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Pre-service health and physical education teachers' obesity-related nutrition knowledge and food habits

Thea Werkhoven, Dr Wayne Cotton and Dr Kate Russell

Abstract

This study aimed to quantify the levels of nutrition knowledge of pre-service health and physical education teachers as well as their ability to provide suitable weight-based advice to overweight adolescents. The influence of degree progression, gender and their own food habits on knowledge and ability was also assessed. Pre-service health and physical educators (n=72) were surveyed at three consecutive points in their degree with a questionnaire designed to extract information on demographics, food habits, nutrition knowledge related to obesity and knowledge about obesity counselling. Degree progression resulted in improvements to nutrition knowledge, as expected. When surveyed just prior to degree completion, scores on repeated measures reflect inaccuracies in obesity-related nutrition knowledge and the propensity to advocate inappropriate weight-control advice to future overweight students. Females had higher levels of obesity-related nutrition knowledge than males. Gender was also significantly associated with obesity counselling knowledge among students in their second and fourth years of study and with dieting behaviours in second- and third-year students, with female students more likely to diet for weight control than their male peers. These results identify the need for further research into methods of increasing nutrition knowledge and obesity counselling skills in pre-service health and physical education teachers.

Contact details:
Thea Werkhoven
Faculty of Education and Social Work
The University of Sydney, NSW 2006
Tel: + 61 2 9351 4247
Email: thea.werkhoven@sydney.edu.au

Dr Wayne Cotton
Faculty of Education and Social Work
The University of Sydney, NSW 2006
Tel: + 61 2 9351 4247
Email: wayne.cotton@sydney.edu.au

Dr Kate Russell
Faculty of Education and Social Work
The University of Sydney, NSW 2006
Tel: + 61 2 9351 4247
Email: kate.russell@sydney.edu.au

Introduction

Australian obesity

Among the adult and paediatric populations of Western countries worldwide, two chronic conditions have long been the subject of scrutiny and public health concern. These are overweight and obesity, both of which are linked to comorbidities and detrimental health outcomes in both the short and long term (Reilly & Kelly, 2011; Wake et al., 2013). In 1985, the World Health Organization (WHO) declared rates of worldwide obesity to have reached epidemic status in adults and children and, in turn, included it as a condition that required a plan of action (World Health Organization, 1986). The Ottawa Charter was developed by WHO (1986), with public health issues such as obesity in mind. Health professionals in industrialised countries such as Australia have used the Charter to create goals for reducing rates of obesity and underpinning the care of obese individuals. The need for a global action plan was recognised when WHO released statistics representing the extent of the rise in rates of prevalence of obesity from 1980 to 2008. Across the three decades, the worldwide prevalence of obesity had almost doubled and 35% of the adult population was classified as overweight or obese. It was also reported that, in 2011, there were more than 40 million children aged five years or under who were overweight (World Health Organization, 2014). The Australian population has not been immune to the rise in prevalence of these diseases and, for more than three decades, they have remained the main foci of public health campaigns and social issues (National Health and Medical Research Council, 2013).

Of particular interest to this article are rates of paediatric overweight and obesity in Australian children aged between 5 and 17 years. In this age group, national health surveys conducted every four years show that the proportion of children who are overweight or obese has not changed significantly over the last eight years, with the proportion remaining high. The most recent survey, conducted across 2011/12, showed that 25.3% of children aged 5–17 years were classified as overweight or obese according to their height, weight and gender, made up of 17.7% being overweight and 7.6% being obese (Australian Bureau of Statistics, 2012). Contrary to public perception, these rates are now at a plateau and Australian children are no longer

getting significantly fatter (Olds, Tomkinson, Ferrar, & Maher, 2010). Predictions made for the Australian paediatric population paint a dire prospect, in contradiction to the apparent plateau in rates, estimating that over the next twenty years approximately a third of all children will be classified as overweight or obese (Haby, Markwick, Peeters, Shaw, & Vos, 2012), reaching rates seen in the adult population (Norton, Dollman, Martin, & Harten, 2006). These differences in opinion occur due to varying methods of analysis of population datasets and statistical algorithms to predict future prevalence.

While there is contention surrounding the accepted rates of prevalence of paediatric obesity, current research is ongoing to determine at which age children are at greater risk of developing obesity so that prevention and treatment strategies can be designed for this at-risk group. A British study involving 4000 children aged between 3 and 15 years was conducted to determine at which age they were more at risk of developing overweight or obesity (Hughes, Sherriff, Lawlor, Ness, & Reilly, 2011). Key findings were that children in the age range of 7–11 years old were more likely to develop overweight and obesity than from 3–7 and 11–15 years olds. The researchers found that, regardless of age, once a child developed issues with adiposity, they were likely to remain overweight or obese until the age of 15 years.

Food and nutrition education in Australian schools

Food and nutrition education for children in Foundation to Year 10 is addressed in Australian schools within the key learning area of Health and Physical Education (HPE), spanning primary and secondary schooling (Australian Curriculum, Assessment and Reporting Authority, 2014). *The Australian Curriculum: Health and Physical Education* (Australian Curriculum, Assessment and Reporting Authority, 2014) has two strands—one for movement and physical activity and the other for personal and community health. The strand concerned with health is inclusive of food and nutrition. *The Australian Curriculum: Health and Physical Education* (Australian Curriculum Assessment and Reporting Authority, 2014) notes that the intention of food and nutrition education is to enable children to make healthy food choices and equip them with appropriate knowledge and skills required to do so. It also aims to encourage children to question the influences on food habits and lead them to make improvements to their own diets based on knowledge and skill. This follows a previous statement by ACARA that the '*focus in the Health and Physical Education curriculum will be on understanding healthy choices in relation to nutrition, understanding the range of influences on these choices, and developing and applying the knowledge, understanding and skills to make healthier choices in relation to food and* nutrition (Australian Curriculum Assessment and Reporting Authority, 2012, p.11). Hence, pre-service HPE teachers must be effectively equipped with up-to-date and practical nutrition knowledge and adequate skills required to teach appropriately in accordance with these syllabus intentions.

> "Children in the age range of 7–11 years old were more likely to develop overweight and obesity than from 3–7 and 11–15 years old"

Role of health and physical educators in education to promote a healthy weight range

Obesity management strategies are complex and the treatment of paediatric overweight and obesity is not the sole responsibility of HPE teachers. Instead, HPE classes provide an opportunity for nutrition education to be presented in a manner that may benefit overweight and obese children.

However, in 1993, Rutz reported that practising teachers already employed in schools believed that they were perceived as agents of health promotion and involved in prevention of youth obesity and this matched public perception of their roles in prevention of and treatment for obese children (Rutz, 1993). Research has shown that up to 90% of HPE pre-service teachers believe that HPE educators should be involved in treating childhood obesity (Greenleaf, Martin, & Rhea, 2008; Greenleaf & Weiller, 2005) and are responsible for promotion of weight loss to overweight children in their care (Allensworth & Kolbe, 1987; Plimpton, 1987).

Practising teachers struggle with the apparent discord between public and personal perception of their roles in the treatment and prevention of childhood obesity in schools. In turn, this can impact on their ability to provide successful nutrition education to overweight or obese youth (Tinning, Macdonald, Wright, & Hickey, 2006).

Barriers to obesity prevention

Health-related degrees such as HPE, kinesiology and public health are ideal settings for the delivery of nutrition education that prepares pre-service HPE teachers with the required skills and knowledge to teach nutrition in schools. While the setting may be ideal, the acquisition of knowledge by the pre-service HPE students is highly dependent on the perceived value of receiving this education and of the importance of being health promoters in schools.

Although some pre-service teachers exhibit enthusiasm towards the concept of being health-promotion agents in schools, not all share this view or wish to educate overweight students (Yager & O'Dea, 2005) and not all feel competently trained to fulfil this role (Davidson, 2007).

Common feedback received from practising teachers and school professionals is that they feel they lack training in nutrition (Morgan & Hansen, 2008) and methods of integrating weight-based prevention strategies into their classes, despite high levels of interest in the area of prevention (Jenkinson & Benson, 2010; Neumark-Sztainer, Story, & Coller, 1999; Stang, Story, & Kalina, 1997).

Practising teachers involved in health promotion are often aware of their lack of nutrition knowledge and inability to teach nutrition and health effectively (Fox, Cooper, & McKenna, 2004). However, when questioned, these teachers are often unsure of methods to overcome barriers to improve their skills and knowledge (Haines, Neumark-Sztainer, & Thiel, 2007).

Common barriers to being health-promotion agents in schools and providing nutrition knowledge include both intrinsic and extrinsic factors. Intrinsic factors include attitudes and beliefs that affect motivation to teach nutrition and extrinsic factors include drawbacks in the school environment and institution rather than their own competence (Kinnunen & Lewis, 2013). Extrinsic factors include the pressure of achieving syllabus and curriculum requirements and having limited access to resources (Morgan & Hansen, 2008).

Obesity-prevention strategies implemented in schools often lack teacher involvement as they are not educated on the importance of their role in obesity prevention, often resulting in lower than expected outcomes of school-based programs (Yager & O'Dea, 2005).

Pre-service health educators are susceptible to unhealthy food habits such as dieting for weight control, and feel pressured by the culture of exercising for weight loss and diet cycling found among peers, thought to be instrumental to being competent HPE teachers (Schulken, Pinciaro, Sawyer, Jensen, & Hoban, 1997; Striegel-Moore, Silberstein, & Rodin, 1986). These unhealthy eating practices make the pre-service health educators more likely to discriminate based on weight and advocate unhealthful eating practices to overweight students in their classes (Bacon & Aphramor, 2011; O'Hara & Gregg, 2010).

Attitudes and knowledge held just prior to graduation can negatively impact the interactions that HPE teachers will have with overweight and obese students and the ways in which they teach them (Wright & Welch, 2011).

Aims of this study

The main issues raised by this study include

- the inclusion of obesity-related nutrition education in pre-service HPE teacher education to prepare HPE teachers to teach obesity- related nutrition
- the obesity counselling skills that they possess in order to be involved in obesity treatment and prevention in schools.

Key aims of the study include examining the levels of obesity-related nutrition knowledge, and any changes in obesity counselling skills throughout a health-related education degree. It is expected that nutrition knowledge and obesity counselling skills will be low at baseline and improve with degree progression, reflected in quantitative instruments used in this study.

Methods

Methodology, survey design and permission to collect data were granted as part of a wider research project approved by the corresponding authors' University's Human Ethics Committee.

Participants

Students at a major university in New South Wales who were training to become HPE teachers were recruited for this study, completing the first questionnaire in their second year of study (n=58). The same group of students was surveyed in their third and fourth year of study and were matched according to provided dates of birth. As the undergraduate degree that the students were enrolled in was four years in duration, the final survey represented attitudes of the pre-service HPE teachers just prior to completion of the degree and thus attitudes persisting through to practice.

In total, 58 students were surveyed across the three years from 2009–11, of which 34% were male (n=20) and 66% were female (n=38). Across all three time-points, 38 students completed the survey, resulting in a retention rate of 66%. Mean age of females at the time of first data collection was 23 years (SD=1) and mean age of males was 25 years (SD=4).

"Practising teachers involved in health promotion are often aware of their lack of nutrition knowledge and inability to teach nutrition and health effectively"

> *Significantly more males (35%) than females (3%) were dieting for weight gain*

Questionnaire

Participants in the study completed a survey, the 'Survey for Trainee Teachers' that had been developed and pilot tested on similar subjects (O'Dea & Abraham, 2001). It consisted of demographic questions, food habits, knowledge about growth, development and obesity and appropriate advice to give overweight teenagers. This survey was developed with an expert panel that also reviewed questions within the survey after piloting it, thus ensuring the face and content validity and clinical accuracy (O'Dea & Abraham, 2001).

Questions about participants' food habits asked participants if they were currently dieting to gain or lose weight (yes or no) and measured their satisfaction with their weight by asking if they wanted to be heavier or lighter (by a little or a lot) or stay the same weight.

Knowledge about growth and development and obesity was tested in a set of 11 questions embedded in a series of 20 true/false statements with false statements such as 'overweight people are generally unfit' and true statements such as 'body weight is largely genetically determined'.

Students' knowledge of appropriate advice to provide to overweight students in Years 7 and 8 (aged 11–14 years) was tested by providing participants with 18 pieces of advice and asking them to choose the appropriate options. Of the provided statements, only three were considered appropriate by the authors, including 'increase daily exercise/eat a variety of foods/avoid certain foods like chips, lollies and fried foods'. Inappropriate advice included options such as 'cleansing the body of toxins through a fast/drink water before meals to fill up'.

Statistical analyses

Data from the questionnaires were entered into SPSS Version 21.0 (IBM, 2012) and analysed using a combination of descriptive and parametric statistics. Chi-square analyses were conducted to compare time and gender differences and Fisher's Exact Test was used when sample sizes were less than 5. Repeated measures of analysis of variance were used to compare mean scores on questionnaires across each year of study and gender differences were explored using post-hoc tests. Significance was set at $p < 0.05$. Effect sizes (φ) were taken from Cohen's limits, appropriate for behavioural and social sciences with values of 0.10 for small effect, 0.30 for medium effect and 0.50 for large effect (Cohen, 1988).

Results

Food habits

Chi-squared tests for independence were conducted for each year of study against gender for each dieting behaviour and significant differences were found for males and females who were dieting to gain and lose weight. Results are shown in Table 1.

Gender was significantly associated with dieting for weight loss among second-year students, χ^2 (1, N=56) = 6.72, p = 0.01, with a greater proportion of females (61%) dieting for weight loss than males (25%). Fisher's Exact Test on this group revealed that significantly more males (35%) than females (3%) were dieting for weight gain (p = 0.002) and the effect size of this was large (φ = -0.44).

Similarly, gender was significantly associated with dieting for weight loss in the third-year cohort, χ^2 (1, N=49) = 10.21, p = 0.001 with a greater proportion of females (46%) dieting than males (5%). Fisher's Exact Test on this group revealed that significantly more males (43%) than females (4%) were dieting for weight gain (p = 0.001) and the effect size of this was large (φ = -0.48).

No significant difference was found in dieting for weight loss among males and females in their fourth year of study χ^2 (1, N=43) = 3.68, p = 0.06. However, Fisher's Exact Tests showed that significantly more males (41%) than females (8%) were dieting to gain weight (p = 0.02) and the effect size was medium to large (φ = -0.40).

Table 1. Proportion of males and females in each year group who reported dieting to either lose or gain weight

	2nd Year		3rd Year		4th Year	
	Males n=20 (%)	Females n=38 (%)	Males n=21 (%)	Females n=28 (%)	Males n=17 (%)	Females n=26 (%)
Dieting behaviour						
To lose weight	25	61*	5	46**	18	46
To gain weight	35	3††	43	4††	41	8†

Chi-squared tests for gender, * chi-square 6.72, p < .05; df = 1, ** chi-square 10.21, p < 0.01; df = 1.
Fisher's Exact Test for gender, †† p < 0.01 and † p <0 .05.

Obesity counselling and nutrition advice

Dietary advice that the pre-service HPE teachers would advocate using when informing overweight teenagers on health and diet aged between 11 and 14 years of age is depicted in Table 2. Where the advice that would be given was by less than 15% of the pre-service HPE teachers, the advice is not shown in the table but is explained below.

Provision of appropriate advice

Advice considered to be appropriate for overweight teenagers had good response rates, with up to 100% of participants advocating increasing daily exercise and eating a variety of foods.

Provision of inappropriate advice

Spanning each year of study, up to 54% of participants advocated inappropriate advice such as informing their students that growing taller will help them grow out of it or that they should eat less food but more frequently.

Provision of inappropriate advice that would be given by 15% or less of participants

Across all years of study, no participants advocated the 'inappropriate advice' of becoming a vegetarian or to eat two meals a day instead of three. A maximum of 6% of participants advocated the practice of avoiding combining foods or cleansing the body of toxins through fasting. A maximum of 13% of participants (in their fourth year of study) advocated that overweight students should weigh themselves every day and a maximum of 10% (in their second year of study) advocated that overweight students should reduce their daily intake to 1500 calories.

Differences according to year of study

Only the advice to 'eat a variety of foods' was found to be significantly different, $\chi^2(2, N=22) = 6.00$, $p = 0.05$ among years of study. Three post-hoc McNemar's tests with Bonferroni corrections were conducted to explore this. However, no significant differences were found between groups. This is most likely due to the borderline nature of original significance found and the small sample size. Secondary analysis conducted split the data by gender to assess if changes in advocacy were significantly different for males and females across the three time points; however, no significance were found.

Differences according to gender

To determine if gender was associated with advice advocated for overweight teenagers at each year of study, three chi-squared tests for independence were completed. Significant associations were found between gender and advice in the second and fourth year of study but not in the third year of their degree.

There was a significant association between gender and the advice provided to 'eat less food but more frequently', $\chi^2(1, N=57) = 4.57$, $p < 0.05$. The odds ratio suggests that females are 3.58 times more likely to advocate this advice to overweight teenagers than males in their second year of study.

In the fourth and final year of study an association was found between gender and advice provided

> *"Up to 54% of participants advocated inappropriate advice"*

Table 2. Proportion of males and females in each year of study who would advocate the use of each piece of in/appropriate advice

	2nd Year		3rd Year		4th Year	
	Males n=21 % Yes	Females n=36 % Yes	Males n=19 % Yes	Females n=26 % Yes	Males n=16 % Yes	Females n=22 % Yes
Inappropriate nutrition advice						
Go on a strict weight reducing diet	10	0	0	0	19	0
Aim to lose 1–2 kilograms per week	24	14	16	12	25	9
Reduce their daily intake to 1200 calories	10	3	5	0	19	5
Drink water before meals to fill up	24	17	11	8	31	5
Choose only low-calorie foods	10	11	5	12	25	5
Cut out all between-meal snacks	24	14	11	4	31	0
Eat less food but more frequently	24	53*	42	38	44	36
Take a vitamin and mineral supplement	10	11	11	8	31	5
Inform them that growing taller will help them grow out of it	19	22	63	54	31	36
Appropriate nutrition advice						
Increase daily exercise	100	100	89	88	88	95
Eat a variety of foods	95	97	89	88	88	95
Avoid eating certain foods like chips, lollies, fried foods	81	86	74	65	81	50

Chi-square tests for gender differences, * chi-square 4.57, $p < 0.05$; df = 1.

to 'cut out all between-meal snacks'. Fisher's exact test (n<10) revealed males and females were both significantly likely to advocate providing this advice to overweight teenagers (p = 0.009, φ = -0.46), although this effect was very small.

Obesity-related nutrition knowledge

Analysis of the nutrition knowledge included scoring each participant for an overall total score of knowledge regarding growth, development, obesity and eating disorders as well as subscale scores for obesity and eating disorders. Only the total knowledge score and obesity subscale scores are reported as they are of interest to this article. Maximum scores possible for overall knowledge and obesity subscale were 20 and 11 respectively.

Table 3 depicts the per cent of males and females in each year of study who answered questions on the obesity subscale of the knowledge test incorrectly.

> *"Males (59%) were more likely than females (23%) to answer incorrectly"*

Differences according to gender

Chi-squared tests were conducted to determine if males and females answered the obesity subscale questions of the knowledge test differently. In the fourth year of study, likelihood of answering the obesity subscale questions incorrectly was significantly influenced by gender $\chi^2(1, N=56) = 5.23$, $p < 0.05$ where males (59%) were more likely than females (23%) to answer incorrectly and the effect size of this difference was medium (φ = .37).

Other significant differences between gender and knowledge were found. However, due to small sample sizes, Fisher's Exact Tests are reported instead of chi-squared. In the second year of study, more females (89%) than males (57%) answered the question 'underweight teens can delay their growth' correctly (p =0 .01) and the effect of this was medium (φ = 0.36). In the same year, more females (94%) than males (71%) answered the question 'slim people are generally healthier than others' correctly, (p = 0.04) and the effect of this was medium (φ = 0.32). One significant difference between gender and answer was found in third year of study on the question 'slim people are generally healthier than others' (p = 0.02) where more females (93%) than males (63%) answered correctly, with a medium effect (φ = 0.37). The strongest significant difference between gender and answer was observed in the fourth year of study on the question 'overweight teenagers should go on strict weight-reducing diets' (p=0 .05) where more females (96%) than males (53%) answered correctly, with a large effect size (φ = 0.50).

Differences according to year of study

In order to determine if the total knowledge score and obesity subscale scores were affected by the year of study that participants were in when they were surveyed, a one-way repeated measures analysis of variance was completed. Both total and subscale scores were not normally distributed, however this test was used as it is robust to small variations to this assumption (Field, 2013).

Table 3. Proportion of males and females who answered the obesity subscale of the knowledge test incorrectly.

		2nd Year		3rd Year		4th Year	
		Males n=21	Females n=35	Males n=21	Females n=35	Males n=21	Females n=35
	True/False	Incorrect (%)	Incorrect (%)	Incorrect (%)	Incorrect (%)	Incorrect (%)	Incorrect (%)
Obesity subscale of knowledge test							
Overweight teenagers should go on strict weight-reducing diets	F	48	23	32	11	47	5†
Girls begin their growth spurt before boys	T	24	6	0	4	0	5
Body weight is largely genetically determined	T	62	54	11	32	18	32
Using a spa or sauna is an effective method of weight control	F	5	6	11	0	6	0
Body weight should not increase after middle age	T	67	66	63	75	77	64
Weight on the hips has fewer health risks than weight in the chest or abdomen	T	52	34	42	36	59	23*
It is normal for teenage girls to put on weight around their thighs and hips	T	5	0	11	0	18	0
The growth spurt causes clumsiness in teenagers	T	62	46	21	11	6	14
Underweight teenagers can delay their growth	T	43	11†	11	11	24	5
Overweight people are generally unfit	F	33	34	37	21	18	9
Slim people are generally healthier than others	F	29	6†	37	7†	35	9

Chi-square tests for gender differences, * chi-square 5.28, p< 0.05; df = 1.
Fisher's Exact Tests for gender, † p < 0.05

In tests on the overall knowledge score, Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2(2, N=23) = 7.41$, $p = 0.025$, therefore degrees of freedom were corrected using the Huynh-Feldt estimate of sphericity ($\varepsilon = 0.82$). Overall knowledge score was significantly different between years of study, $F(1.64, 35.98) = 7.52$, $p < 0.005$). Post-hoc tests using the Bonferroni correction revealed insignificant improvements in knowledge score from second year of study to third (12.96 ± 2.95 points to 14.09 ± 2.45 points respectively, $p = 0.106$) and also from third year to fourth year (14.09 ± 2.45 points to 14.65 ± 1.92 points, $p = 0.220$). However, knowledge scores from second year of study to fourth and final year improved significantly ($p < 0.05$), increasing from 12.96 ± 2.95 to 14.65 ± 1.92. This suggests that with progressive years of study and training to become HPE teachers, knowledge about obesity and eating disorders improved.

In tests for the scores on the obesity subscale dealing solely with growth, development and obesity, Mauchly's test for sphericity indicated that the assumption of sphericity had been violated, $\chi^2(2, N=23) = 10.79$, $p = 0.005$, therefore degrees of freedom were corrected using the Greenhouse-Geisser estimate of sphericity ($\varepsilon = 0.71$). Tests of within-subjects effects showed that scores on the obesity subscale of the test were significantly affected by year of study, $F(1.43, 31.39) = 8.30$, ($p < 0.005$). Post-hoc tests using the Bonferroni correction revealed that degree progression improved scores on the obesity subscale, with mean score increasing from 7.74 ± 2.16 in second year to 8.83 ± 1.44 in third year ($p = 0.03$). The largest improvement in mean obesity subscale scores was between second and fourth year of study, increasing from 7.74 ± 2.16 in second year to 9.04 ± 1.46 in fourth year ($p = 0.01$). This supports the finding that content-specific units provided to pre-service HPE teachers improve their obesity knowledge and beliefs.

Differences according to year of study and gender

To assess if degree progression and gender both influenced total scores and obesity subscale scores, a mixed between-within analysis of variance was completed. The normality of the data was assessed using the Shapiro Wilk test for both males and females and although most of the scores were not normally distributed, the analysis was completed using the two-way repeated measures as it is considered robust against small deviations from normality (Field, 2013).

Mauchly's test for sphericity of the total knowledge scores indicated that the assumption of sphericity had been violated, $\chi^2(2) = 9.65$, $p = 0.008$, therefore degrees of freedom were corrected using the Huynh-Feldt estimate of sphericity ($\varepsilon = 0.80$). Sphericity had also been violated for obesity subscale scores, $\chi^2(2) = 6.67$, $p = 0.04$, so degrees of freedom were also corrected using the Huynh-Feldt estimate of sphericity ($\varepsilon = 0.87$).

Tests for between-subjects effects showed that gender has a significant effect on total knowledge score $F(1, 21) = 5.53$, ($p = 0.028$) and has a significant effect on obesity subscale scores, $F(1, 21) = 8.67$, ($p = 0.008$).

Bonferroni corrected post-hoc tests were conducted between years of study to explore any significant differences in total knowledge scores. No significant differences were found between second and third year of study ($p = 0.065$) or between third and fourth year of study ($p = 0.325$). Total knowledge scores significantly improved between second and fourth year of study ($p = 0.007$) with females having consistently higher scores than their male peers. Post-hoc tests on the obesity subscale scores revealed no significant differences between third and fourth year of study ($p = 1.00$); however, significant increases were found from second to third year ($p = 0.012$) and from second to fourth year ($p = 0.007$) with females having consistently higher scores than their male peers.

Discussion

Obesity-related nutrition knowledge

The pre-service HPE teachers surveyed in this study practised unhealthful food habits such as dieting for weight loss throughout their degrees and were likely to advocate advice to overweight students considered inappropriate for overall health. When provided with a mixture of true and false statements regarding the aetiology, treatment and implications of obesity in teenagers, the pre-service HPE teachers could not correctly identify all statements as correct or incorrect.

These findings are similar to those of O'Dea and Abraham (2001), who found that trainee home economics and physical education teachers in their final year of training had inadequate levels of knowledge and inappropriate beliefs and attitudes about nutrition, weight control and weight issues and dieted for weight loss. The likelihood of advocating lifestyle and diet advice to overweight teenagers that was considered to be inappropriate by a panel of dieticians and

> *"The pre-service HPE teachers… were likely to advocate advice to overweight students"*

eating disorder specialists was high in the O'Dea and Abraham 2001 study. This was seen in the maximum proportion of students advocating any one inappropriate statement, being 84%, higher than the maximum proportion of students in this study across their degree, which was 54%, observed among females in their third year of their degree.

However, in order to compare beliefs and knowledge, it is necessary to focus on maximum proportion of students advocating inappropriate advice in their fourth year of study, representing an equivalent duration of time spent in their degree receiving nutrition instruction. At this point, the maximum proportion of students who would advocate inappropriate advice was 44%, almost half that observed in O'Dea and Abraham's cohort, also seen among males.

The reduced proportion of students likely to advocate inappropriate obesity management advice to overweight teenagers is potentially due to the nature of the nutrition education they received. Between 2001 and the first point at which this study's cohort was surveyed in 2009, the Australian Dietary Guidelines changed from the Australian Healthy Eating Pyramid (National Health and Medical Research Council, 1992) to the Australian Guide to Healthy Eating pie graph (National Health and Medical Research Council, 2005), representing updates in nutrition education provided to students over the eight-year gap. Also, although it is known that students in 2001 were educated on factors affecting food habits, metabolism and obesity, it is possible that the nature of the education provided to this study's cohort was more closely matched to the statements included in the knowledge and counselling instruments.

Responses gathered on appropriate and inappropriate advice provided to overweight teenagers aged between 11 and 14 years of age indicated that the pre-service HPE teachers were lacking in training that would equip them with the knowledge necessary to teach or counsel overweight children in effective ways, with up to 54% recommending inappropriate advice. This is not as high as the results of O'Dea and Abraham (2001), who found that up to 84% of trainee teachers would advocate inappropriate advice, and this may be due to differences in a Bachelor of Education degree between 2001 and 2009–11, including the subjects offered, content and focus on nutrition education.

Where O'Dea and Abraham (2001) found that up to 87% of the trainee home economics and physical education teachers surveyed were likely to advocate for overweight teenagers to go on strict weight-reducing diets, the proportion of students in this study mirroring this advocacy was much lower. Across all three years of study a maximum of 19% advocated the use of this advice to overweight teenagers. This maximum occurred in male students in their fourth and final year of study and represents an inappropriate approach to counselling overweight teenagers as determined by the expert panel. It is possible that the males who advocated this advice misunderstood that a strict diet was not referring to an approved weight loss plan instigated through an agency such as general practitioner or weight-loss clinic and may represent possible ambiguity found in the wording of the statement.

Between gender, females demonstrated higher scores on knowledge of growth, development and obesity and had higher scores on nutrition knowledge than males, and this suggests that males are at higher risk of having insufficient knowledge to adequately teach nutrition in HPE classes or be effective health promotion agents in obesity prevention strategies in schools. Further research is required into the potential causes for gender differences in nutrition knowledge gained during a health degree as well as knowledge about growth, development and obesity.

In order to be effective health promotion agents in schools and be involved in obesity prevention, ideally the proportion of students who answered the knowledge test questions incorrectly should have been lower than seen in this study. As expected, knowledge scores improved with degree but did not reach full marks by the final year of study. This suggests that the nutrition education provided to pre-service HPE teachers needs to be more tailored, matching the required syllabus outcomes for the subject HPE in schools.

Food habits of participants

In the female cohort, up to 61% of participants expressed that they were dieting to lose weight at the time of being surveyed, despite the majority of them having a healthy weight according to the WHO categories (World Health Organization, 2000). In the male cohort, up to 25% of participants were dieting to lose weight while having a healthy weight. These overall figures are higher than the results of O'Dea and Abraham (2001), who reported dieting behaviours in 47% of females and 16% of males surveyed. These proportions are similar to those found in this study where 46% of females and 18% of males reported weight-based dissatisfaction and dieting

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behaviours to achieve weight loss. The danger of pre-service HPEs practising these unhealthy dieting behaviours is the potential for them to promote the behaviours to future students regardless of intention, passing on negative beliefs, attitudes and behaviours related to weight control (Cotugna & Vickery, 2005; Yager, 2010).

In the present study, significantly more females reported practising dieting behaviours to lose weight than males and this mirrors the findings of O'Dea and Abraham (2001) in their cohort of trainee home economics teachers, representing dissatisfaction with body weight. This is despite the significant result in the present study that females in their second and fourth years of study were more likely to be classified in the healthy weight range than overweight or obese, practising dieting behaviours when not required.

Limitations

Limitations of the study include the small sample sizes of each year group, including the dropout of males and females at each time point, resulting in a total small sample size of students that could be tracked longitudinally across all three years of study.

As the sample is one of convenience it is also possible that it is not representative of pre-service HPE teachers nationwide. The study did not collect information from participants on ethnicity, their perception of their readiness to teach or current attitudes towards the physical appearance of obese children, factors which have shown to be important in the roles of teachers in school-based health prevention strategies (Martínez-López, Zagalaz Sánchez, Ramos Álvarez, & de la Torre Cruz, 2010; Peters & Jones, 2010).

It is also possible that changes in knowledge that occurred over the progression of the degree were influenced by factors extrinsic to tertiary education, such as information gathered from the media, peers, professionals and personal research or other units of study completed as well.

Although the nutrition knowledge measured in this study was based upon obesity awareness, a better measure would have been one that represented nutrition knowledge that specifically reflected curriculum requirements such as knowledge regarding the Australian Dietary Guidelines and the Australian Guide to Healthy Eating (National Health and Medical Research Council, 2013).

Conclusions

The opportunity for pre-service HPE teachers to acquire nutrition knowledge to become effective health promotion agents involved in obesity prevention in schools exists through their tertiary education. Despite a formal tertiary education to improve nutrition knowledge, pre-service HPE teachers in their final year of study are likely to advocate inappropriate nutrition counselling advice to overweight teenagers in their care. They also inaccurately answered repeated nutrition knowledge questionnaires and displayed attitudes of body dissatisfaction regardless of healthy weight status.

In order for HPE teachers to fulfil syllabus requirements related to the promotion of the healthy weight range, act as health promotion agents and have a high level of personal nutrition knowledge/skill, their formal tertiary education would benefit from the inclusion of a mandatory nutrition elective. Such an elective would aid HPE teachers in overcoming common barriers they face to being effective health educators and equip them with the required accurate knowledge.

Future directions of research into the field of nutrition education and paediatric obesity management could include analysis into the expectations placed on educators to fulfil public health promotion in schools while fulfilling curricular requirements, what constitutes an appropriate level of nutrition knowledge for successful nutrition education and the personal views of practising teachers under the new HPE syllabus.

> *"Knowledge scores improved with degree but did not reach full marks by the final year of study"*

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