: Blackwell.
- Muzigaba, M., Kolbe-Alexander, T.L., & Wong, F. (2014). The perceived role and influencers of physical activity among pregnant women from low socioeconomic status communities in South Africa. *Journal of Physical Activity and Health*, 11(7), pp.1276-1283.
- Nakhon Sawan provincial statistical office, Thailand. (2014). *Nakhon Sawan Provincial statistical report: 2014*. Nakhon Sawan: Nakhon Sawan provincial statistical office.
- Nakhon Sawan provincial statistical office, Thailand. (2017). *Nakhon Sawan Provincial statistical report: 2017*. Nakhon Sawan: Nakhon Sawan provincial statistical office.
- Nascimento, S.L., Surita, F.G., & Cecatti, J.G. (2012). Physical exercise during pregnancy: a systematic review. *Current Opinion in Obstetrics & Gynecology*, 24(6), pp.387–394.
- Nascimento, S.L., Surita, F.G., Godoy, A.C., Kasawara, K.T., & Morais, S.S. (2015). Physical activity patterns and factors related to exercise during pregnancy: a cross sectional study. *PLoS One*, 10(6), e0128953. doi: 10.1371/journal.pone.0128953.
- The National Economic and Social Development Board, Thailand. (2011). *Summary the Eleventh National Economic and Social Development Plan 2012-2016*. Bangkok: Office of the Prime Minister, Thailand.
- The National Health Development Plan Committee (NHDPC), Thailand. (2011). *National Health Development Plan in period of the Eleventh National Economic and Social Development Plan 2012-2016*. Bangkok: Department of Health, Ministry of Public Health (MoPH), Thailand.

- The National Heart Foundation of Australia. (2015). *Level of exercise statistics*. [Online]. Available at: <https://www.heartfoundation.org.au/about-us/what-we-do/heart-disease-in-australia/level-of-exercise-statistics>. [Assessed 18 August 2017].
- The National Maternity Review. (2016). *BETTER BIRTHS, Improving outcomes of maternity services in England*. [Pdf, online] Available at: <https://www.england.nhs.uk/wp-content/uploads/2016/02/national-maternity-review-report.pdf>. [Assessed 21 August 2017].
- The National Statistical Office (NSO), Thailand. (2011). *Statistical year book Thailand 2011*. Thailand: National Statistical Office, Ministry of Information and Communication Technology.
- The National Statistical Office (NSO), Thailand. (2012). *Executive summary: The 2011 Survey on Population Behaviour in Playing Sport or Physical Exercising and Mental Health*. Thailand: National Statistical Office, Ministry of Information and Communication Technology. [Pdf, Online]. Available at: http://web.nso.go.th/en/survey/data_survey/570225_Executivesummaryexerciset.pdf. [Assessed 18 August 2014].
- The National Statistical Office (NSO), Thailand. (2015). *The 2015 Physical Activity Survey*. Thailand: National Statistical Office, Ministry of Information and Communication Technology. [Pdf, Online]. Available at: http://web.nso.go.th/en/survey/excerc/data/Full_Report_excercise_15.pdf. [Assessed 18 August 2014].
- The National Statistical Office (NSO), Thailand. (2016). *Statistical year book Thailand 2016*. Thailand: National Statistical Office, Ministry of Information and Communication Technology.
- The National Statistical Office (NSO), Thailand. (2017). *Summary of the labor force survey in Thailand: January 2017*. Thailand: National Statistical Office, Ministry of Information and Communication Technology.
- The National Institute of Development Administration (NIDA). (2010). *Thais' quality of life in Year 2010*. [Pdf, Online]. Available at: <http://rc.nida.ac.th/en/attachments/article/120%202553.pdf>. [Assessed 18 August 2014].
- Naratpattanasai, K. (2002). *Exploring the many dimensions of 'kreng jai'*. [Pdf, Online]. Available at: http://www.geocities.com/econ_10330/kreng_jai.html. [Assessed 20 December 2017].

- Newmark, P. (1995). *Paragraphs on translation*. Clevedon/Philadelphia/Adelaide: Multilingual Matters Ltd.
- Ngamvichaikit, A. (2015). Mixed methods approach: Qualitative and quantitative research design. *Modern Management Journal*, 13(1), pp.1-12.
- Ng, M., et al, (2014). Global, regional and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 384(9945), pp.766-781.
doi: 10.1016/S0140-6736(14)60460-8.
- The NHS Information Centre, Lifestyles Statistics, United Kingdom (UK). (2011). *Statistics on obesity, physical activity and diet: England, 2011*. United Kingdom: The Health and Social care Information Centre, Lifestyles Statistics.
- Ning, Y., Williams, M.A., Dempsey, J.C., Sorensen, T.K., Frederick, I.O., & Luthy, D.A. (2003). Correlates of recreational physical activity in early pregnancy. *Journal of Maternal-Fetal & Neonatal Medicine*, 13(6), pp.385–393.
- Noble, H. & Smith, J. (2018). Reviewing the literature: Choosing a review design. *Evidence Based Nursing*, 0(0). [Online]. Available at: <https://ebn.bmj.com/>. [Assessed 10 September 2018].
- Nordberg, C. (2010). *Exploring the text free interface for illiterate users: Designing an icon-based prototype for mobile phones*. Norway: Department of Information Science and Media Studies University of Bergen.
- The Non-formal and Informal Education (NFE), Thailand. (2016). *Survey literacy rate*. [Online]. Available at: http://202.29.172.133/DMIS/surveytumbol/summary_illi.php. [Assessed 10 May 2016].
- Ogden, C.L., et al. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *Journal of the American Medical Association (JAMA)*, 311(8), pp.806-814.
- Onwuegbuzie, A.J. & Johnson, R.B. (2006). The validity issue in mixed research. *Research in the Schools*, 13(1), pp.48–63.
- Osman, A., Subhani, M.I., & Hasan, S.A. (2013). Asian ascendancy: media in the age of globalization. *SpringerPlus*, 2(2): 646. doi: 10.1186/2193-1801-2-646.
- Ouzounian, J.G. & Elkayam, U. (2012). Physiologic changes during normal pregnancy and delivery. *Cardiology Clinics*, 30(3), pp.317–329. doi: 10.1016/j.ccl.2012.05.004.
- Özdemir, A. (2015). Maternal obesity and public health. *International Journal of Caring Sciences*, 8(1), pp.217-220.

- Palaganas, E.C., Sanchez, M.C., Molintas, M.P., & Caricativo, R.D. (2017). Reflexivity in Qualitative Research: A Journal of Learning. *The Qualitative Report*, 22(2), pp.426-438.
- Pantaewan, P. & Prasittivatechakod, A. (2014). Application of Transtheoretical Model and smoking behaviour modification. *Journal of The Royal Thai Army Nurses*, 15(1), pp.36-44.
- Papachatz, E., Dimitriou, G., Dimitropoulos, K., & Vantarakis A. (2013). Pre-pregnancy obesity: maternal, neonatal and childhood outcomes. *Journal of Neonatal Perinatal Medicine*, 6(3), pp.203–216. doi: 10.3233/NPM-1370313.
- Parnkasem, S. (2013). Effect of a self-efficacy enhancement and social support programme on exercise behaviour among pregnant women. *Journal of the Royal Thai Army Nurses*, 14(2), pp.35-42.
- Pearce, E.E., Evenson, K.R., Downs, D.S. & Steckler, A. (2013). Strategies to promote physical activity during pregnancy: A systematic review of intervention evidence. *American Journal of Lifestyle Medicine*, 7(1), pp.38-50. doi: 10.1177/1559827612446416.
- Pender, N.J. (2002). *Health Promotion in Nursing Practice*. (Forth edition). New Jersey: Pearson Education.
- Pestronk, R.M., Elligers, J.J., & Laymon, B. (2013). Public Health's Role: Collaborating for healthy communities. *Health Progress*, 94(1), pp.20-25. [Pdf, Online]. Available at: <https://www.chausa.org/docs/default-source/health-progress/db58522c02524c899bba93725fee36741-pdf.pdf?sfvrsn=0>. [Assessed 18 July 2017].
- Peters, M.D.J., et al. (2015). Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare*, 13(1), pp.141-146. doi: 10.1097/XEB.0000000000000050. [Pdf, Online]. Available at: <http://www.researchgate.net/publication/279730442>. [Assessed 25 March 2018].
- Peterson, J., Pearce, P.F., Ferguson, L.A., & Langford, C.A. (2017). Understanding scoping reviews: Definition, purpose, and process. *Journal of the American Association of Nurse Practitioners*, 29(1), pp.12-16. doi: 10.1002/2327-6924.12380.
- Pierce, V., Cheesebrow, D. & Braun, L.M. (2000). Facilitator competencies. *Group facilitation: A Research and Applications Journal*, 2(winter), pp.24-32.
- Pimpa, N. (2012). Amzing Thailand: Organizational culture in the Thai public sector. *International Bussiness Research*, 5(11), pp. 34-42.

- Piravej, K. & Saksirinukul, R. (2001). Survey of patterns, attitudes, and the general effects of exercise during pregnancy in 203 Thai pregnant women at King Chulalongkorn Memorial Hospital. *Journal of the Medical Association of Thailand*, 84(S1), pp.S276-S282.
- Poobalan, A.S., Aucott, L.S., Gurung, T., Smith, W.C., & Bhattacharya S. (2009). Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women-systematic review and meta-analysis of cohort studies. *Obesity Review*, 10(1), pp.28-35. doi: 10.1111/j.1467-789X.2008.00537.
- Powell, L., Amsbary, J. & Hickson, M. (2014). The Wai in Thai Culture: Greeting, Status-Marking and National Identity Functions. *Journal of Intercultural Communication*, 34(1), pp.7-7
- Prather, H., Spitznagle, T. & Hunt, D. (2012). Benefits of exercise during pregnancy. *The American Academy of Physical Medicine and Rehabilitation*, 4(11), pp.845-850. doi: 10.1016/j.pmrj.2012.07.012.
- ThePresident's Council on Fitness, Sports and Nutrition, The United States (US). (2015). Facts & Statistics of Physical activity. [Online]. Available at: <https://www.hhs.gov/fitness/resource-center/facts-and-statistics/index.html>. [Assessed 25 February 2016].
- The Primary Health Care Division, Thailand, (2014). *The Four-Decade Development of Primary Health Care in Thailand 1978-2014*. Nonthaburi: The Primary Health Care Division, The Department of Health Service Support, Thailand.
- Prybil, L., Jarris, P., & Montero, J. (2015). *Discussion paper: A perspective on Public-Private collaboration in the Health Sector*. [Pdf, Online]. Available at: <https://nam.edu/wp-content/uploads/2015/11/NAM-Public-Private-Collaboration-Perspective.pdf>. [Assessed 25 February 2016].
- The Public Health England. (2013). *Trends in obesity prevalence*. [Online]. Available at: http://www.noo.org.uk/NOO_about_obesity/trends. [Assessed 25 February 2015].
- Pannucci, C.J. & Wilkins, E.G. (2010). Identifying and Avoiding Bias in Research. *Plastic and reconstructive surgery*, 126(2), pp.619-625. doi:10.1097/PRS.0b013e3181de24bc.
- Punyapiroje, C. & Morrison, M.A. (2007). Behind the smile: reading cultural values in Thai advertising. *Asian Journal of Communication*, 17(3), pp.318-336. doi: 10.1080/01292980701458406.
- Put, W.M., Chuang, S.L., & Chan, L.W. (2015). Physical activity in pregnancy: attitudes and

- practices of Hong Kong Chinese women. *Journal of Gynaecology, Obstetrics and Midwifery*, 15(2), pp.138-147.
- QSR International Pty Ltd. (2014). *NVivo qualitative data analysis Software, Version 11*. ABN 47 006 357 213.
- Rasmussen, K.M. & Yaktine, A.L. (Editor). *Weight gain during pregnancy: Reexamining the Guidelines*. Washington (DC): National Academies Press (US).
- 3rd Regional Health Centre, Nakhon Sawan, Thailand. (2011). *Perinatal care handbook for health professional provider*. Thailand: The Health Promoting Hospital, 3rd Regional Health Centre, Bureau of Health Promotion, Department of Health, Ministry of Public Health.
- 3rd Regional Health Centre, Nakhon Sawan, Thailand. (2011). *Health knowledge centre*. [Online]. Available at: <http://kcenter.anamai.moph.go.th/>. [Assessed 15 November 2015].
- 3rd Regional Health Centre, Nakhon Sawan, Thailand. (2015). *Report of maternal and child health during period 2014-2015*. [Online]. Available at: http://hpc3.anamai.moph.go.th/ewtadmin/ewt/hpc3/ewt_dl_link.php?nid=2457&filename=index. [Assessed 10 December 2015].
- 3rd Regional Health Centre, Nakhon Sawan, Thailand. (2016). *Organizational structure of 3rd Regional Health Centre*. [Online]. Available at: <http://203.157.71.162/main.php?filename=structure2016>. [Assessed 9 June 2016].
- Regmi, K., Naidoo, J., & Pilkington, P. (2010). Understanding the processes of translation and transliteration in qualitative research. *International Journal of Qualitative Methods*, 9(1), pp.16–26.
- Ribeiro, C.P. & Milanez, H. (2011). Knowledge, attitude and practice of women in Campinas, Sao Paulo, Brazil with respect to physical exercise in pregnancy: a descriptive study. *Reproductive Health*, 3, pp.8-31. doi: 10.1186/1742-4755-8-31.
- Rhein, D. (2016). Westernisation and the Thai higher education system: past and present. *Journal of Educational Administration and History*, 48(3), pp.261-274. doi: 10.1080/00220620.2016.1184133.
- Rogers, A. & Horrocks, N. (2010). Chapter 3: Perception of adult education. In *teaching adults*. (Forth edition). [electronic resource]. Maidenhead: Open University Press.
- Rooney, B.L., Mathiason, M.A., & Schauburger, C.W. (2011). Predictors of obesity in childhood, adolescence, and adulthood in a birth cohort. *Maternal and Child Health Journal*, 15(8), pp.1166–1175. doi: 10.1007/s10995-010-0689-1.

- The Royal College of Obstetricians and Gynaecologists. (RCOG). (2006). *Exercise in pregnancy*. [Pdf, Online]. Available at:
<https://www.rcog.org.uk/globalassets/documents/patients/patient-information-leaflets/pregnancy/recreational-exercise-and-pregnancy.pdf>.
 [Assessed 24 October 2014].
- Saereeporncharenkul, K. (2011). Correlation of BMI to pregnancy outcomes in Thai women delivered in Rajavithi Hospital. *Journal of the Medical Association of Thailand*, 94 (Suppl 2), pp.S52–S58.
- Sainani, K.L. (2010). Making sense of intention to treat. *Journal of the American Academy of Physical Medicine and Rehabilitation*, 2(3), pp.209-213.
 doi: [10.1016/j.pmrj.2010.01.004](https://doi.org/10.1016/j.pmrj.2010.01.004).
- Sagedal, L.M., et al. (2013). Study protocol: fit for delivery-can a lifestyle intervention in pregnancy result in measurable health benefits for mothers and newborns? A randomized controlled trial. *BMC Public Health*, 13(132). [Pdf, Online]. Available at:
<https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/1471-2458-13-132>.
 [Assessed 3 January 2015].
- Sanklaleak, W., Boromtananat, C., & Tiautchasuwan, Y. (2014). *Factors affecting the utilization of antenatal care service of migrant workers in Government hospitals in Samut Sakhon province*. [Pdf, Online]. Available at:
http://www.stou.ac.th/thai/grad_stdy/masters/ผลสส/research/4nd/FullPaper/HS/Poster/P-HS%20003%20นางสาววิชุดา%20%20สังขฤกษ์.pdf. [Assessed 3 January 2015].
- Saokaew, S., Sapoo, U., Nathisuwan, S., Chaiyakunapruk, N., & Permsuwan, U. (2012). Anticoagulation control of pharmacist-managed collaborative care versus usual care in Thailand. *International Journal of Clinical Pharmacy*, 34(1), pp.105-112.
 doi: [10.1007/s11096-011-9597-8](https://doi.org/10.1007/s11096-011-9597-8).
- Santos, P.C., et al. (2014). Impact of compliance with different guidelines on physical activity during pregnancy and perceived barriers to leisure physical activity. *Journal of Sports Sciences*, 32(14), pp.1398-1408.
- Say, L., Chou, D., et al. (2014). Global causes of maternal death: a WHO systematic analysis. *The Lancet Global Health*, 2(6), pp.e323-333.
- Schellong, K., Schulz, S., Harder, T., & Plagemann, A. (2012). A. Birth weight and long-

- term overweight risk: systematic review and a meta-analysis including 643,902 persons from 66 studies and 26 countries globally. *PLoS One*, 7(10), e47776. doi: 10.1371/journal.pone.0047776.
- Scholten, R. R., Thijssen, D.J., Lotgering, F.K., Hopman, M.T., & Spaanderman, M.E. (2014). Cardiovascular effects of aerobic exercise training in formerly preeclamptic women and healthy parous control subjects. *American Journal of Obstetrics and Gynecology*, 211(5), pp.516.e1-516.e11. doi: 10.1016/j.ajog.2014.04.025.
- Schulz, K.F., Altman, D.G., Moher, D. for the CONSORT Group. (2010). CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. *Obstetrics & Gynecology Journal*, 115(5), pp.1063-1070. doi:10.1097/AOG.0b013e3181d9d421.
- Sereetrakul, W. (2012). Predicting factors of body image satisfaction of students in Bangkok. *Journal of the Association of Researchers*, 17(3), pp.102-112.
- Seewan, S. & Benjarongkij, Y. (2014). The influencing factors pressuring Thai women on decision making on beauty and appearance transformation. *Journal of Public Relations and Advertising*, 7(2), pp.125-137.
- Seneviratne, S.N., et al. (2014). Antenatal exercise in overweight and obese women and its effects on offspring and maternal health: design and rationale of the IMPROVE (Improving Maternal and Progeny Obesity via Exercise) randomised controlled trial. *BMC Pregnancy and Childbirth*, 14(1), pp.1-16. doi: 10.1186/1471-2393-14-148.
- Sharma, G. (2017). Pros and cons of different sampling techniques. *International Journal of Applied Research*, 3(7), pp.749-752.
- Sharts-Hopko, N.C. (2002). Assessing rigor in qualitative research. *Journal of the Association of Nurses in AIDS Care*, 13(4), pp.67-69.
- Shephard, B. (2014). *Understanding the role of a facilitator*. [Pdf, Online]. Available at: <http://www.cpsb.com/research/communique/featured-articles/Understanding-the-role-of-Facilitator.pdf>. [Assessed 24 November 2014].
- Shenton, A.K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), pp.63-67.
- Shiri, R., Coggon, D., & Falah-Hassani, K. (2018). Exercise for the prevention of low back and pelvic girdle pain in pregnancy: A meta-analysis of randomized controlled trials. (Review article). *European Journal of Pain*, 22(1), pp.19-27. doi: 10.1002/ejp.1096.
- Shivakumar, G., et al. (2011). Antenatal depression: A rationale for studying exercise. *Depression Anxiety*, 28(3), pp.234-242.

- Siebel, A. L., Carey, A. L., & Kingwell, B. A. (2012). Can exercise training rescue the adverse cardio-metabolic effects of low birth weight and prematurity?. *Clinical and Experimental Pharmacology and Physiology*, 39(11), pp.944–957.
doi: 10.1111/j.1440-1681.2012.05732.
- Sindhu, S., Pholpet, C., & Puttapitukpol, S. (2010). Meeting the challenges of chronic illness: A nurse-led collaborative community care programme in Thailand. *Collegian*, 17(2), pp.93-99.
- Sitthi-amorn, C., Somrongthong, R., & Janjaroen, W.S. (2001). Globalization and health viewed from three parts of the world. *Bulletin of the World Health Organization*, 79(9), pp.889-893.
- Smith, K.M. & Campbell, C.G. (2013). Physical activity during pregnancy: Impact of applying different physical activity guidelines. *Journal of Pregnancy*. [Pdf, Online]. Available at: <https://www.hindawi.com/journals/jp/2013/165617/>. [Assessed 15 October 2014].
- Smith, J. & Noble, H. (2014). Bias in research. *Evidence-based Nursing*, 17(4), pp.100-101.
doi: 10.1136/eb-2014-101946.
- Sorensen, T.K., et al, (2003). *Recreational physical activity during pregnancy and risk of preeclampsia*. [Pdf, Online]. Available at: <https://hyper.ahajournals.org/content/41/6/1273.full>. [Assessed 15 October 2014].
- Spencer, M., Dineen, R., & Phillips, A. (2013). *Tool for improvement 8: co-producing services - co-creating health*. [Pdf, Online]. Available at: www.1000livesi.wales.nhs.uk. [Assessed 13 June 2015].
- Sporis, G., Badric, M., & Miljkovic, Z. (2014). Do the overweight and obesity effect on motor ability level among girls?. *Sport Science*, 7(2), pp.36-43.
- Squibb, L. (2014). Pregnancy, delivery, and childhood obesity. *International Journal of Childbirth Education*, 29(2), pp.73-77.
- Stadtlander, L. (2014). Maternal Obesity and the Development of Child Obesity. *The International journal of childbirth education: the official publication of the International Childbirth Education Association*, 29(2), pp.20-24
- Stan, E.A.. (2014). Pregnancy and aquatic aerobic activity. *Sport and Society Interdisciplinary Journal of Physical Education and Sport*, 14(special issue), pp.260-268.
- Stevens, G.A., et al. (2012). National, regional, and global trends in adult overweight and obesity prevalence. *Population Health Metrics*, 10(22), pp.1-16.

- Stirrat, L.I. & Reynolds, R.M. (2014). Effects of maternal obesity on early and long-term outcomes for offspring. *Research and Reports in Neonatology*, 4, pp.43-53.
- The Strategy and Planning Division, Ministry of Public Health (MoPH), Thailand. (2016). *Public Health Statistics 2016*. Nontaburi: The Strategy and Planning Division, Ministry of Public Health (MoPH), Thailand.
- The Strategy and Planning Division, Ministry of Public Health (MoPH), Thailand. (2017). *Statistical Thailand 2017*. Nontaburi: The Strategy and Planning Division, Ministry of Public Health (MoPH), Thailand.
- Suhonen, R., Saarikoski, M., & Leino-Kilpi, H. (2009). Cross-cultural nursing research. *International Journal of Nursing Studies*, 46(4), pp.593–602.
- Sui, Z., Grivell, R.M., & Dodd, J.M. (2012). Antenatal exercise to improve outcomes in overweight or obese women: a systematic review. *Acta Obstetrica et Gynecologica Scandinavica*, 91(5), pp.538-545.
- Suksabai, W. & Thongsuk, S. (2009). Patients' perception on moral characteristics of nurses in Ramathibodi hospital. *Ramathibodi Nursing Journal*. 2009;15(1), pp.60-75.
- Sullivan, D.H. (2014). Obesity prevention starts prenatally. *International Journal of Childbirth Education*, 29(2), pp.12-15.
- Sunsaneevithayakul, P., Titapant, V., Ruangvutilert, P., et al. (2014). Relation between gestational weight gain and pregnancy outcomes. *The Journal of Obstetrics and Gynaecology Research*, 40(4), pp.995–1001.
- Suputtitada, A. (2005). *Series of exercise recommendation for healthcare professionals: Guideline of promoting exercise during pregnancy in community healthcare centre*. Thailand: Division of Physical Activity and Health, Department of Health, Ministry of Public Health (MoPH).
- Supavitipatana, B., Phanchaoenworakul, K., Yeo, S.A., Sinsuksai, N., & Vorapongsathorn, T. (2012). Using theory of Planned Behaviour to predict physical activity intention among pregnant Thais. *The Pacific Rim International Journal of Nursing Research*, 16(3), pp.192-205.
- Tang, J.W., Mason, M., Kushner, R.F., Tirodkar, M.A., Khurana, N., & Kandula, N.R. (2012). South Asian American perspectives on overweight, obesity, and the relationship between weight and health. *Preventing Chronic Diseases*, 9:E107. 10.5888/pcd9.110284.
- Tansupong, S. (2015). *Factors influencing the adoption of LINE Application*. Thesis of

- Master degree in Information Technology and Management, Graduate School, Bangkok University, Thailand.
- Teddlie, C. & Tashakkori, A. (2009). *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioural Sciences*. London: SAGE Publication.
- Teerawattananon, Y. & Luz, A. (2017). Obesity in Thailand and its economic cost estimation. ADBI Working Paper 703. Tokyo: Asian Development Bank Institute. [Pdf, Online]. Available at: <https://www.adb.org/publications/obesity-thailand-and-its-economic-cost-estimation>. [Assessed 10 May 2016].
- Tennant, G.A. (2014). Preventing childhood obesity by managing pregnancy weight gain. *International Journal of Childbirth Education*, 29(2), pp.41-45.
- Tennant, G. (2014). Exercise and women's Health. *International Journal of Childbirth Education*, 29(2), pp.31-36.
- Terryn, B. (2003). *Measuring literacy in developing countries from an international perspective*. Canada: UNESCO Institution for Statistics. [Pdf, Online]. Available at: <http://iase-web.org/documents/papers/isi54/TerrynI68.pdf>. [Assessed 10 May 2016].
- Thomas, D.R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation*, 27(2), pp.237-246.
doi: 10.1177/1098214005283748.
- Tie, H.T., Xia, Y.Y., Zeng, Y.S., Zhang, Y., Dai, C.L., Guo, J.J., & Zhao, Y. (2014). Risk of childhood overweight or obesity associated with excessive weight gain during pregnancy: a meta-analysis. *Archives of Gynecology and Obstetrics*, 289(2), pp.247–257. doi: 10.1007/s00404-013-3053-z.
- Tiran, D. (2014). Nausea and vomiting in pregnancy: An 'alternative' approach to care. *British Journal of Midwifery*, 22(8), pp.544-550.
- T Jahn, W. (2011). The 4 basic ethical principles that apply to forensic activities are respect for autonomy, beneficence, nonmaleficence, and justice. *Journal of Chiropractic Medicine*, 10(1), pp.225-226.
- Tomic, V., et al. (2013). *The effect of maternal exercise during pregnancy on abnormal fetal growth*. [Pdf, Online]. Available at: <http://www.cmj.hr/2013/54/4/23986277.htm>. [Assessed 24 October 2014].
- Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREG): a 32-item checklist for interviews and focus group. *International Journal for Quality in Health Care*, 19(6), pp.349-357.

- Torop, P. (2002). Translation as translating as culture. *Sign System Studies*, 30(2), pp.593–605.
- Torres, R.M. (2000). *Who is illiterate?*. [Online}. Available at: http://www.swaraj.org/shikshantar/torres_illiterate.htm. [Assessed 3 June 2016].
- Treuth, M.S., Butte, N.F., & Puyau, M. (2005). Pregnancy-related changes in physical activity, fitness, and strength. *Medicine and Science in Sports and exercise*, 37(5), pp.832-837.
- Trottier, M., Erebara, A., & Bozzo, P. (2012). Treating constipation during pregnancy. *Canadian Family Physician*, 58(8), pp.836-838.
- The United Nations Educational, Scientific and Cultural Organization (UNESCO), Institute for Statistics. (2013). *UIC factsheet: Adult and youth literacy*. [Pdf, Online]. Available at: <http://www.uis.unesco.org/Education/Documents/fs26-2013-literacy-en.pdf>. [Assessed 10 May 2016].
- The United States Department of Health and Human Service (USDHHS). (2008). *2008 Physical activity guidelines for Americans*. USA: The Secretary of Health and Human Service.
- The United States (US) Bureau of Labor Statistics. (2008). *Sports and exercise (May 2008)*. [Pdf, Online]. Available at: https://www.bls.gov/spotlight/2008/sports/pdf/sports_bls_spotlight.pdf. [Assessed 10 May 2016].
- Utsahawararat, J. (1999). *Locus of Control and Physical Activities of Woman during Pregnancy*. Thesis of Master degree in Education (Health Promotion), Graduate School, Chiang Mai University, Thailand.
- Uusitalo, U., Pietinen, P., & Puska, P. (2002). *Dietary Transition in Developing Countries: Challenges for chronic disease prevention*. Geneva: World Health Organization.
- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, 15(2013), pp.398-405.
- Venkatesh, V., Brown, S.A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: guidelines for conducting Mixed Methods Research in information system. *MIS Quarterly*, forthcoming 2012–2013. [Pdf, Online]. Available at: http://www.vvenkatesh.com/wp-content/uploads/2015/11/Venkatesh_Brown_Bala_MISQ_forthcoming.pdf. [Assessed 10 May 2016].

- Vickers, A.J. & Altman, D.G. (2001). Statistics notes: analysing controlled trials with baseline and follow up measurements. *BMJ*, 323(7321), pp.1123-1124.
- Visuthipanich, V. (2011). Psychometric Testing of GPAQ among the Thai Population. *Thai Pharmaceutical and Health Science Journal*, 11(4), pp.144-152.
- Wang, J., et al. (1994). Asians have lower body mass index (BMI) but higher percent body fat than do Whites: comparisons of anthropometric measurements. *American Society for Clinical Nutrition*, 60(1), pp.23-28.
- Wee, H. L., et al. (2008). The association of body mass index with health-related quality of life: an exploratory study in a multiethnic Asian population. *Value in Health: The Journal of the International Society for Pharmacoeconomics and Outcomes Research*, 11(S1), pp.S105–114. doi: 10.1111/j.1524-4733.2008.00374.x.
- White, I.R., Horton, N.J., Carpenter, J., & Pocock, S.J. (2011). Strategy for intention to treat analysis in randomised trials with missing outcome data. *BMJ*, 342:d40. doi: 10.1136/bmj.d40.
- Williams, H. (2012). Maternal obesity: Risk or resolution? A literature review-part 2. *British Journal of Midwifery*, 20(10), pp.698–70.
- The World Bank. (2014). *World Bank data: Economy & Growth*. [Online]. Available at: <http://data.worldbank.org/topic/economy-and-growth>. [Assessed 29 May 2016].
- The World Bank. (2018). *World Bank data: World Bank Country and Lending Groups*. [Online]. Available at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups%20%20%20%20ไทย>. [Assessed 5 September 2018].
- The World Health Organization (WHO) Western Pacific Region) WPRO(. (2000). *The Asia-Pacific perspective: redefining obesity and its treatment*. Melbourne: Health Communications Australia.
- The World Health Organization expert consultation (2004). Appropriate body mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*, 363(1), pp.157–163.
- The World Health Organization (WHO). (2012). *Physical activity*. [Online]. Available at: <http://www.who.int/mediacentre/factsheets/fs385/en/>. [Assessed 24 October 2014].
- The World Health Organization (WHO). (2013). *What are the health consequences of being overweight?*. [Online]. Available at: <http://www.who.int/features/qa/49/en/>. [Assessed 15 March 2015].

- The World Health Organization (WHO). (2014). *Global health observatory (GHO) data: overweight and obesity*. [Online]. Available at: http://www.who.int/gho/ncd/risk_factors/overweight/en/. [Assessed 5 March 2015].
- The World Health Organization (WHO). (2015). *Media centre: overweight and obesity*. [Online]. Available at: <http://www.who.int/mediacentre/factsheets/fs311/en/>. [Assessed 5 March 2015].
- The World Health Organization (WHO). (2015). *Non-communicable diseases*. [Online]. Available at: <http://www.who.int/mediacentre/factsheets/fs355/en/>. [Assessed 15 March 2015].
- Wyatt, B. & Promkandorn, S. (2012). A discourse analysis of the Thai experience of “being krengrjai”. *Intercultural Pragmatics*, 9(3), pp. 361-383. doi:10.1515/ip-2012-0021.
- Yang, S., Peng, A., Wei, S., Wu, J., Zhao, J., Zhang, Y., et al. (2015). Pre-Pregnancy Body Mass Index, Gestational Weight Gain, and Birth Weight: A Cohort Study in China. *PLoS ONE*, 10(6), e0130101. doi:10.1371/journal.pone.0130101.
- Yang, W., Han, F., Gao, X., Chen, Y., Ji, L., & Cai, X. (2017). Relationship Between Gestational Weight Gain and Pregnancy Complications or Delivery Outcome. *Scientific Reports*, 7(1), 12531. doi: 10.1038/s41598-017-12921-3.
- Yanamandra, N. & Chandraharan, E. (2012). *Anatomical and physiological changes in pregnancy and their implications in clinical practice*. [Pdf, Online]. Available at: http://assets.cambridge.org/97805212/68271/excerpt/9780521268271_excerpt.pdf. [Assessed 15 October 2014].
- Yeo, S., Cisewski, J., Lock, E.F., & Marron, J.S. (2010). Exploratory analysis of exercise adherence patterns with sedentary pregnant women. *Nurse Researcher Journal*, 59(4), pp.280-287. doi: 10.1097/NNR.0b013e3181dbbd61.
- Young, S.N. (2007). How to increase serotonin in the human brain without drugs. *Journal of Psychiatry and Neuroscience*, 32(6), pp.394-399.
- Zanardo, V., Mazza, A., Parotto, M., Scambia, G., & Straface, G.1. (2016). Gestational weight gain and fetal growth in underweight women. *Italian Journal of Pediatrics*, 42, pp.74-79. doi: [10.1186/s13052-016-0284-1](https://doi.org/10.1186/s13052-016-0284-1).
- Zavorsky, G.S. & Longo, L.D. (2011). Exercise guidelines in pregnancy. *Sports Medicine*, 41(5), pp.345-360.
- Zhang, Y., Dong, S., Zuo, J., Hu, X., Zhang, H., & Zhao, Y. (2014). Physical activity level of

urban pregnant women in Tianjin, China: a cross-sectional study. *PLoS One*, 9(10), e109624. doi:10.1371/journal.pone.0109624.

Zhou, B.F. (2002). Effect of body mass index on all-cause mortality and incidence of cardiovascular diseases-report for meta-analysis of prospective studies open optimal cut-off points of body mass index in Chinese adults. *Biomedical and Environmental Sciences*, 15(3), pp.245–252.

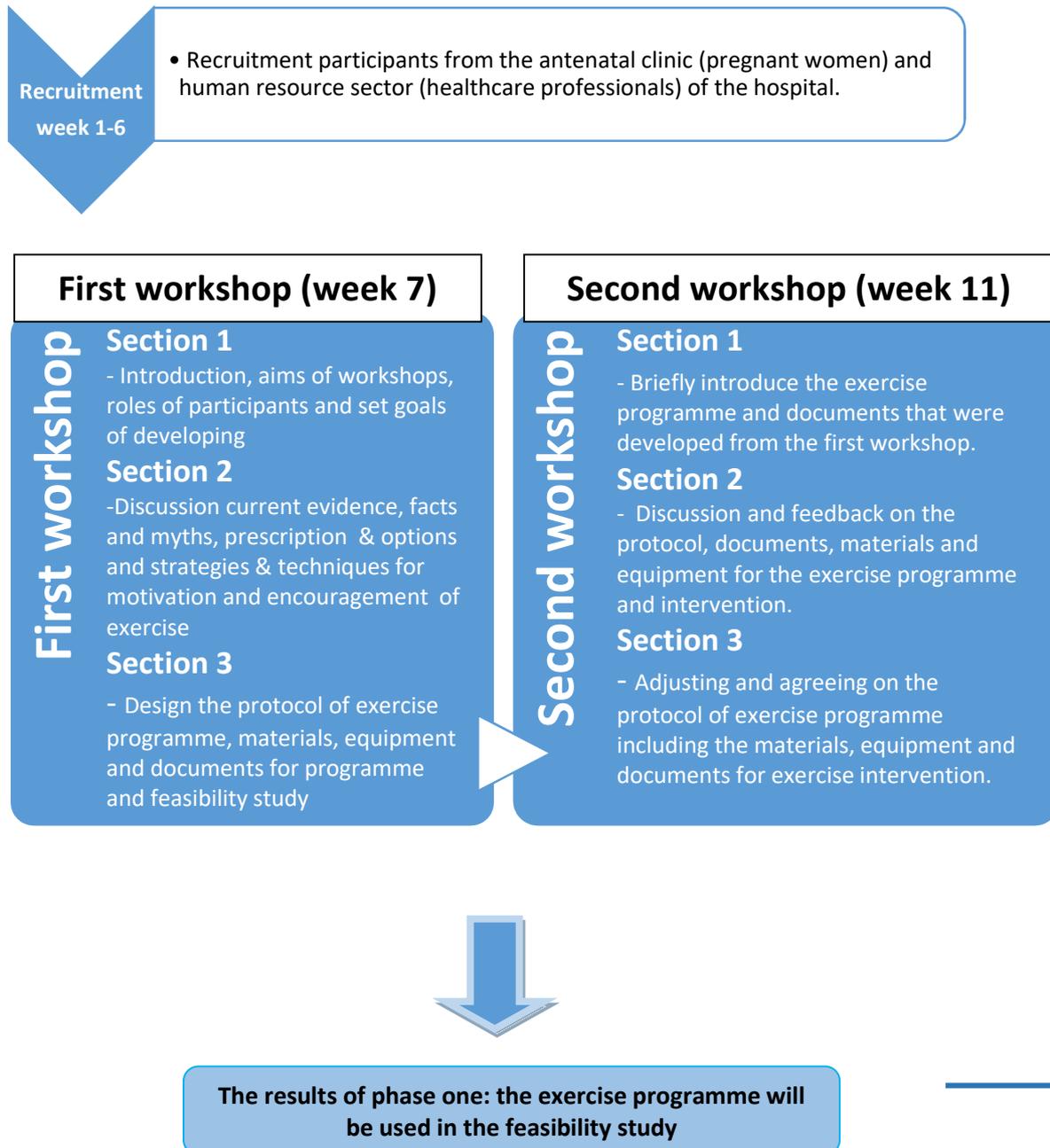
Zhou, B.F. (2002). Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults-study on optimal cut-off points of body mass index and waist circumference in Chinese adults. *Biomedical and Environmental Sciences*, 15(1), pp.83–96.

APPENDIX

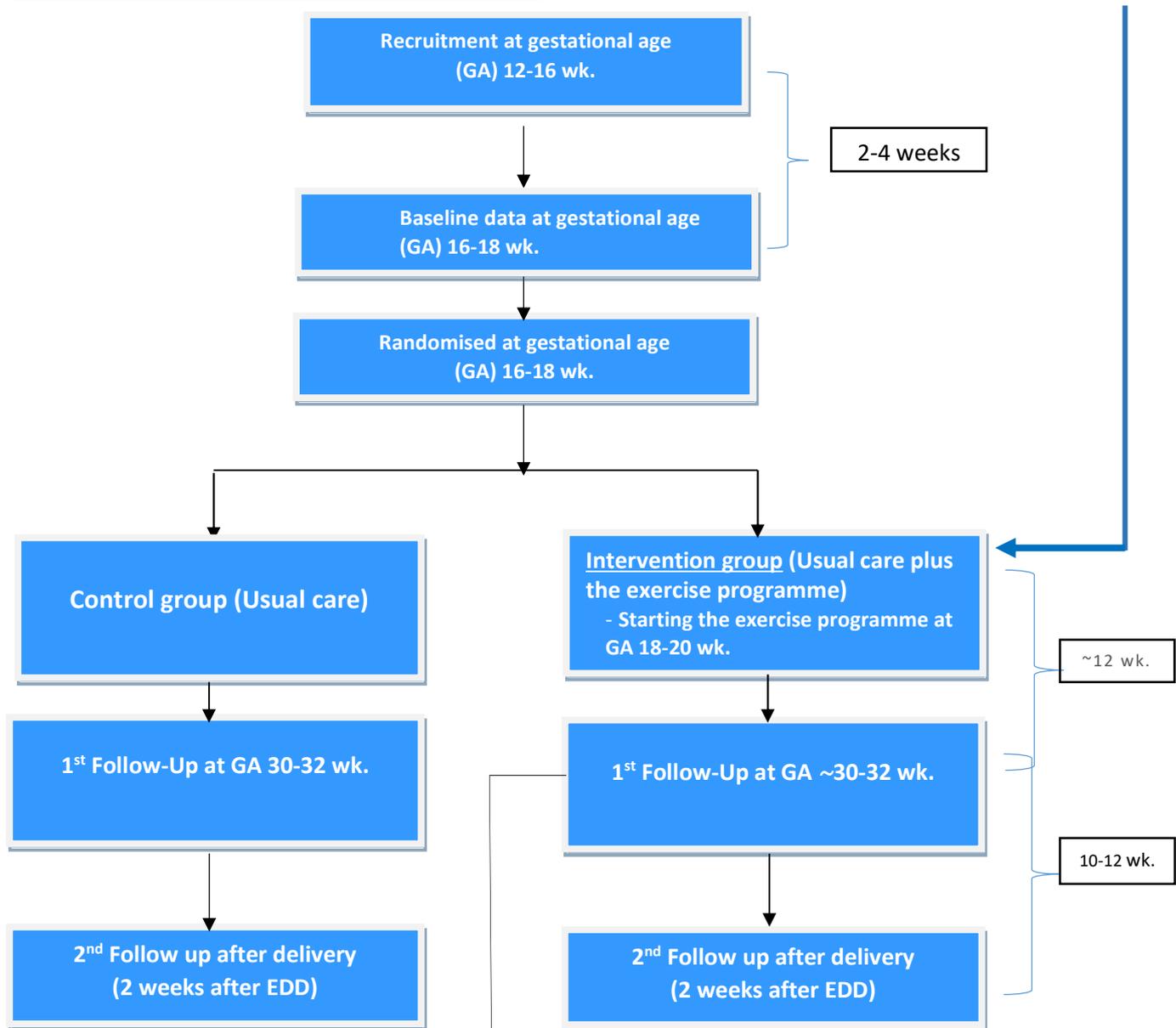
APPENDIX A

The flowchart of the study

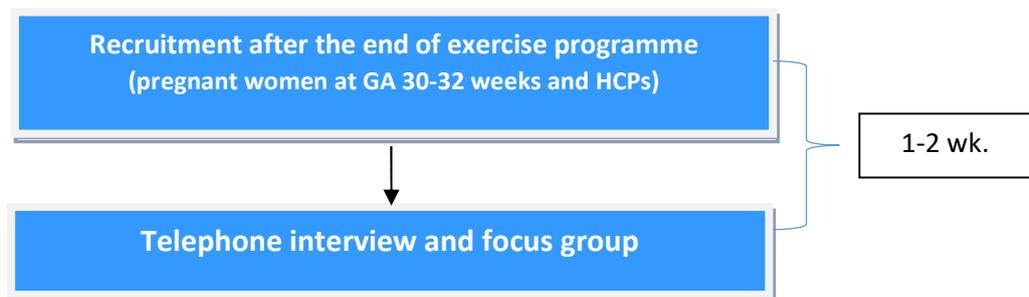
Phase 1: Workshops



Phase 2 Feasibility study: Part 1 Intervention



Part 2 Qualitative component



APPENDIX B

The prescription of exercise during pregnancy

The prescription of exercise during pregnancy includes frequency, duration, types and intensity of exercise (ACOG, 2015). In Thailand, the recommendation for exercise during pregnancy for low risk pregnant women without any contraindications follows the ACOG guidelines (ACOG, 2002, 2015; ACSM, 2014; Suputtitada, 2005).

Core concept of exercise

- Duration: at least 30 minutes or more of accumulated exercise a day (at least 10 minutes a session), which include a 5-10 minutes warm up and cool down period, 20-30 minutes exercise from protocol: muscular workouts and/or cardiovascular training.
- Frequency: at least 3 times a week.
- Intensity: moderate level of exercise as measured by 3 methods: talk test, Borg rating scale and target heart rate (THR) (Royal College of Obstetricians and Gynaecologists. (RCOG), 2006; Suputtitada, 2005).
- Types: muscular workouts and cardiovascular training such as walking, stationary cycling, swimming, low-impact aerobics, prenatal yoga, prenatal Pilates, running, jogging, and racquet sports and muscular workouts. However, unsafe activities should be avoided.

(Adapted from: ACSM, 2014; ACOG, 2015; Suputtitada, 2005)

Unsafe activities for exercise during pregnancy	
Types of activities	Examples of activities
1. Contact sports	6. Soccer, squash and basketball
2. Fall-prone activities	7. Water skiing, surfing, off-road cycling, gymnastics, and horseback riding
3. Exercising in the heat	8. Hot yoga and hot Pilates
4. High-altitude exercise	9. Sky diving and exercise on the mountains
5. Bouncing or jarring activities	10. Kickboxing and high-impact aerobics

(Adapted from: ACSM, 2014; ACOG, 2015; Suputtitada, 2005)

- The outline of the exercise protocol for women who participate in exercise intervention will be processed as follows:

- The exercise programme will be designed for hospital-based group exercise. The hospital has a regular educational room with free access for clients. Exercise prescription will consist of once a week, 30-40 minutes/session over 10 weeks (total of 10 prescribed sessions). Exercise intervention class will be split into two small classes (class 1: 16 women and class 2: 17 women).

- Exercise education session consist of benefits of exercise, physiological change during pregnancy and exercise and exercise safety during pregnancy. The exercise training will be under the supervision of the researcher and consultation of the physiotherapist. Pregnant women will be observed closely and any warning signs will be picked up by the researcher.

- Each training session will include a 5 minutes warm up (muscle stretching), 10-15 minutes muscular workout, 10-15 minutes low-impact aerobics (cardiovascular training) and 5 minutes cool down (muscular progressive relaxation). Duration of the muscular workout and cardiovascular training will increase progressively from 10 minutes during first two weeks to 15 minutes by the end of first month. The muscular workout will include dynamic exercises from head to toe. It will start with a set of 10 repetitions per exercise and progress to 2 sets of 10 repetitions. Muscular workouts will involve a total of 20-30 exercises. The muscular workouts may be modified every 2-4 weeks during the intervention period for enhancing motivation depending on participant's decision in the workshop.

- Before starting and during the exercise class, pregnant women will be observed for warning signs to exercise by the researcher. If pregnant women have any contraindications and/or warning signs to exercise, they will be referred to nurse (ANC) for further care.

- After the exercise class in each session, pregnant women will be self-reported using carotid pulse check (peak rate and base rate) and take a rest about 15-30 minutes at the hospital. Then, the researcher will provide refreshments, feedback and make appointment for next exercise class.

APPENDIX C

The project information for the physiotherapist

The research project will be designed in two linked phased studies aimed at improving the exercise behaviour of pregnant women in Thailand. The first phase will be designed to develop the exercise programme for Thai pregnant women through consultation at two workshops between the researcher, pregnant women and healthcare professionals. The second phase will test the exercise programme that has been developed in a first phase in the feasibility RCT over 10 weeks. The research project will be conducted at the Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand during the period between October and December 2016 with further period of study in next year 2017. The researcher would like to invite you as a consultant in this study to advise me in terms of suitability, safety, current evidence and practical application.

For the workshops: In the workshops, you will discuss with pregnant women and other healthcare professionals about your knowledge of facts and myths about exercise in pregnancy, and your experiences about barriers or facilitators to doing exercise whilst pregnant, strategies and techniques for motivating and encouraging women to do more exercise. Then, you will discuss the final exercise programme for pregnant women with participants in the second workshop. All the decisions from the development stage will inform how the exercise activities will be designed and explained to the pregnant women. For the exercise intervention: The researcher will consult you over 10 weeks by e-mail and telephone during office hours. You will visit at the exercise class during the first, fifth and tenth weeks of intervention.

APPENDIX D

Prompt sheet for reception nurse

1. Workshops: (During the period between Date/Month/Year and Date/Month/Year)

Expected population: For pregnant women who age at least 20 years old and without complications (low risk pregnancy).

Conversation: we are developing a programme of exercises for women who are pregnant. We are looking for pregnant women who might be interested in coming to a workshop to help us choose the type of activities which would most appeal to women and fit with their lifestyles. If you are interested in taking part, please keep this leaflet and contact Miss Sirikanok Klankhajhon at the appointment area within the antenatal clinic.

2. Intervention: (During the period between Date/Month/Year and Date/Month/Year)

Expected population: For pregnant women who age at least 20 years old and without complications (low risk pregnancy).

Conversation: If you are a woman who does not regularly take exercise we would like to ask you to take part in a new programme of activities for pregnancy to help with fitness. If you are interested in participating in the exercise programme for pregnant women, please keep this leaflet and contact Miss Sirikanok Klankhajhon at the appointment area within the antenatal clinic.

APPENDIX E

The Screening question for recruitment pregnant women in the workshops

Interview length: approximate 2-3 minutes

Starting interview: Introduction, explain the screening questions for workshops

Initial screening

1. Age < 20 years old ≥ 20 years old
2. Language Thai Others
3. Abilities for reading, writing, speaking and understanding Thai language
 Unable to read, speak, write and understand Thai language
 Able to read, speak, write and understand Thai language
4. Exercise behaviour during pregnancy
 Exercise ≥ 30 minutes a day and ≥ 3 days a week
 Exercise < 30 minutes a day and < 3 days a week or non-exercise
5. Do you have contraindication for exercise during pregnant women
 Have contraindications during pregnancy
 Don't have contraindications during pregnancy

**The Physical Activity Readiness Medical Examination for Pregnancy Thai version
(PARmed-X)**

Do you have?	Contraindication for exercise		Before exercise	
	Y	N	Y	N
Hemo-dynamically significant heart disease				
Restrictive lung disease such as acute respiratory distress syndrome, kyphoscoliosis				
Incompetent cervix or cerclage				
Multiple gestation at risk of premature labour				
Persistent second or third-trimester bleeding				
Placenta previa after 26 weeks of gestation				
Premature labour during the current pregnancy				
Ruptured membranes				
Pre-eclampsia or pregnancy induced hypertension				
Anaemia (HB < 10 mg%)				
Unevaluated maternal cardiac arrhythmia				
Chronic bronchitis				
Extreme morbid obesity (BMI \geq 40 kg/m ²)				
Extreme underweight (BMI \leq 12 kg/m ²)				
Orthopedic limitations				
Heavy smoker (> 20 cigarettes/day)				
Poorly controlled chronic diseases before pregnancy such as type 1 diabetes, hypertension				
History of extremely sedentary lifestyles				
Other significant medical condition. Please, specify.....				
During pregnancy, have you experienced?	Contraindication for exercise		Before exercise	
	Y	N	Y	N
Vaginal bleeding, vaginal discharge				
Regular painful contractions (uterine contraction every 10 minutes or > 6 times/hour)				
Amniotic fluid leakage				
Dyspnea before exertion				
Dizziness				
Headache, blurred vision				
Muscle weakness affecting balance				
Calf pain or swelling				
Decreased fetal movement count (< 10 times/day or < 3 times in hour)				

APPENDIX F

Prompt sheet for use by secretary of the human resource meeting after monthly meeting

Workshops: (During the period between Date/Month/Year and Date/Month/Year)

Expected population: Healthcare professionals whose work is concerned with antenatal care would be eligible for recruitment.

Conversation: we are developing a programme of exercises for women who are pregnant. We are looking for healthcare professionals who might be interested in coming to a workshop to help us review which exercises would fit best into a programme that would work for women and service providers. If you are interested in taking part, please keep this leaflet and contact Miss Sirikanok Klankhajhon at the appointment area within the antenatal clinic.

APPENDIX G

The Screening question for recruitment healthcare professionals in the workshops

Interview length: approximate 1-2 minute

Starting interview: Introduction, explain the purposive sampling for workshops.

Personal Characteristics

- | | | |
|-----------------------------------|--|--|
| 1. Work (nurses/midwives) | <input type="checkbox"/> Follow up room | <input type="checkbox"/> Admission room |
| 2. Are you a specialists | <input type="checkbox"/> Doctor | <input type="checkbox"/> Physiotherapists |
| 3. Are you a healthcare providers | <input type="checkbox"/> Healthcare educator | <input type="checkbox"/> Healthcare worker |

APPENDIX H

The Screening question for recruitment pregnant women in the intervention

Interview length: approximate 3-5 minutes

Starting interview: Introduction, explain the screening questions for intervention

Initial screening

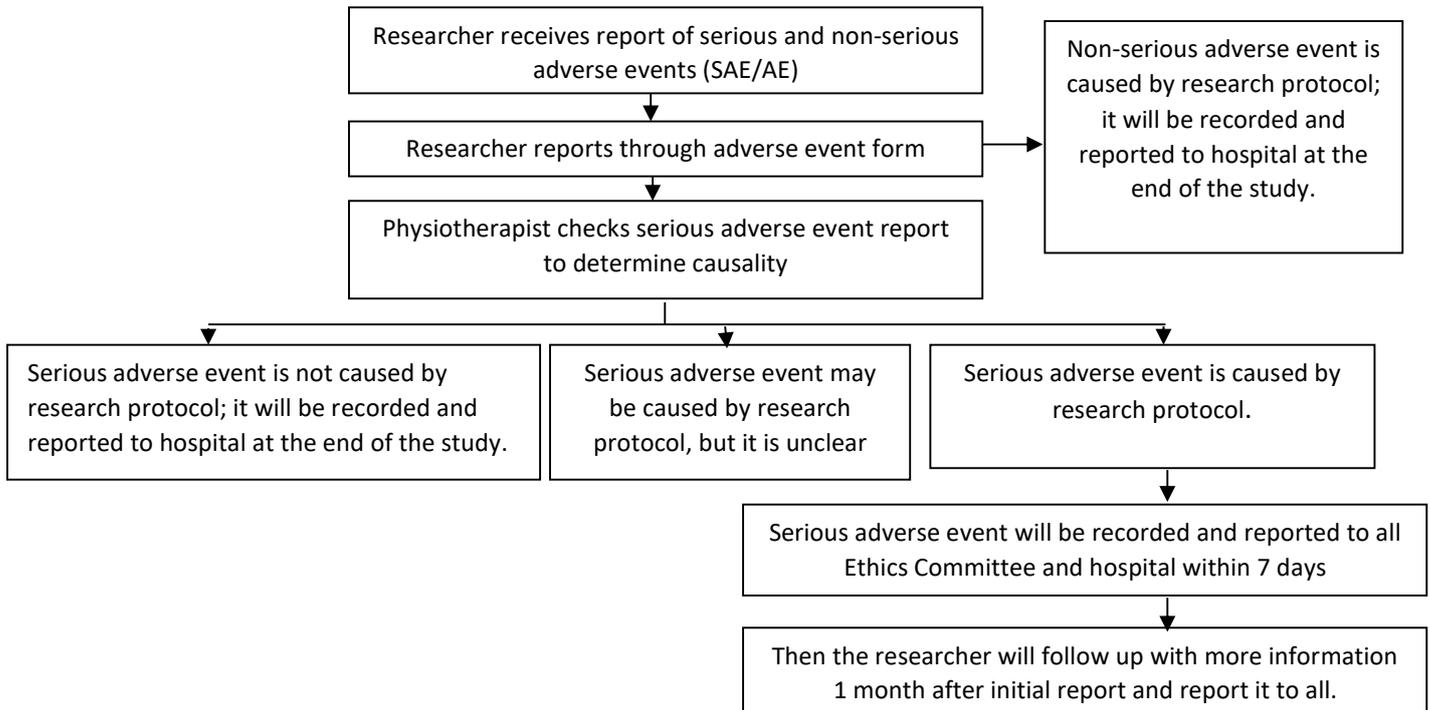
1. Age < 20 years old ≥ 20 years old
2. Language Thai Others
3. Abilities for reading, writing, speaking and understanding Thai language
 Unable to read, speak, write and understand Thai language
 Able to read, speak, write and understand Thai language
4. Exercise behaviour during pregnancy
 Exercise ≥ 30 minutes a day and ≥ 3 days a week
 Exercise < 30 minutes a day and < 3 days a week or non-exercise
5. How far is your current pregnancy?
 Your current pregnancy is between 12 and 16 weeks
 Your current pregnancy is less than 12 and more than 16 weeks
6. How many the stress score during pregnancy do you have?
 Stress score < 30 points
 Stress score ≥ 30 points
7. Do you have contraindication for exercise during pregnant women
 Have contraindications during pregnancy
 Don't have contraindications during pregnancy

**The Physical Activity Readiness Medical Examination for Pregnancy Thai version
(PARmed-X)**

Do you have?	Contraindication for exercise	
	Y	N
Hemo-dynamically significant heart disease		
Restrictive lung disease such as acute respiratory distress syndrome, kyphoscoliosis		
Incompetent cervix or cerclage		
Multiple gestation at risk of premature labour		
Persistent second or third-trimester bleeding		
Placenta previa after 26 weeks of gestation		
Premature labour during the current pregnancy		
Ruptured membranes		
Pre-eclampsia or pregnancy induced hypertension		
Anaemia (HB < 10 mg%)		
Unevaluated maternal cardiac arrhythmia		
Chronic bronchitis		
Extreme morbid obesity (BMI \geq 40 kg/m ²)		
Extreme underweight (BMI \leq 12 kg/m ²)		
Orthopedic limitations		
Heavy smoker (> 20 cigarettes/day)		
Poorly controlled chronic diseases before pregnancy such as type 1 diabetes, hypertension		
History of extremely sedentary lifestyles		
Other significant medical condition. Please, specify.....		
During pregnancy, have you experienced?	Before exercise	
	Y	N
Vaginal bleeding, vaginal discharge		
Regular painful contractions (uterine contraction every 10 minutes or > 6 times/hour)		
Amniotic fluid leakage		
Dyspnea before exertion		
Dizziness		
Headache, blurred vision		
Muscle weakness affecting balance		
Calf pain or swelling		
Decreased fetal movement count (< 10 times/day or < 3 times in hour)		

APPENDIX I

Protocol for recording and reporting adverse events



The researcher will determine that a serious adverse event (SAE) has occurred (SAE are death or life-threatening injuries or illness, requires hospitalisation overnight, or result in persistent or significant disability or incapacity, congenital anomaly or birth defect). The physiotherapist who is a consultant in this study will determine whether SAE is likely to have been caused by the research study-in particular the exercise programme. If the research study was the likely cause of SAE the researcher will record the event and report to all Ethics Committees and hospital within 7 days of the initial report to the researcher of the SAE. Where necessary further investigations as to the cause and the consequences of the event will be reported to all relevant parties within a month of the initial report. For non-serious adverse events: the researcher will record and make a report summarising this data to hospital at the end of the study. We will check their causality with the consultant physiotherapist and the number of non-serious adverse events in both groups will be recorded at the end of the study. If the number of non-serious adverse events are significantly higher than expected and their cause is thought to be due to the research protocol (in either group), it will be reported to all Ethics Committees and hospital.

For serious and non-serious adverse events are not caused by exercise, the researcher will record them and report to hospital at the end of the study. All of serious and non-serious adverse events will be recorded and analysed in my thesis.

Adverse event reporting form

Full title of Study:			
Ethics No:		Hospital Study Reference no:	

AE No:	Patient ID	Description of Event	Start date	Duration/End date	Outcome	**Sequelae
					<input type="checkbox"/> Resolved <input type="checkbox"/> Ongoing <input type="checkbox"/> Ongoing with sequelae**	
Assessment						
Intensity:		<input type="checkbox"/> mild <input type="checkbox"/> moderate <input type="checkbox"/> severe	Expectedness	<input type="checkbox"/> expected <input type="checkbox"/> unexpected i.e. not described in protocol, product information or Investigator Brochure.		
Causality: Relationship to study drug/device/ intervention		<input type="checkbox"/> not related <input type="checkbox"/> unlikely to be related <input type="checkbox"/> possibly related <input type="checkbox"/> probably related <input type="checkbox"/> definitely related	Seriousness	<input type="checkbox"/> Not serious <input type="checkbox"/> Results in death* <input type="checkbox"/> Life threatening* <input type="checkbox"/> Results in hospitalisation or prolongation of existing hospitalisation* <input type="checkbox"/> Results in disability or incapacity* <input type="checkbox"/> Congenital anomaly or birth defect* <input type="checkbox"/> Other (please specify)*		

*Please, see the details and definitions of assessment in the adverse event handbook

Adapt from: Ethics Committee, Naresuan University, Thailand, 2014 & Clinical Research Network, National Institute for Health Research, UK, 2011.

APPENDIX J

The baseline data questionnaire

Interview length: approximate 10-15 minutes

Starting interview: Introduction, explain the aim of the study again and the process of interview. Check consent for short answer interview.

Part 1: Baseline the data

1. Body weight at 1st booking in ANC..... kilograms and height..... centimetres
2. Current gestational ageweeks
3. Current weight Kilograms
4. Current Blood pressuremmHg.
5. Stress score Points

Part 2: Personal Characteristics

1. Age years old
2. What is the highest degree or level of education you have completed?
 Informal education Primary school
 Secondary school High school
 College degree Bachelor's degree
 Master's degree and higher Other (please, specify).....
3. Occupation Work inside or outside home
4. Number of pregnancy....., Number of delivery....., Number of children
5. Expected date of delivery (EDD).....

Part 3: Global Physical Activity Questionnaire (GPAQ)

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week (**now**). Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions

'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate such as running, fast cycling, aerobics, carrying or moving heavy load (>20 kg.),

'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate such as cycling, swimming, housework, brisk walking, carrying or moving moderate load (<20 kg.).

Activity at work

1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads (>20 kg.), digging, construction work or heavy shovelling for at least 10 minutes continuously?
 Yes No. **If No, go to question 4**
2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work? Number of days.....
3. How much time do you spend doing vigorous-intensity activities at work on a typical day? Hours:minutes
4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as working or carrying light loads (<20 kg.) for at least 10 minutes continuously?
 Yes No. **If No, go to question 7**
5. In a typical week, on how many days do you do moderate-intensity activities as part of your work? Number of days.....
6. How much time do you spend doing moderate-intensity activities at work on a typical day? Hours:minutes

Travel to and from places

The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.

7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?
 Yes No. **If No, go to question 10**
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? Number of days.....
9. How much time do you spend walking or bicycling for travel on a typical day?
.....Hours :minutes

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure).

10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running, aerobics or fast cycling for at least 10 minutes continuously?

- Yes No. **If No, go to question 13**

11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities? Number of days.....

12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? Hours :minutes

13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, cycling or swimming at least 10 minutes continuously?

- Yes No. **If No, go to question 16**

14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities? Number of days.....

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? Hours :minutes

Sedentary behaviour

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day?
.....Hours :minutes

APPENDIX K

The outcomes questionnaire (1st Follow up)

Interview length: approximate 10-15 minutes

Starting interview: Introduction, explain the aim of the study again and the process of interview. Check consent for short answer interview.

Part 1: Outcome measures of preliminary effects

1. Current gestational ageweeks
2. Current weight Kilograms
3. Current Blood pressuremmHg.
4. Stress score points

Part 2: Global Physical Activity Questionnaire (GPAQ)

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week (**now**). Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions

'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate such as running, fast cycling, aerobics, carrying or moving heavy load (>20 kg.),

'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate such as cycling, swimming, housework, brisk walking, carrying or moving moderate load (<20 kg.).

Activity at work

1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads (>20 kg.), digging, construction work or heavy shovelling for at least 10 minutes continuously?
 Yes No. **If No, go to question 4**
2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work? Number of days.....
3. How much time do you spend doing vigorous-intensity activities at work on a typical day? Hours:minutes

4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking, swimming or carrying light loads (<20 kg.) for at least 10 minutes continuously?
 Yes No. **If No, go to question 7**
5. In a typical week, on how many days do you do moderate-intensity activities as part of your work? Number of days.....
6. How much time do you spend doing moderate-intensity activities at work on a typical day? Hours:minutes

Travel to and from places

The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.

7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?
 Yes No. **If No, go to question 10**
8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? Number of days.....
9. How much time do you spend walking or bicycling for travel on a typical day?
.....Hours :minutes

Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure).

10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running, aerobics or fast cycling for at least 10 minutes continuously?
 Yes No. **If No, go to question 13**
11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities? Number of days.....
12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? Hours :minutes
13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, cycling or swimming at least 10 minutes continuously?
 Yes No. **If No, go to question 16**

14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities? Number of days.....

15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? Hours :minutes

Sedentary behaviour

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day?
.....Hours :minutes

Part 3: The acceptability of the exercise programme

1. Did you participate in the complete programme (attended every session)?

Yes. No. If no. When you stop participating?
Why?

2. Did you enjoy participating in the exercise programme?

Enjoyable Neither enjoyable nor unenjoyable Unenjoyable
What did you enjoy/ not enjoy about the programme?

3. In your experiences, how difficult or easy did you find it to participate this programme? Easy Neither easy nor difficult Difficult

What was this?

4. In your experiences, is the programme helpful in maintaining fitness levels?

Helpful Neither helpful nor unuseful unhelpful What was this?

5. Were you satisfied with the exercise programme that you participated in?

Satisfied Neither satisfied nor dissatisfied Dissatisfied
What was this?

6. In your opinion, should the exercise programme be part of the routine antenatal care at clinic. Do you agree or disagree? Agree Neither agree nor disagree Disagree

Why?

7. In your opinion, if this programme is being in the part of the antenatal clinic what do you want to change in this programme? Please, specify.....

8. Would you like to say anything about the exercise programme that you participated in?

APPENDIX L

The outcomes questionnaire (2nd Follow up)

Interview length: approximate 5-10 minutes

Starting telephone interview: Introduction, explain the aim of the study again and the process of interview. Check consent for the interview. Before asking the questions, the researcher will greet with general conversation.

Part 1: Outcome measures of preliminary effects

1. What is your gestational age at delivery? weeks
2. What is your weight, when you were admitted at labour room for delivery? kilograms
3. What is your baby birth weight? grams

APPENDIX M

Self-assessment and analysis of stress from mother and child health handbook, Thailand

(Ministry of Public Health, Thailand, 2012)

75

PART 3 ESSENTIAL KNOWLEDGE FOR SAFE AND QUALITY PREGNANCY

Self Assessment and Analysis of Stress

During the past 2 months, to what extent have you experienced any of the following symptoms, behaviors or feelings?

Please mark “**X**” into the box corresponding to the level of occurrence of the symptoms you actually experienced.

Symptom, Behavior, or Feeling	Level of Occurrence			
	Never	Occa- sionally	Fre- quently	Regu- larly
1. Sleepless due to persistent thought or anxiety.				
2. Irritable, annoyed.				
3. Unable to accomplish anything due to tension				
4. Feeling nervous				
5. Antisocial				
6. Having either a migraine or a headache at both sides of the temporal.				
7. Unhappy and sad				
8. Hopeless in life				
9. Losing sense of self-value				
10. Feeling disturbed at all time				
11. Unable to concentrate				
12. Fatigue, low energy to do anything				
13. Feeling bored, uninterested to do anything				
14. Strong heartbeat				
15. Shaking voice, mouth, and hands when feeling dissatisfied.				
16. Fear of mistake with doing things.				
17. Painful and tight muscles around the occiput, back, and shoulder				
18. Easily excited with unfamiliar situation				
19. Confused and dizzy				
20. Reduced sexual pleasure				

76

PART 3 ESSENTIAL KNOWLEDGE FOR SAFE AND QUALITY PREGNANCY

Scoring your responses

Once you complete responding to all of the 20 items, score each item as follows.

Your response is scored:		
Never	= 0	Add up the scores of all 20 items to obtain the total scores ranged between 0 – 60. Your scores can be interpreted below.
Occasionally	= 1	
Frequently	= 2	
Regularly	= 3	

Interpretation of the scores

Scores 0 – 5: Your stress is below average level. Your life goes smooth and easy without struggling for the living. Ask yourself whether you are satisfied with what are going on, if yes and without suffering in life, you can go on living your happy life, but if no, you may make some adjustments in your lifestyle by such as reading books, meeting with friends, or planning for appropriate goals in life and move towards such goals.

Scores 6 – 17: Your stress is at average level. You cope well with stress in daily life. and adjust properly with various situations. You should maintain this level for long.

Scores 18 – 25: Your stress is slightly higher than the average level. You might have faced some disturbing problems, hence with somewhat unusual physical and mental expressions. Having some rest and relaxation, you will be improved, but if it does not work, you should talk or consult the disturbing matters with trusted people.

Scores 26 – 29: Your stress is moderately higher than the average level. You might have some problems in life that is insoluble, hence with obviously unusual physical and mental expressions. Despite with rest and relaxation, the stress persists. You should find the cause of such disturbing problems, and seek for resolution and improvement.

Scores 30 – 60: Your stress is extremely higher than the average level. You might have been facing with the crisis in life or your stress accumulated for a prolonged period. You should release the stress by placing your thought aside, then doing some stretching to relax your body, and going for relaxation such as seeing movies, listening to music. You should think about resolving and rectifying the problems, if without improvement, seek counseling from health personnel.

The exercise diary

Please, tick ✓ the box that you do it everyday

Month.....

Day	Type of exercise				Duration				❤ Pulse		Talk test
	Walking	Cycling	Exercise (programme)	Other	< 10 min	10-19 min	20-29 min	≥30 min	Base rate	Peak rate	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											

Recommendation: You should do moderate exercise at least 30 minutes or more of accumulated exercise a day (at least 10 minutes a session), at least 3 days a week, which include 5 minutes warm up period, 20-30 minutes muscular workouts and/or cardiovascular training and 5 minutes cool down.

How to assess your exercise intensity?

1. Carotid pulse check:

You should put three fingers of your left hand onto your Adam's apple in your throat (that's the bit that sticks out and goes up and down when you swallow.) You feel gently to the side of it, and you will find your pulse beating (you can feel it going up and down). When you have found a steady beat, count how many beats in 15 seconds (use a watch or clock with a second hand). Times your score by 4, and that will tell you your pulse rate per minute.

Note: You should assess your pulse rate before warm up and after cardiovascular exercise and cool down.

2. Talk test

1. Light intensity = you able to talk and sing while being active
2. Moderate intensity = you able to talk but not sing
3. Vigorous intensity = you unable to say more than a few words without talking a breath (unable to carry on a conversation)

APPENDIX O

The process of accessing medical records

Permission to access medical records has been gained from Director of 3rd Regional Health Centre, Nakhon Sawan, Thailand. The translation of the permission to access the medical records including the handheld records is attached (see page 96). This permission will be provided as evidence to the ethical review board of the hospital who will be asked for ethical approval of the study in Thailand. Women who participate in the study will give permission through the consent form to access the medical records. The permission letter includes the details of the research project, researcher's name, and period of study. The researcher will take permission letter to the medical record department when accessing individual records. The researcher will review the participant's medical record at the health record room during office hours. The health record staff will record name of researcher, date, time and name of participant's medical record after completion every time. Other data will be accessed from the woman's hand held records during the research.

APPENDIX P

The Screening question for recruitment pregnant women in telephone interviews

Interview length: approximate 1-2 minutes

Starting interview: Introduction, explain the purposive sampling for interviews

Personal Characteristics

1. Age < 30 years old ≥ 30 years old
2. Work None or working at home Working away from home
3. Number of pregnancy First time Second time or more
4. Adherent the exercise programme < 60% ≥ 60%

APPENDIX Q

Question guide for pregnant women: telephone interviews

Interview length: approximate 30-45 minutes

Starting interview: Introduction, explain the aim of the study again and the process of interview. Check consent for recording the telephone interview.

Part 1: Experiences of exercise programme during pregnancy

Q.1 Could you tell me about your experiences, when you participated the exercise programme?

Prompt:

1A. Could you tell me, how do you feel when you participated in this programme?

1B. In your opinion, is the difference between your exercise behaviour before and after participating the exercise programme?

1C. Could you tell me, how about your exercise behaviour after you participated this programme that compare with your behaviour in the past?

Q.2 In your opinion, after you participated the exercise programme, do you want to perform exercise continuously until delivery or postpartum period? Please, explain me how?

Prompt:

2A. Could you tell me, what is the related factors that impact on your exercise behaviour after participating the exercise programme?

2B. In your opinion, is the programme easy to perform exercise during pregnancy and explain why?

2C. In your opinion, did you satisfaction with the exercise programme?

2D. Could you explain me why do you think that?

Part 2: Strengths and weakness of exercise programme during pregnancy and suggestion for changes to the programme

Q.3 What are the strongest and weakest points of the exercise programme?

Prompt:

3A. Please, explain me in more details of the strongest point or advantages, how to gain or maintain your exercise behaviour during pregnancy?

3B. Please, explain me in more details of the weakest point or disadvantages.

3C. In your opinion, what do you like the top three most about the programme? Why?

3D. In your opinion, what do you dislike the top three most about the programme? Why?

Q.4 In your opinion, is the programme helpful for you and pregnant women?

Prompt:

4A. Could you tell me why the programme is helpful for motivating or maintaining your exercise behaviour and fitness level?

Q.5 In your opinion, if this programme will be integrated or being in the routine antenatal care at clinic. What do you think?

Prompt:

5A. Why do you think that?

5B. In your opinion, if this programme were provided as a usual of antenatal care what would you want to see change?

5C. Please, explain me, why?

Part 3 Personal characteristics

- 6. Please, tell me how old are you? 20-34 years old > 35 years old
- 7. Could you tell me about your education, what is the highest degree or level of education you have completed?
 - Informal education Primary school Secondary school High school
 - College degree Bachelor's degree Master's degree and higher
- 8. What is your religion?
 - No religion Buddhist Christian Muslim
 - Hindu Other (please, specify).....
- 9. What is your total household income in a month?
 - < 5,000 baht 5,000-10,000 baht 10,001-20,000 baht 20,001-30,000 baht
 - 30,001-40,000 baht 40,001-50,000 baht > 50,000 baht
- 10. What is your job? Work inside or outside home
- 11. Please tell me your weight and height before pregnancy?
- 12. How far along in your pregnancy are you?
- 13. Do you have any children? If yes, how many?

The end of interview: Thank you very much for your participation. Do you have any questions? Your responses in this interview will be reported and presented in overall without personal identify. If you are unavailable and/or uncomfortable, you can withdraw from this study anytime. Please, do not hesitate to let me know. Thank you very much.

APPENDIX R

Question guide for healthcare professionals: focus group

Interview length: approximate 45-60 minutes

Starting interview: Introduction, explain the aim of the study again and the process of focus group. Check consent for recording the focus group. Brief summary of the new exercise programme for pregnant women.

Part 1: Strengths and weakness of the new exercise programme during pregnancy

Q.1 I would like to start with your usual care, please tell me about your work related with exercise for pregnant women?

Prompt:

1A. Please tell me, how do you deliver information about exercise to pregnant women in usual care?

1B. How do you motivate or facilitate the pregnant women doing exercise in usual care?

Q.2 In your opinion, what is the differences between usual care and usual care plus exercise programme? Please, tell me more why do you think that?

Prompt:

2A. Have pregnant women ever told you about their experiences of the new exercise programme?

2B. If yes, what is their experiences that they told you?

Q.3 Could you tell me about the strengths or advantages of the new exercise programme?

Prompt:

3A. What do you think these strengths or advantages of the new exercise programme would be fit within usual antenatal care

3B. Could you tell me about the weakness or disadvantages of the new exercise programme?

3C. In your opinions, is the new exercise programme easy to deliver exercise information to pregnant women?

Part 2: Idea to integrate the new exercise programme in the usual antenatal care

Q.4 If this exercise programme will be integrated or being in the routine antenatal care at clinic. What do you think?

Prompt:

4A. In your experiences, what are the impacts of exercise programme on usual antenatal care? (for example workload, organization, or management)

4B. How do you manage this programme with your usual care?

Part 3: Suggestions for alternatives or changes to the programme to benefit women and the healthcare service.

Q.5 What is the suggestion for the exercise programme for pregnant women?

5A. In your opinion, if this programme is being in the part of the antenatal clinic what do you want to suggest or change in this programme?

5B. Please, explain me, how?

The end of interview: Thank you very much for your participation. Do you have any questions? Your responses in this focus group will be reported and presented in overall without personal identify. If you are unavailable and/or uncomfortable, you can withdraw from this study anytime. Please, do not hesitate to let me know. Thank you very much.

APPENDIX S

Participant information sheet

Participant Information Sheet for Pregnant Women: Workshops

Study title: Improving the exercise behaviour of pregnant women in Thailand

Can you help?

We would like to invite you to take part in this study. To help you to understand what this study is about, please take the time to read this information sheet carefully and discuss it with your family and friends if you wish. We want to be sure you understand the information that follows before you agree to participate. Be sure to ask any questions you have about the information and we will do our best to explain and provide any further information you require. My contact details are given at the end of this leaflet.

What is the purpose of the study?

The study is looking at the benefits of exercise in pregnancy. The study will have two stages. This first stage will ask people to help us develop an exercise programmes suitable for pregnant women. The next stage of the study will see if the exercise programme works; you will not be involved in this part of the study.

Why have I been invited?

The antenatal clinic has agreed to work with us to find up to 10 pregnant women to help us design the exercise programme. The study is with Naresuan University (Thailand) and University of East Anglia, United Kingdom (UK).

Do I have to take part?

No, it is up to you to decide. If you wish to take part please keep this information sheet. The researcher will meet with you at the antenatal care clinic and you will be asked to sign the consent form. You will also get a copy of the consent form to keep.

If you decide not to take part or wish to leave the study at a later date you may do so at any time without giving a reason. This will not affect the care you and your baby will receive. If you wish to leave the study, please contact the researcher: Sirikanok Klankhajhon in person or by phone on +66 (0) 895633784 (free call). All of the information we have collected to that point in time will be kept by the research team.

What will happen if I agree to take part?

You will be asked to come to talk with other pregnant women and some healthcare professionals, including a nurse. This will be to give us your ideas in a workshop setting. There will be 2 workshops a month apart. They will each last for 2 hours and be in a meeting

room at the hospital (Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand). In them we will discuss how to best design an exercise programme that is suitable for pregnant women in your area. The researcher and the assistant researcher will take some notes and the discussion will be audio recorded using a digital voice recorder.

In the first workshop we will discuss how to help pregnant women exercise. In the second workshop (1 month later) you will give your views about how the researcher could run an exercise programme in this area.

What are the possible benefits of taking part?

There may be no direct benefit to you from taking part in this study. However if you take part you will be helping us to find out how best to design an exercise programme that helps pregnant women in your area. We will provide drinks and snacks during the workshops and travel expenses of 150 baht as well as a gift voucher 300 baht at the end of each of the two workshops. Once we have completed this study. We will also send a summary of our findings to everyone who has taken part.

What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages to taking part. Taking part in the study will not affect the treatment you or your baby will be offered in the antenatal clinic as part of the usual care provided.

Will my taking part in the study be kept confidential?

Yes, we will follow ethical practice and all information you provide will be treated in confidence. All information you give us will be kept confidential and will not be shared with anyone else. However, if you tell us something that makes us worried about your safety or the safety of others then we will want to share this with clinical care team of hospital. We will ask for your permission to do so, but if you refuse it and we remain concerned about safety issue, we will have to discuss these serious issues with appropriate professionals.

We will ask you and others in the group not to talk to people outside the group about what was said in the group. We will, in other words, ask each of you to keep what was said in the group confidential. While we plan to publish the results of the study in scientific journals and present at conferences, they will not contain any names and we will ensure that individuals cannot be identified in the reports or study results.

Complaints: If you have any complaints about the study, you can use the hospital complaints procedure. Address: Patient Complaint Centre, Health Promoting Hospital, 3rd Regional Health Centre, 157, M.1, T. Nakhon Sawan-ook, A. Mueang, Nakhon Sawan, 60000

(Thailand). Telephone: (Thailand) +66 (0) 56 255 451, Office hours: Monday - Friday 8.30 am – 4.30 pm.

Who is organising and funding this research?

The study is part of my doctoral degree in Nursing at the University of East Anglia, Norwich (UK). The study is partly funded by Naresuan University, Phitsanulok (Thailand).

Has the project been approved on ethical grounds?

This study has been reviewed and approved by an independent group of people Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia which protects your safety, rights, wellbeing and dignity. The Health Promoting Hospital, 3rd Regional Health Centre (Thailand) has also reviewed and approved this study.

Yes, I would like to take part in the study – what do I need to do now?

The researcher will be in the antenatal care clinic during office hours and can be contacted by phone on +66 (0) 895633784 (free call). We will meet with you at your next visit to the clinic and answer any further questions you may have about the study before getting your consent and then tell you when the first workshop will be held.

I am not sure about taking part – where can I get further information?

We would be very happy to answer any questions you may have. Please contact the researcher: Miss Sirikanok Klankhajhon, (Thailand) +66 (0) 895633784, +66 (0) 55966647 (free call).

No, I do not wish to take part in the study – what do I need to do now?

You don't need to do anything further. Many thanks for your time.

If you require further information about this study please contact us.

- Researcher: Miss Sirikanok Klankhajhon

Address: Faculty of Nursing, Naresuan University, Phitsanulok, Thailand, 65000

Position: PhD student at School of Health Sciences, Faculty of Medicine and Health

Sciences, University of East Anglia, UK E-mail: Sirikanok_k@hotmail.com,

s.klankhajhon@uea.ac.uk

Telephone: (Thailand) +66 (0) 895633784, +66 (0) 55966647

THANK YOU FOR READING THIS INFORMATION SHEET

Participant Information Sheet for Healthcare Professionals: Workshops

Study title: Improving the exercise behaviour of pregnant women in Thailand

Can you help?

We would like to invite you to take part in this study. To help you to understand what this study is about, please take the time to read this information sheet carefully and discuss it with your family and friends if you wish. We want to be sure you understand the information that follows before you agree to participate. Be sure to ask any questions you have about the information and we will do our best to explain and provide any further information you require. My contact details are given at the end of this leaflet.

What is the purpose of the study?

The study is looking at the benefits of exercise in pregnancy. The study will have two stages. This first stage will ask people how best to run exercise programmes for pregnant women. This will help us understand what pregnant women want in an exercise programme and test the benefit of the exercise programme you have helped us design here that could benefit for the pregnant women in the future. The next stage will determine if the exercise programme works.

Why have I been invited?

You have been invited to take part in this study because you are a health care worker who provides health promotion information to pregnant women attending the antenatal clinic. As an experienced healthcare professional your expertise is valued. I need to find up to 8 healthcare professionals to participate in the study. We need you to share your knowledge and experience in a workshop that aims to develop a programme to exercise suitable for pregnant women and which could be delivered within the Thai healthcare service.

Do I have to take part?

No, it is up to you to decide. If you wish to take part please keep this information sheet. The researcher will meet with you at the antenatal care clinic and you will be asked to sign the consent form. You will also get a copy of the consent form to keep.

If you decide not to take part or wish to withdraw the study at a later date you may do so at any time without giving a reason. A decision to withdraw or not to take part, will not affect to your work or responsibilities. If you wish to withdraw the study, please contact the researcher: Sirikanok Klankhajhon in person or by phone on +66 (0) 895633784 (free call). All of the information we have collected to that point in time will be kept by the research team.

What will happen if I agree to take part?

This study will involve you coming to 2 workshops each being 2 hours long with the other healthcare professionals and some pregnant women. The 2 workshops will take place a month apart. The workshops will take place in meeting room at the hospital (Health Promoting Hospital, 3rd Regional Health Centre, Nakhon Sawan, Thailand). In them we will discuss how to best design an exercise programme that is suitable for pregnant women in your area. The researcher will take some notes and record using a digital voice recorder during the workshops. In the first workshop we will mostly discuss how to help pregnant women exercise enough. In the second workshop (1 month later) we will look at the suggestions from you for how exercise programmes could be run in the area for pregnant women.

What are the possible benefits of taking part?

There may be no direct benefit to you from taking part in this study. However if you take part you will be helping researchers to identify how best to design an exercise programme that works for pregnant women in your area. We will provide refreshments during the workshops, and a gift voucher 300 baht for taking part at the end of each of the two workshops. Once we have completed this study we will also send a summary of our results to everyone who has taken part.

What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages of taking part. Participating in the study will not influence or alter your position, responsibilities or work.

Will my taking part in the study be kept confidential?

Yes, we will follow ethical practice and all information you provide will be treated in confidence. We will ask you and others in the group not to talk to people outside the group about what was said in the group. We will, in other words, ask each of you to keep what was said in the group confidential. While we plan to publish the results of the study in scientific journals and present at conferences, they will not contain any names and we will ensure that individuals cannot be identified in the reports or study results.

Complaints

If you have any complaints about the study, you can do this through the hospital complaints procedure. Address: Patient Complaint Centre, Health Promoting Hospital, 3rd Regional Health Centre, 157, Moo1, Tambon Nakhon Sawan-ook, A. Mueang Nakhon Sawan, Nakhon Sawan, 60000 (Thailand). Telephone: +66 (0) 56 255 451, Monday - Friday 8.30 am – 4.30pm.

Who is organising and funding this research?

The study is a part of my PhD degree in Nursing at University of East Anglia, Norwich (UK).
The study is partly funded by Naresuan University, Phitsanulok (Thailand).

Has the project been approved on ethical grounds?

This study has been reviewed and approved by an independent group of people Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia which protects your safety, rights, wellbeing and dignity. The Health Promoting Hospital, 3rd Regional Health Centre (Thailand) has also reviewed and approved this study.

Yes, I would like to take part in the study – what do I need to do now?

The researcher will be in the antenatal clinic during office hours and can be contacted by phone on +66 (0) 895633784 (free call). We will meet with you at your convenience and answer any further questions you may have about the study and take your consent and then tell you when the first workshop will be held.

I am not sure about taking part – where can I get further information?

We would be very happy to answer any questions you may have. Please contact the researcher: Miss Sirikanok Klankhajhon, (Thailand) +66 (0) 895633784, +66 (0) 55966647 (free call).

No, I do not wish to take part in the study – what do I need to do now?

You don't need to do anything further. Many thanks for your time.

If you require further information about this study please contact us.

- Researcher: Miss Sirikanok Klankhajhon

Address: Faculty of Nursing, Naresuan University, Phitsanulok, Thailand, 65000

Position: PhD student at School of Health Sciences, Faculty of Medicine and Health Sciences, University of East Anglia, United Kingdom

E-mail: Sirikanok_k@hotmail.com, s.klankhajhon@uea.ac.uk

Telephone: (Thailand) +66 (0) 895633784, +66 (0) 55966647

THANK YOU FOR READING THIS INFORMATION SHEET

Participant Information Sheet for Pregnant Women: Exercise Intervention

Study title: Improving the exercise behaviour of pregnant women in Thailand

Can you help?

We would like to invite you to take part in this study. To help you to understand what this study is about, please take the time to read this information sheet carefully and discuss it with your family and friends if you wish. We want to be sure you understand the information that follows before you agree to participate. Be sure to ask any questions you have about the information and we will do our best to explain and provide any further information you require. My contact details are given at the end of this leaflet.

What is the purpose of the study?

The purpose of this study is to investigate the benefits of exercise in pregnancy. This stage of the study is to test the benefits of an exercise programme

Why have I been invited?

The antenatal clinic has agreed to work with us to find up to 66 pregnant women to help us test the benefit of the exercise programme that discuss from the workshops in the first stage. We are seeking women aged 20 years and over, who have no health reason why they should not exercise during pregnancy. The study is with Naresuan University (Thailand) and University of East Anglia, United Kingdom.

Do I have to take part?

No, it is up to you to decide. If you wish to take part please keep this information sheet. The researcher will meet with you at the antenatal care clinic and you will be asked to sign the consent form. You will also get a copy of the consent form to keep.

If you decide not to take part or wish to leave from the study at a later date you may do so at any time without giving a reason. This will not affect the care you and your baby will receive. If you wish to leave the study, please contact the researcher: Sirikanok Klankhajhon in person or by phone on +66 (0) 895633784 (free call). All of the information we have collected to that point in time will be kept by the research team.

What will happen if I agree to take part?

You will be put into exercise or control group randomly by chance. You will be put in one of two groups. If you are in the control group, you will get the usual antenatal care only. The exercise programme was developed in workshops in discussion with other pregnant women and the healthcare professionals who look after them. You will be asked to complete questionnaires at 3 time points as follow:

1. At about 4 months of pregnancy, we will collect some information from you. The researcher will ask you about your age, schooling, occupation, expected date of delivery, number of pregnancy and children. The researcher will ask to look at your hospital records so that you can copy some information about your blood pressure, body weight, height and stress score. You will be asked some questions about your health and exercise or activities that you do.

2. At about 7 months of pregnancy, the researcher will ask to look at your hospital records so that you can copy some information about your blood pressure, body weight and stress score. You will be asked some questions about exercise and activities that you do. If you were in the group who did the exercise classes the researcher will ask you about your experience and how easy or difficult it was to come to classes and do the exercises. There are no right or wrong answers. The researcher will ask you how it was for you.

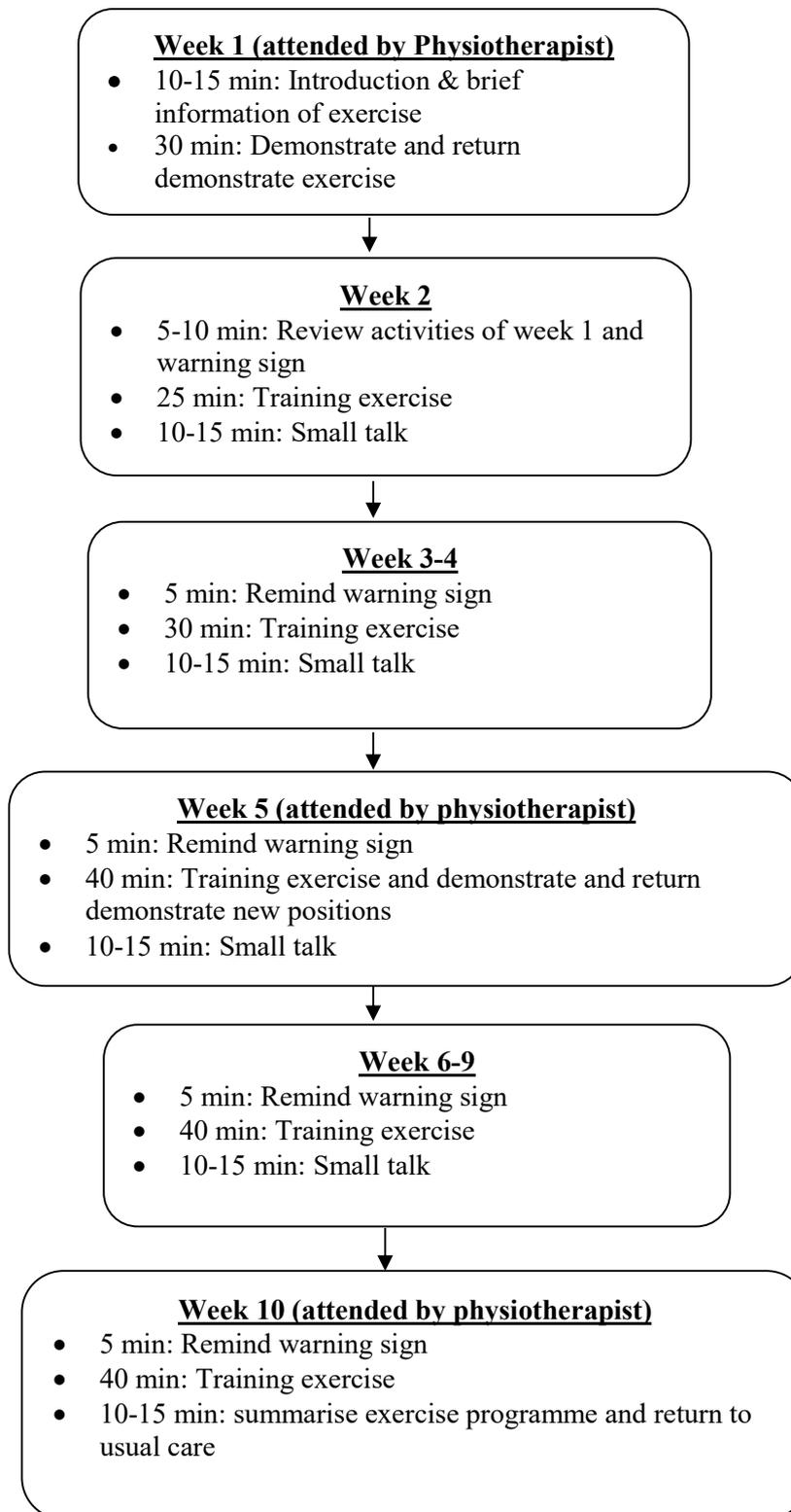
3. ~2 weeks after childbirth, you will be phoned by the researcher to ask you some short questions about your body weight when you were admitted in the delivery room, baby's birth weight and exercise behaviour from the exercise diary.

Each of these sets of questions will be carried out by the researcher who will ask the questions and fill in the form. You should take about 15-20 minutes each time. The stress score is measured as a part of the routine antenatal care. This is carried out by a nurse in the antenatal clinic. If your score is high then you will be seen by a counselling nurse who will provide some support and help to find out the causes of your stress.

If you are in the exercise group, you will attend an hour long session of exercise every week for 10 weeks at the hospital from around 18-20 weeks to 28-30 weeks of your pregnancy. The exercise classes will be under the supervision of the researcher and consultation of the physiotherapist. The physiotherapist will attend at the exercise class during the first, fifth and tenth week of intervention. Exercise education session consists of benefits of exercise, contraindications for exercise during pregnancy, warning signs, general regulations during exercise and intensity of exercise evaluation. The positions of exercise will be demonstrated by the researcher.

Each training session will include a 5 minutes warm up, 10-15 minutes muscular workout, 10-15 minutes low-impact aerobics and 5 minutes cool down. Duration of the exercise training will increase progressively from 20 minutes during the first week to 40 minutes at the fifth week. Pregnant women will self-report pulse rate using carotid pulse check (base rate and peak rate) and take a rest 10-15 minutes in the educational room. Then, the refreshments and remind appointment for next exercise class will be provided.

The protocol of the exercise programme



In addition, the researcher would like to get permission from you to access your medical records to check that exercise is suitable for you medically and also to collect data on

your height, weight, stress score and blood pressure during pregnancy and baby birth weight. You will be involved in the study for about 6 months in total.

What are the possible benefits of taking part?

There may be no direct benefit to you but your participation is likely to help us test if an exercise programme is practical to run again and evaluate with more pregnant women in a future research study. You will receive a gift voucher 1,000 baht for completing the study and travel expenses of 150 baht per time when you come to join an exercise programme at the hospital. Once we have completed this study we will also send our findings to everyone who has taken part.

What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages of taking part. Taking part in the study will not affect the treatment you or your baby will be offered in the antenatal clinic as part of the usual care provided. Safety protocol for exercise intervention will be provided to the participants in the intervention group by the researcher based on evidence from American College of Obstetricians and Gynecologists (ACOG), American College of Sports Medicine (ACSM) guidelines and the Department of Health, Thailand. If you had health issues that would mean that exercise was not medically recommended any more during the exercise intervention, you will be withdrawn from the study from that point. You will be referred to a nurse in the antenatal clinic for further usual care. If you are harmed in any way by taking part in this study your normal rights apply and you may have grounds for legal action.

Will my taking part in the study be kept confidential?

Yes, we will follow ethical practice and all information you provide us will be treated in confidence. All information you give us will be kept confidential and will not be shared with anyone else. However, if you tell us something that makes us worried about your safety or the safety of others then we will want to share this with clinical care team of hospital. We will ask for your permission to do so, but if you refuse it and we remain concerned about safety issue, we will have to discuss these serious issues with appropriate professionals.

While we plan to publish the results of the study in scientific journals and present at conferences; they will not contain any names and we will make sure that individuals cannot be identified in the reports or study results.

Complaints

If you have any complaints about the study, you can do this through the hospital complaints procedure. Address: Patient Complaint Centre, Health Promoting Hospital, 3rd Regional Health Centre, 157, M. 1, T. Nakhon Sawan-ook, A. Mueang Nakhon Sawan, Nakhon

Sawan, 60000 (Thailand). Telephone: +66 (0) 56 255 451, Office hours: Monday - Friday 8.30 am – 4.30pm.

Who is organising and funding this research?

The study is a part of my doctoral degree in Nursing at University of East Anglia, Norwich (UK). The study is partly funded by Naresuan University, Phitsanulok (Thailand).

Has the project been approved on ethical grounds?

This study has been reviewed and approved by an independent group of people Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia which protects your safety, rights, wellbeing and dignity. The Health Promoting Hospital, 3rd Regional Health Centre (Thailand) has also reviewed and approved this study.

Yes, I would like to take part in the study – what do I need to do now?

The researcher will be in the antenatal care clinic during office hours and can be contacted by phone on +66 (0) 895633784 (free call). We will meet with you at your next visit to the clinic and answer any further questions you may have about the study and take your consent and then tell you about the process of study.

I am not sure about taking part – where can I get further information?

We would be very happy to answer any questions you may have. Please contact the researcher: Miss Sirikanok Klankhajhon, (Thailand) +66 (0) 895633784, +66 (0) 55966647 (free call).

No, I do not wish to take part in the study – what do I need to do now?

You don't need to do anything further. Many thanks for your time.

If you require further information about this study please contact us.

- Researcher: Miss Sirikanok Klankhajhon

Address: 214/49, Moo 10, T.Nakhon Sawan-tok, A.Muang, Nakhon Sawan 60000

Position: PhD student at School of Health Sciences, Faculty of Medicine and Health Sciences, University of East Anglia, United Kingdom

E-mail: Sirikanok_k@hotmail.com, s.klankhajhon@uea.ac.uk

Telephone: (Thailand) +66 (0) 895633784, +66 (0) 55966647

THANK YOU FOR READING THIS INFORMATION SHEET

Participant Information Sheet for Pregnant Women: Telephone Interview

Study title: Improving the exercise behaviour of pregnant women in Thailand

Can you help?

We would like to invite you to take part in this study. To help you to understand what this study is about, please take the time to read this information sheet carefully and discuss it with your family and friends if you wish. We want to be sure you understand the information that follows before you agree to participate. Be sure to ask any questions you have about the information and we will do our best to explain and provide any further information you require. My contact details are given at the end of this leaflet.

What is the purpose of the study?

The purpose of this study is to test the benefits of exercise in pregnancy. This stage of the study is to explore the participant's experiences after participating in the exercise programme.

Why have I been invited?

We need to find up to 15 pregnant women who took part in the new exercise intervention for interviews. We believe that you can help us by telling us of your experiences and opinions about the new exercise programme. It may allow us to better understand about the exercise behaviour of women and provide insights regarding their experiences of the exercise programme as well as suggestions for improving the design in the future.

Do I have to take part?

No, it is up to you to decide. If you wish to take part please keep this information sheet. The researcher will meet with you at the antenatal care clinic and you will be asked to sign the consent form. You will also get a copy of the consent form to keep.

If you decide not to take part or wish to leave from the study at a later date you may do so at any time without giving a reason. This will not affect the care you and your baby will receive. If you wish to leave the study, please contact the researcher: Sirikanok Klankhajhon in person or by phone on +66 (0) 895633784 (free call). All of the information we have collected to that point in time will be kept by the research team.

What will happen if I agree to take part?

You will be interviewed by telephone at an agreed time and a location that is convenient to you. I will be calling you from a private room within the antenatal clinic. The telephone interviews will take between 30 and 45 minutes at least 1 week after finish the exercise programme. You will only be involved in one telephone interview. If you do not wish to answer any of the questions during the interview, you may say no and we will move on the

next question. The telephone interviews will be recorded with a digital telephone voice recorder.

What are the possible benefits of taking part?

There may be no direct benefit to you but your participation is likely to help us understand more about your experiences of the exercise programme for pregnant women. Your experiences will allow us to improve the exercise programme for pregnant women. We will give you a gift voucher 300 baht for taking part. Once we have completed this study we will also send our findings to everyone who has taken part.

What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages of taking part. Taking part in the study will not affect the treatment you or your baby will be offered in the antenatal clinic as part of the usual care provided.

Will my taking part in the study be kept confidential?

Yes, we will follow ethical practice and all information you provide will be treated in confidence. All information you give us will be kept confidential and will not be shared with anyone else. However, if you tell us something that makes us worried about your safety or the safety of others then we will want to share this with clinical care team of hospital. We will ask for your permission to do so, but if you refuse it and we remain concerned about safety issue, we will have to discuss these serious issues with appropriate professionals.

While we plan to publish the results of the study in scientific journals and present at conferences; they will not contain any names and we will make sure that individuals cannot be identified in the reports or study results.

Complaints

If you have any complaints about the study, you can do this through the hospital complaints procedure. Address: Patient Complaint Centre, Health Promoting Hospital, 3rd Regional Health Centre, 157, Moo1, Tambon Nakhon Sawan-ook, Amphoe Mueang Nakhon Sawan, Nakhon Sawan, 60000 (Thailand). Telephone: (Thailand) +66 (0) 56 255 451, Office hours: Monday - Friday 8.30 am – 4.30pm. except public holiday.

Who is organising and funding this research?

The study is a part of my doctoral degree in Nursing at University of East Anglia, Norwich (UK). The study is partly funded by Naresuan University, Phitsanulok (Thailand).

Has the project been approved on ethical grounds?

This study has been reviewed and approved by an independent group of people Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia which

protects your safety, rights, wellbeing and dignity. The Health Promoting Hospital, 3rd Regional Health Centre (Thailand) has also reviewed and approved this study.

Yes, I would like to take part in the study – what do I need to do now?

The researcher will be in the antenatal care clinic during office hours and can be contacted by phone on +66 (0) 895633784 (free call). We will meet with you at your next visit to the clinic and answer any further questions you may have about the study and take your consent and then arrange with you when the telephone interview will be held.

I am not sure about taking part – where can I get further information?

We would be very happy to answer any questions you may have. Please contact the researcher: Miss Sirikanok Klankhajhon, (Thailand) +66 (0) 895633784, +66 (0) 55966647 (free call).

No, I do not wish to take part in the study – what do I need to do now?

You don't need to do anything further. Many thanks for your time.

If you require further information about this study please contact us.

- Researcher: Miss Sirikanok Klankhajhon

Address: 214/49, Moo 10, T.Nakhon Sawan-tok, A.Muang, Nakhon Sawan 60000

Position: PhD student at School of Health Sciences, Faculty of Medicine and Health Sciences, University of East Anglia, United Kingdom

E-mail: Sirikanok_k@hotmail.com, s.klankhajhon@uea.ac.uk

Telephone: (Thailand) +66 (0) 895633784, +66 (0) 55966647

THANK YOU FOR READING THIS INFORMATION SHEET

Participant Information Sheet for Healthcare Professionals: Focus Group

Study title: Improving the exercise behaviour of pregnant women in Thailand

Can you help?

We would like to invite you to take part in this study. To help you to understand what this study is about, please take the time to read this information sheet carefully and discuss it with your family and friends if you wish. We want to be sure you understand the information that follows before you agree to participate. Be sure to ask any questions you have about the information and we will do our best to explain and provide any further information you require. My contact details are given at the end of this leaflet.

What is the purpose of the study?

The purpose of this study is to investigate the benefits of exercise in pregnancy. This stage of the study is to explore the healthcare professional's experiences of caring for pregnant women who have participated in the research exercise programme.

Why have I been invited?

We need to find up to 6 healthcare professionals who took part in the workshops to help design the exercise programme for pregnant women to participate in the focus group. We believe that you can help us by telling us of your experiences, opinions and ideas about the new exercise programme. It may allow us to better understand about the exercise behaviour of women and provide insights regarding their experiences of the exercise programme as well as suggestions for improving the design an exercise programme in the future.

Do I have to take part?

No, it is up to you to decide. If you wish to take part please keep this information sheet. The researcher will meet with you at the antenatal care clinic and you will be asked to sign the consent form. You will also get a copy of the consent form to keep.

If you decide not to take part or wish to withdraw from the study at a later date you may do so at any time and without giving a reason. A decision to withdraw or not to take part, will not affect to your work or responsibilities. If you want to withdraw from the study, please contact the researcher: Sirikanok Klankhajhon in person or by phone on +66 (0) 895633784 (free call). All of the information we have collected to that point in time will be kept by the research team.

What will happen if I agree to take part?

Your experiences of the exercise programme will be explored in a focus group. The focus group will take approximate 45-60 minutes at least 1 week after we finish the exercise programme. You will only be involved in one focus group. If you do not wish to answer any

of the questions during focus group, you may say no and we will move on the next question. The focus group will be led by the assistant researcher. The researcher will take some notes and the discussion will be audio recorded using a digital voice recorder.

What are the possible benefits of taking part?

There may be no direct benefit to you but your participation is likely to help us understand more about the exercise behaviour of pregnant women. Your experiences of the exercise programme will suggest us for improve the exercise programme for pregnant women. We will give you a gift voucher 300 baht for taking part. Once we have completed this study we will also send a summary of our results to everyone who has taken part.

What are the possible risks and disadvantages of taking part?

There are no known risks or disadvantages of taking part. Participating in the study will not influence or alter your position, responsibilities or work.

Will my taking part in the study be kept confidential?

Yes, we will follow ethical practice and all information you provide will be treated in confidence. We will ask you and others in the group not to talk to people outside the group about what was said in the group. We will, in other words, ask each of you to keep what was said in the group confidential. While we plan to publish the results of the study in scientific journals and present at conferences; these reports will not contain any names and we will ensure that individuals cannot be identified in the reports or study results.

Complaints

If you have any complaints about the study, you can do this through the hospital complaints procedure. Address: Patient Complaint Centre, Health Promoting Hospital, 3rd Regional Health Centre, 157, Moo1, Tambon Nakhon Sawan-ook, Amphoe Mueang Nakhon Sawan, Nakhon Sawan, 60000 (Thailand). Telephone: (Thailand) +66 (0) 56 255 451, Office hours: Monday - Friday 8.30 am – 4.30pm.

Who is organising and funding this research?

The study is a part of my PhD degree in Nursing at University of East Anglia, Norwich (UK). The study is partly funded by Naresuan University, Phitsanulok (Thailand).

Has the project been approved on ethical grounds?

This study has been reviewed and approved by an independent group of people Faculty of Medicine and Health Sciences Research Ethics Committee, University of East Anglia which protects your safety, rights, wellbeing and dignity. The Health Promoting Hospital, 3rd Regional Health Centre (Thailand) has also reviewed and approved this study.

Yes, I would like to take part in the study – what do I need to do now?

The researcher will be in the antenatal clinic during office hours and can be contacted by phone on +66 (0) 895633784. We will meet with you at your convenience and answer any further questions you may have about the study and take your consent and then tell you when the focus group will be held.

I am not sure about taking part – where can I get further information?

We would be very happy to answer any questions you may have. Please contact the researcher: Miss Sirikanok Klankhajhon, (Thailand) +66 (0) 895633784, +66 (0) 55966647 (free call).

No, I do not wish to take part in the study – what do I need to do now?

You don't need to do anything further. Many thanks for your time.

If you require further information about this study please contact us.

- Researcher: Miss Sirikanok Klankhajhon
Address: 214/49, Moo 10, T.Nakhon Sawan-tok, A.Muang, Nakhon Sawan 60000
Position: PhD student at School of Health Sciences, Faculty of Medicine and Health Sciences, University of East Anglia, United Kingdom
E-mail: Sirikanok_k@hotmail.com, s.klankhajhon@uea.ac.uk
Telephone: (Thailand) +66 (0) 895633784, +66 (0) 55966647

THANK YOU FOR READING THIS INFORMATION SHEET

APPENDIX T

Consent form

Consent Form: Workshops

Title of research project: Improving the exercise behaviour of pregnant women in Thailand

Name of researcher: Miss Sirikanok Klankhajhon (PhD student)

Please initial each box, sign and date and give to the researcher

Please initial each box separately

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, without my medical care or legal rights being affected.

3. Should I wish to withdraw from the study I agree that any information already collected can still be used.

4. I agree to allow the workshops to be recorded with digital voice recorder and for notes to be taken.

5. I agree to take part in the research project which has been explained to me.

Participant name:

Participant signature:

Date:

****A copy of this Informed consent form has been provided to the participant.**

Consent Form: Exercise Intervention

Title of research project: Improving the exercise behaviour of pregnant women in Thailand

Name of researcher: Miss Sirikanok Klankhajhon (PhD student)

Please initial each box, sign and date and give to the researcher

Please initial each box separately

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, without my medical care or legal rights being affected.

3. Should I wish to withdraw from the study I agree that any information already collected can still be used.

4. I agree to participate in the feasibility study and the data will be collected through structured individual and telephone interviews.

5. I agree to take part in the research project which has been explained to me.

6. I allow you to access my medical record during the study which has been explained to me.

Participant name:

Participant signature:

Date:

****A copy of this Informed consent form has been provided to the participant.**

Consent Form for Pregnant Women: Telephone Interview

Title of research project: Improving the exercise behaviour of pregnant women in Thailand

Name of researcher: Miss Sirikanok Klankhajhon (PhD student)

Please initial each box, sign and date and give to the researcher

Please initial each box separately

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, without my medical care or legal rights being affected.

3. Should I wish to withdraw from the study I agree that any information already collected can still be used.

4. I agree to allow the telephone interview to be recorded with a digital telephone voice recorder.

5. I agree to take part in the research project which has been explained to me.

6. I allow you to access my medical record during the study which has been explained to me.

Participant name:

Participant signature:

Date:

****A copy of this Informed consent form has been provided to the participant.**

Consent Form for Healthcare Professionals: Focus Group

Title of research project: Improving the exercise behaviour of pregnant women in Thailand

Name of researcher: Miss Sirikanok Klankhajhon (PhD student)

Please initial each box, sign and date and give to the researcher

Please initial each box separately

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, without my legal rights being affected.

3. I agree to allow the focus group to be recorded with a digital voice recorder and for notes to be taken.

4. I agree to take part in the research project which has been explained to me.

Participant name:

Participant signature:

Date:

****A copy of this Informed consent form has been provided to the participant.**

APPENDIX U

Poster and leaflet for advertisement

Poster & leaflet for pregnant women: Workshops



**Are you a pregnant woman?
What do you want for exercise?
Your ideas would be
GREAT!**

JOIN US

**We need pregnant women for a study
To give us your ideas
for our new exercise programme.**

You will join two workshops with other pregnant women and healthcare professionals.

A gift voucher & travel expense will be given for your help.

Am I eligible to take part? You can take part if...

1. You are a pregnant women
2. You are 20 years old and over.
3. You are able to read, write, speak and understand Thai language.

How do I sign-up?

Please, contact the researcher Sirikanok Klankhajhon at the appointment area in the clinic or

Tel (free call): +66 (0) 895633784

**MUMMY!
We can be
healthy together**





Research Participants Wanted

Are you a health care worker?
Do you work with pregnant women?

Join Us

We are looking for health care worker to help us design the exercise programme for pregnant women.

You will take part in two workshops.

Your knowledge and experience will be valuable in designing a new programme of exercise activity.

A gift voucher will be given for your help.

Am I eligible to take part? You can take part if...

- You are a health care worker who provides health promotion information for pregnant women attending ANC.

How do I sign-up?

Please, contact the researcher Sirikanok Klankhajhon at the appointment area in the ANC or
Tel (free call): +66 (0) 895633784



Poster & leaflet: Exercise intervention



**Exercise in pregnancy
can benefit both
mum & baby**

JOIN US

We need pregnant women to join in the exercise programme.



You will join in the programme of activity for pregnant women over 10 weeks.

A gift voucher & travel expense will be given for your help.

You can take part if...

1. You are a pregnant woman without complications during pregnancy
2. You are 20 years old or over.
3. You are able to speak and understand Thai language.

How do I sign-up?

Please, contact the researcher Sirikanok Klankhajhon at the appointment area in the clinic or

Tel (free call): +66 (0) 895633784



MUMMY!

**We can be
healthy
together**

APPENDIX V

The permission letters for the study

A translation of the permission letter to conduct the research in the hospital



No. Sor Thor 0913.07/2764

The 3rd Regional Health Centre, Nakhon Sawan,
157, Phahonyothin Road, T. Nakhon Sawan-ook,
A. Mueang , Nakhon Sawan, Thailand 60000

7 September 2016

Subject: Permission for a nursing PhD candidate to conduct the research to support the doctoral-level study

Dear Miss Sirikanok Klankhajhon,

Reference: Letter of Sirikanok Klankhajhon (University of East Anglia) dated July 13, 2016.

The subject matters are as follows:

1. Request for permission to conduct the research under the Improving Exercise Behavior of Pregnant Women in Thailand.
2. Request for permission to inform the healthcare professionals involved about the research project.
3. Request for permission to access medical record of participants in the research project.
4. Request for permission to access and gather data from pregnant women and healthcare professionals who will participate in the research project.
5. Invite healthcare professionals to be participants and consultants in the research project.

In response the letter of your letter dated on July 13, 2016, requesting permission to conduct the research under the Improving Exercise Behavior of Pregnant Women in Thailand, we require the above lists 1-5 to be follow during the period of October to December this year with further period of study next year 2017.

In this regard, the Health Promoting Hospital under 3rd Regional Health Centre has considered and given permission to Miss Sirikanok Klankhajhon, a PhD candidate of UEA to conduct the research, with the following suggestions:

1. Submit a copy of the evidence of passing the Ethical consideration from UEA to Mrs. Pichakarn Wichiankunyarat (coordinator) before conducting the research including using facilities to do the research.
2. For the researcher to collect data and to access medical records in the content of the questionnaire and scope of the research project only.

Thank you very much for your kind consideration on this matter.

Sincerely yours,

Nursing Group
Health Promoting Hospital
Tel: 0 5625 5451 Ext. 232
Fax. 0 5625 5403

(Dr.Chanchai Pinmuang-ngam)
Director of 3rd Regional Health Centre

Certified Correct Translation

(MISS PAWIMON PRASANTHONG)
Plae2you Translation Services
www.plae2you.com Tel. 081 7022 948

A translation of the permission letter to conduct the research in the hospital

Dear the Director of 3rd Regional Health Centre via the Director of Health Promoting Hospital,

The Department of Nursing of the Health Promoting Hospital has received the copy of the approval the Ethical consideration from UEA.

In this regard, the Health Promoting Hospital under 3rd Regional Health Centre is pleased to confirm the permission that Miss Sirikanok Klankhajhon, a PhD candidate of the UEA, is permitted to conduct the research: the Improving Exercise Behavior of Pregnant Women in Thailand, dated on 7th September 2016 that is activated.

Thank you very much for your kind consideration on this matter.

(Mrs.Sirinanta Thitisap)

Public Health Technical Officer, Senior Professional level

To the Director of 3rd Regional Health Centre,

- Perceived
- Approved
- Proceeded
- Transferred to.....

(Dr.Nongnuch Pataraanuntanop)

Director of 3rd Regional Health Centre

Certified Correct Translation



(MISS PAWIMON PRASANTHONG)
Plae2you Translation Services
www.plae2you.com Tel. 081 7022 988

The permission letter from the physiotherapist's employer



Faculty of Allied Health Sciences
Naresuan University, Thapoo
Meung, Phitsanulok 65000 THAILAND
Tel : +66-559-66231 Fax : +66-559-66234

July 29th, 2016

Dear Ms.Sirikanok Klankhajhon,

According to your letter to invite Assistant Professor Dr. Kanokwan Srisupornkornkool, an academic staff at our faculty, to be a consultant on the research project entitled : Improving exercise behavior of pregnant women in Thailand, especially during the data collection period from October to December 2016, with further period of study next year 2017.

I would like to inform you that we are delighted to allow Assistant Professor Dr. Kanokwan Srisupornkornkool to be a consultant for this research project.

I wish you success in your research project as well as your study. If there any further information required, please do not hesitate to contact us.

Yours sincerely,

Professor Emeritus Taweessook Kanluan
Dean, Faculty of Allied Health Sciences

The agreement letter from the physiotherapist



Faculty of Allied Health Sciences
Naresuan University, Thapoo
Meung, Phitsanulok 65000 THAILAND
Tel : +66-559-66231 Fax : +66-559-66234

July 29th, 2016

Dear Ms.Sirikanok Klankhajhon,

Thank you very much for inviting me as a consultant on your research project : improving exercise behavior of pregnant women in Thailand both the workshops and feasibility study that carry out data collection in Thailand during the period of October to December this year, with further period of study next year 2017. It is an honor for me to participate on your research project.

I am looking forward to meet you and your research team.

Yours sincerely,

Assistant Professor Dr.Kanokwan Srisupornkornkool
Faculty of Allied Health Sciences

The agreement letter from the assistant researcher

The assistant researcher is a nurse/midwife since 2001 to present. Current, she works at Tambon Health Promoting Hospital, Banbung, Tambon Nongkrot, A. Banphotpisai, Naknon Sawan, Thailand.

66/1, Moo 1, Tambon Nongkrot,
A.Banphotpisai, Nakhonsawan,
Thailand, 60180

27th July 2016

Subject: Accepting invitation letter

Dear Sirikanok Klankhajhon,

Thank you very much for inviting me as an assistant researcher on your research project that carry out data collection in Thailand during the period of October to December this year with further period of study next year 2017. I understand my role as an assistant researcher for taking notes, recording voice by a digital voice recorder, facilitating and supporting the group discussion in the workshops and leading in the focus group. It is an honour for me to participate on your research project.

I am looking forward to meet you and your research team.

Best Regards,

Piyanat Chiamsuk (ปิยนัต ชัยสมศักดิ์)

Piyanart Chiamsuk

The confidentiality agreement from the assistant researcher

CONFIDENTIALITY AGREEMENT

Title of Research Project: Improving exercise behaviour of pregnant women in Thailand

As a member of this research team I understand that I may have access to confidential information about study sites and participants. By signing this statement, I am indicating my understanding of my responsibilities to maintain confidentiality and agree to the following:

- I understand that names and any other identifying information about study sites and participants are completely confidential.
- I agree not to divulge, publish, or otherwise make known to unauthorized persons or to the public any information obtained in the course of this research project that could identify the persons who participated in the study.
- I understand that all information about study sites or participants obtained or accessed by me in the course of my work is confidential. I agree not to divulge or otherwise make known to unauthorized persons any of this information, unless specifically authorized to do so by approved protocol or by the researcher acting in response to applicable law or court order, or public health or clinical need.
- I understand that I am not to read information about study sites or participants, or any other confidential documents, nor ask questions of study participants for my own personal information but only to the extent and for the purpose of performing my assigned duties on this research project.
- I agree to notify the researcher and field supervisor immediately should I become aware of an actual breach of confidentiality or a situation which could potentially result in a breach, whether this be on my part or on the part of another person.

ปิยนดา เขียมศักดิ์
____ 6 July 2016 ____ Piyanat Chiamsuk (ปิยนดา เขียมศักดิ์)
Signature Date Printed name

ศิริกานท์ กลั่นหงษ์
____ 6 July 2016 ____ Sirikanok Klankhajhon ____
Signature of researcher Date Printed name

**An approval letter from the Faculty of Medicine and Health Sciences Research Ethics
Committee, University of East Anglia, United Kingdom**

Faculty of Medicine and Health Sciences Research Ethics Committee



Sirikanok Klankhajon
HSC

Research & Enterprise Services
West Office (Science Building)
University of East Anglia
Norwich Research Park
Norwich, NR4 7TJ

Telephone: +44 (0) 1603 591490
Email: fmh.ethics@uea.ac.uk

Web: www.uea.ac.uk/researchandenterprise

14.10.16

Dear Sirikanok,

Project title: Improving the exercise behaviour of pregnant women in Thailand.
Reference: 2015/2016-46

The amendments to your above proposal have been considered and I can confirm that your proposal has been approved.

Please could you ensure that any further amendments to either the protocol or documents submitted are notified to us in advance and also that any adverse events which occur during your project are reported to the Committee. Please could you also arrange to send us a report once your project is completed.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Mark Wilkinson', is written over a horizontal line.

Mark Wilkinson
Chair FMH Research Ethics Committee

Cc Kenda Crozier

Sirikanok Klankhajon
HSC

Research & Enterprise Services
West Office (Science Building)
University of East Anglia
Norwich Research Park
Norwich, NR4 7TJ

Telephone: +44 (0) 1603 591490
Email: fmh.ethics@uea.ac.uk

Web: www.uea.ac.uk/researchandenterprise

28.03.17

Dear Sirikanok,

Project title: Improving the exercise behaviour of pregnant women in Thailand.

Reference: 2015/2016-46

The amendments to your above proposal have been considered and I can confirm that your proposal has been approved.

Please could you ensure that any further amendments to either the protocol or documents submitted are notified to us in advance and also that any adverse events which occur during your project are reported to the Committee. Please could you also arrange to send us a report once your project is completed.

Yours sincerely,



Mark Wilkinson
Chair FMH Research Ethics Committee

Cc Kenda Crozier

APPENDIX W

Protocol of exercise programme for pregnant Thai women

The protocol of the exercise programme, based on recommendation of ACOG, ACSM and MoPH (ACOG, 2002, 2015; ACSM, 2014; Suputtitada, 2005) is designed as follows:

1. Exercise class format

Participants will attend a hospital-based group exercise class once a week, 20-40 minutes/session over 10 weeks (total of 10 prescribed sessions). Exercise classes will split participants into two small classes (16-17 women a class) at an educational room on Thursday and Friday, from 1.30 to 2.30 pm. The exercise training will be under the supervision of the researcher as an instructor in consultation with a physiotherapist. The physiotherapist will attend the first, fifth, and tenth weeks of the exercise class.

2. Inclusion criteria

The target population is pregnant women without contraindications for exercise, based on the checklist of the Physical Activity Readiness Medical Examination for Pregnancy in the Thai version (PARmed-X) (Davies et al, 2003; Suputtitada, 2005) at gestational age (GA) 18-20 weeks until GA 28-30 weeks.

3. Exercise class

Exercise education session will consist of benefits of exercise, contraindications for exercise during pregnancy, warning signs to be aware of during pregnancy, general regulations and intensity of exercise evaluation. The contents of exercise during pregnancy will be explained by the researcher at the first class of the exercise programme. General regulations will consist of clothing, food and drink, safety for exercise during pregnancy. Intensity of exercise will be evaluated by carotid pulse check and talk test. Positions of exercise, from easy positions at the first week and progressed up to advanced positions at the fifth week, will be demonstrated by the researcher. However, warning signs to be aware of

will be reminded every week. Each exercise training session will include five-minute warm up (muscle stretching), 10-15 minute muscular workout, 10-15 minute low-impact aerobics (cardiovascular exercise) and five-minute cool down (muscular progressive relaxation) with Thai exercise music. The exercise training session will include dynamic exercises from head to toe. Duration of the exercise training will increase progressively from 20 minutes during the first week to 40 minutes at the fifth week. It will start with a set of five repetitions per exercise and will progress up to two sets of 10 repetitions.

During the exercise class, pregnant women will be observed closely and any warning signs will be picked up by the researcher. If pregnant women experienced any contraindications and/or warning signs against exercise, they would be referred to nurses (ANC) for further care. Pregnant women will do a self-report pulse rate using carotid pulse check (base rate and peak rate) and take a rest about 10-15 minutes in the educational room. Then, the researcher will provide refreshments and reminded an appointment for the next class.

The overall goal of exercise will be emphasised. This is to encourage pregnant women to achieve moderate exercise comprising 30 minutes or more of accumulated exercise in a day (at least 10 minutes a session), at least three times a week (American College of Obstetricians and Gynecologists (ACOG), 2002; American College of Sports Medicine (ACSM), 2014). The participants will be advised to perform exercise at home at least twice a week.

Posters and leaflets (see Appendix X) will be provided for pregnant women at the first class of the exercise programme. The exercise information such as leaflets and posters will be uploaded on the group chat application (Line application). The exercise schedule (see Appendix Y) will be updated as a motivator for exercise at least once a week via the group chat. All participants will be reminded at least two days before exercise class via the group chat by the researcher. If the participants did not respond, the researcher would phone them directly via chat call application (Line call) or phone number.

APPENDIX X

Poster and leaflet for the exercise intervention

Poster for the exercise intervention

Exercise during pregnancy

Recommendation: Pregnant women without contraindications** should do moderate exercise at least 30 minutes or more of accumulated exercise a day (at least 10 minutes a session), at least 3 days a week.

Step of exercise: 5 minutes warm up period, 20-30 minutes muscular workouts and/or cardiovascular training and 5 minutes cool down. ❤️ Please, check your pulse rate before and after exercise.

Contraindications for exercise:** cardiovascular diseases, multiple gestation, second or third-trimester bleeding, placenta previa, premature labour, ruptured membranes, pregnancy induced hypertension, hypertension, anemia, extreme morbid obesity, extreme underweight, orthopedic limitations, Heavy smoker, and other significant medical condition.

1. Warm up

2. Muscular workouts

3. Cardiovascular exercise:

Marching and marching with arm and waist exercise 10-20 minutes

4. Cool down

Warning signs during exercise

1. Vaginal bleeding
2. Regular painful contractions
3. Feel like leaking amniotic fluid
4. Difficulty in breathing before exertion
5. Light-headedness (dizziness)
6. Headache, blurred vision
7. Muscle weakness
8. Calf pain or swelling
9. Decreased fetal movement

**Please, contact your nearest hospital to make sure you don't have these conditions

For more information, contact Sirikamok Kankhajhon: sirikamok_k@hotmail.com, 08-9563-3784, Picture by Ruirira Butcha

Leaflet for the exercise intervention

Cardiovascular exercise



Cardiovascular exercise is good for your heart, lungs and blood circulatory system that raises your heart rate and increases your blood circulation such as brisk walking, low impact aerobics, swimming, and racquet sports. You can marching with arm and waist exercise



Cool down



Cool down is the final step of exercise that include stretching to help relax the muscles from head to toe and help to heart rate down near base rate as follows:

1. Tailor sitting and thoracic extension



2. Extremities stretching & progressive relaxation



Warning signs during exercise

1. Vaginal bleeding
2. Regular painful contractions
3. Feel like leaking amniotic fluid
4. Difficulty in breathing before exertion
5. Lightheadedness (dizziness)
6. Headache, blurred vision
7. Muscle weakness
8. Calf pain or swelling
9. Decreased fetal movement

If you have any warning signs, should stop exercise immediately and contact healthcare professionals.



For more information, please contact Sirikanok Klankhajhon: sirikanok_k@hotmail.com, 08-9563-3784

Exercise during pregnancy



Rujji

Picture by Rujira Butcha



Recommendation:

Pregnant women without contraindications** should do moderate exercise at least 30 minutes or more of accumulated exercise a day (at least 10 minutes a session), at least 3 days a week.

Step of exercise: 5 minutes warm up period, 20-30 minutes muscular workouts and/or cardiovascular training and 5 minutes cool down.

Contraindications for exercise**:

- Cardiovascular diseases,
- Multiple gestation,
- Second or third-trimester bleeding,
- Placenta previa,
- Premature labour,
- Ruptured membranes,
- Pregnancy induced hypertension,
- Hypertension,
- Anemia,
- extreme morbid obesity & underweight, and
- Other significant medical condition.

**Please, contact your nearest hospital to make sure you don't have these conditions



Warm up

Warm up should be the first step of exercise for preparing the body and mind including preventing muscle injuries around 5 minutes as follows:

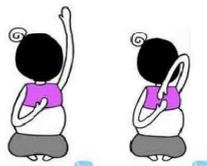
1. Cervical stretching: 1 set 10 repetitions



2. Pectoral stretching: 1 set 10 repetitions



3. Triceps stretching: 1 set 10 repetitions



♥ Please, check your pulse rate before and after exercise.

Muscular workouts

Muscular workouts include dynamic exercises from head to toe around 10-20 minutes as follows:

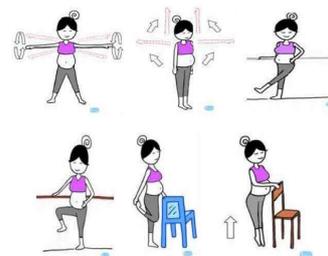
1. Pelvic rock and leg lift



2. Arm exercise and rib lifting



3. Leg and gluteus exercise



APPENDIX Y

The schedule of the exercise programme

Week 1 (attended by physiotherapist)

- 13.30-13.45: Introduction and brief knowledge of exercise including provide poster, leaflet and attached file on group chat (10-15 minutes)
- 13.45-14.15: Demonstrate and return demonstrate of exercise (muscular workouts 1 set of 5 repetitions & cardiovascular exercise 5 min) (30 minutes)
- 14.15-14.30: Small talk (10-15 minutes)

Week 2

- 13.30-13.40: Review activities of week 1 and warning sign (5-10 minutes)
- 13.40-14.05: Training exercise (muscular workouts 1 set of 10 repetitions & cardiovascular exercise 5 min) (25 minutes)
- 14.05-14.20: Small talk (10-15 minutes)

Week 3-4

- 13.30-13.35: Remind warning sign (5 minutes)
- 13.35-14.05: Training exercise (muscular workouts 1 set of 10 repetitions & cardiovascular exercise 10 min) (30 minutes)
- 14.05-14.20: Small talk (10-15 minutes)

Week 5 (attended by physiotherapist)

- 13.30-13.35: Remind warning sign (5 minutes)
- 13.35-14.15: training exercise and demonstrate and return demonstrate exercise 2 new exercises*** (muscular workouts 2 sets of 10 repetitions & cardiovascular exercise 10 min) (40 minutes)
- 14.15-14.30: Small talk (10-15 minutes)

Week 6-9

- 13.30-13.35: Remind warning sign (5 minutes)
- 13.35-14.15: Training exercise (muscular workouts 2 sets of 10 repetitions & cardiovascular exercise 10 min) (40 minutes)
- 14.15-14.30: Small talk (10-15 minutes)

Week 10 (attended by physiotherapist)

- 13.30-13.35: Remind warning sign (5 minutes)
- 13.35-14.15: Training exercise (muscular workouts 2 sets of 10 repetitions & cardiovascular exercise 10 min) (40 minutes)
- 14.15-14.30: Summarise exercise programme and returning to usual antenatal care (10-15 minutes)

APPENDIX Z

Baseline characteristics of excluded participants in the study

Baseline characteristics mean (\pm SD) or n	Intervention group (n = 2)	Control group (n = 3)
Maternal age	26 \pm 2.82	36.67 \pm 1.15
Family income	33,333.33 \pm 15,275.25	33,333.33 \pm 15,275.25
Pre-pregnancy BMI	21.12 \pm 1.54	23.91 \pm 4.58
Educational level		
- Primary school	0	1
- Secondary school	1	0
- College degree	0	1
- Bachelor's degree	1	1
Gravida		
- Primigravida	2	0
- Multigravida	0	3
Number of children		
- None	2	0
- Having children	0	3
Occupation		
- Government/ employee	0	1
- Self-employed	1	1
- Housewife	1	1
Location of work		
- Inside home	1	0
- Outside home	0	2
- None	1	1
Area of living		
- Urban area	1	3
- Rural area	1	0

APPENDIX AA

CONSORT 2010 checklist of information to include when reporting a pilot or feasibility trial

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a pilot or feasibility randomised trial in the title	Page cover
	1b	Structured summary of pilot trial design, methods, results, and conclusions (for specific guidance see CONSORT abstract extension for pilot trials)	1
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale for future definitive trial, and reasons for randomised pilot trial	5
	2b	Specific objectives or research questions for pilot trial	5-6, 79
Methods			
Trial design	3a	Description of pilot trial design (such as parallel, factorial) including allocation ratio	90
	3b	Important changes to methods after pilot trial commencement (such as eligibility criteria), with reasons	-
Participants	4a	Eligibility criteria for participants	97
	4b	Settings and locations where the data were collected	111
	4c	How participants were identified and consented	97-98
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	93-95
Outcomes	6a	Completely defined prespecified assessments or measurements to address each pilot trial objective specified in 2b, including how and when they were assessed	91-92, 98-100
	6b	Any changes to pilot trial assessments or measurements after the pilot trial commenced, with reasons	-
	6c	If applicable, prespecified criteria used to judge whether, or how, to proceed with future definitive trial	193-196
Sample size	7a	Rationale for numbers in the pilot trial	97

Section/Topic	Item No	Checklist item	Reported on page No
	7b	When applicable, explanation of any interim analyses and stopping guidelines	97
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	93-94
	8b	Type of randomisation(s); details of any restriction (such as blocking and block size)	93
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	93
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	93
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	-
	11b	If relevant, description of the similarity of interventions	96
Statistical methods	12	Methods used to address each pilot trial objective whether qualitative or quantitative	101-102
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were approached and/or assessed for eligibility, randomly assigned, received intended treatment, and were assessed for each objective	141-143
	13b	For each group, losses and exclusions after randomisation, together with reasons	141-143
Recruitment	14a	Dates defining the periods of recruitment and follow-up	140
	14b	Why the pilot trial ended or was stopped	141-142
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	145-146
Numbers analysed	16	For each objective, number of participants (denominator) included in each analysis. If relevant, these numbers	141-142

Section/Topic	Item No	Checklist item	Reported on page No
		should be by randomised group	
Outcomes and estimation	17	For each objective, results including expressions of uncertainty (such as 95% confidence interval) for any estimates. If relevant, these results should be by randomised group	146-153
Ancillary analyses	18	Results of any other analyses performed that could be used to inform the future definitive trial	146-153
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	146
	19a	If relevant, other important unintended consequences	-
Discussion			
Limitations	20	Pilot trial limitations, addressing sources of potential bias and remaining uncertainty about feasibility	218-220
Generalisability	21	Generalisability (applicability) of pilot trial methods and findings to future definitive trial and other studies	193-196
Interpretation	22	Interpretation consistent with pilot trial objectives and findings, balancing potential benefits and harms, and considering other relevant evidence	193-196
	22a	Implications for progression from pilot to future definitive trial, including any proposed amendments	193-196
Other information			
Registration	23	Registration number for pilot trial and name of trial registry	323, 330-331
Protocol	24	Where the pilot trial protocol can be accessed, if available	90-91
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	2, 301, 304, 309, 315
	26	Ethical approval or approval by research review committee, confirmed with reference number	119-120

APPENDIX AB

The checklist of quality assessment of studies

- **CASP Checklist for Qualitative studies (CASP, 2017)**
 1. Was there a clear statement of the aims of the research?
 2. Is a qualitative methodology appropriate?
 3. Was the research design appropriate to address the aims of the research?
 4. Was the recruitment strategy appropriate to the aims of the research?
 5. Was the data collected in a way that addressed the research issue?
 6. Has the relationship between researcher and participants been adequately considered?
 7. Have ethical issues been taken into consideration?
 8. Was the data analysis sufficiently rigorous?
 9. Is there a clear statement of findings?
 10. How valuable is the research?

Author	1	2	3	4	5	6	7	8	9	10	Quality
¹ Marquez et al. (2009)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
² Cioffi et al. (2010)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Satisfactory
³ Leiferman et al. (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
⁴ Krans & Chang (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
⁵ Krans & Chang (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
⁶ Bennett et al. (2013)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
⁷ Groth & Morrison-Beedy (2013)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
⁸ Marshall, Bland & Melton (2013)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Satisfactory
⁹ Fieril et al. (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁰ Muzigaba, Kolbe-Alexander & Wong (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory

- **Checklist 11 items for Quantitative studies (Albert Einstein College of Medicine of Yeshiva University, New York, 2002)**

1. Did the study address a clearly focused issue?
2. Did the authors use an appropriate method to answer their question?
3. Were the subjects recruited in an acceptable way?
4. Were the measures accurately measured to reduce bias?
5. Were the data collected in a way that addressed the research issue?
6. Did the study have enough participants to minimize the play of chance?
7. How are the results presented and what is the main result?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. Can the results be applied to the local population?
11. How valuable is the research?

Author	1	2	3	4	5	6	7	8	9	10	11	Quality
¹¹ Duncombe et al. (2009)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹² Haakstad et al. (2009)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹³ Cramps & Bray (2009)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁴ Evenson & Bradley (2010)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁵ Ribeiro & Milanez (2011)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁶ Melton et al. (2013)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁷ Da Costa & Ireland (2013)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁸ Santos et al. (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
¹⁹ Guelfi et al. (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
²⁰ Put, Chuang & Chan (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory
²¹ Merx et al. (2017)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	Yes	Yes	Satisfactory
²² Evenson et al. (2009)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Satisfactory