

1. Introduction

There is growing interest in the association between relative position in the socioeconomic hierarchy and health outcomes, with mounting evidence of relative deprivation as a significant predictor of health problems independent of the absolute level of standard of living (Kondo et al. 2008; Subramanyam et al. 2009; Salti 2010; Mishra and Carleton 2015; Elgar et al. 2016). This evidence tallies with the arguments proposed by Wilkinson (1996, 1997) and Wilkinson and Pickett (2007), according to which relative deprivation may jeopardize health outcomes directly through physiological effects of chronic stress and indirectly through greater likelihood of behavioral risks triggered by psychosocial stress. The empirical analysis of the relative deprivation as a risk factor has covered an array of health domains, ranging from mortality (Kondo et al 2015) to mental health (Wildman 2003), functional disability (Kondo et al 2009), subjective health (Saito et al 2014), sexually transmitted diseases (Harling et al 2014), etc. Beyond empirical contributions, papers like Adjaye-Gbewonyo and Kawachi (2012) and Côté-Lussier (2016) illustrate a number of conceptual and methodological issues concerning the use of relative deprivation measures as explanatory variables for health outcomes.

This paper aims to advance the study of relative deprivation in two directions: i) by providing a methodological contribution for the use of relative deprivation measures as explanatory variables for health and social outcomes and ii) by producing evidence of the association between relative deprivation and body image dissatisfaction (BID), a relationship which, to the best of our knowledge, has not been researched yet. On the methodological count, alongside customary linear measures of relative deprivation we employ also concave measures, which differ in the assumptions made regarding the way higher standards of living impact on the individual. In addition, we address the problem of collinearity, which typically arises when absolute and relative measures of standards of living are used in the same regression as explanatory variables. We show that this problem can be lessened through

1 manipulations of the measures' formulae, but at the same time, we argue that the issue of
2 collinearity should be considered *in tandem* with the desirability of the functional form
3 quantifying relative deprivation.

4 BID is the negatively evaluated discrepancy between people's perceived and desired
5 physical appearances, a subjective evaluation which may occur irrespective of someone's
6 objective body shape (Grogan 2016). According to Bucchianeri and Neumark-Sztainer
7 (2014), BID is an overlooked public health concern. Beyond playing a major role as a
8 determinant for eating disorders (Stice et al. 2010; Rodgers et al 2016), BID is increasingly
9 found to be a potential risk factor for a number of health-related issues and health-
10 compromising behaviors. These include mental illness and sexual functioning (Davison and
11 McCabe 2005), lower levels of physical activity (Neumark-Sztainer et al 2006), binge
12 drinking and drug consumption (Field et al 2014), smoking (Kendzor et al 2009), reluctance
13 to undertake cancer screening (Ridolfi and Crowther 2013), poorer physical health-related
14 quality of life and psychosocial functioning (Wilson et al 2013), inflammatory conditions
15 (McDermott et. al 2015) and emotional wellbeing (Gall et al 2016). Grogan (2016) describes
16 how a growing number of people, due to the anxiety they develop about their body figure
17 and in the pursuit of unrealistic aesthetic ideals, resort to extreme dietary regimes, cosmetic
18 surgery, slimming pills and anabolic steroids, in many cases jeopardising their health.

19 There are reasons to hypothesize that relative deprivation is a risk factor for BID. Body
20 image is a dimension of a person's overall self-concept (Poloskov and Tracey 2013), and we
21 know that the self is deflated by the adverse psychosocial effects of lagging behind others,
22 such as the frustration and the feeling of worthlessness arising from 'looking upward' and
23 seeing more successful individuals (Wilkinson 1996 and 1997; Wilkinson and Pickett 2007).
24 Given that BID has a strong subjective component and is socially constructed (Tiggemann
25 2004; Grogan 2016), and in the light of evidence showing that relative deprivation cripples
26 self-esteem (Callan et al 2008), it is reasonable to hypothesize that the sense of inadequacy
27 triggered by comparisons with better-off individuals affects also a sphere of self-appreciation

1 such as physical appearance. We study the role of relative deprivation for the existence of
2 BID as well as for the type of dissatisfaction (i.e. dissatisfied due to feeling smaller or larger
3 than desired). Given the well-documented existence of marked gender-specific BID patterns,
4 with females more likely to feel larger than desired whilst males smaller than desired (Fallon
5 and Rozin 1985; Feingold and Mazzella 1998; Furnham et al. 2002; Cho and Lee 2013), we
6 refine our analysis by studying gender subsamples as well as by introducing an interaction
7 term between relative deprivation and the gender dummy – in this way also increasing our
8 understanding of the interplay between relative deprivation and socio-demographic variables
9 as advocated by Adjaye-Gbewonyo and Kawachi (2012).

11 **2 Methods and data**

12 ***2.1 Data and outcome variables***

13 For our empirical analysis, we use the health and household modules of the *Encuesta*
14 *Nacional de Salud y Nutricion 2012* (INSP 2012), a Mexican household survey which is
15 representative at national and state levels. The data collection was carried out by the Mexican
16 National Institute of Public Health between October 2011 and May 2012, employing the
17 2010 National Census as a sampling frame. We used the adults' module, where one
18 individual (aged 20+) was randomly selected and interviewed in each household. Surveyed
19 adults were 46,277 and after cleaning the dataset we were left with 45,912 observations. We
20 were able to employ 44,214 of them due to missing data in our dependent variables (1,618)
21 and in our covariates (80).

22 Subjective assessment of body image was carried out through the widely-used Contour
23 Drawing Rating Scale (Stunkard et al 1983; Thompson and Altabe 1991). This scale consists
24 of nine drawings of a body figure in increasing order from very thin to very obese, with
25 specific silhouettes for females and for males respondents as shown in Fig 1 – for a
26 detailed discussion of this methodology, see Gardner and Brown (2010). Respondents were

1 asked to choose which silhouette they believe best represents their current body image and
2 which silhouette represents their desired body image. Using these responses, we generated
3 two dependent variables: *BIDb*, a binary variable which equals 0 if the two selected
4 silhouettes coincide and 1 otherwise, and *BIDp*, a polytomous categorical variable
5 accounting for the type of the dissatisfaction, with a value of 0 if the two silhouettes coincide,
6 1 if the respondents feels smaller than desired and 2 if she feels larger than desired.

7 *[Figure 1]*

8 **2.2 Relative deprivation measures**

9 Our measures of relative deprivation are based on an asset index (see subsection 2.3). The
10 use of assets for the study of economic gradients in health is advocated by Pollak et al (2007),
11 Laaksonen et al (2009) and Sweet (2011). In addition, Bertram-Hümmer and Baliki (2015)
12 argue that their visible character makes assets particularly suitable for the construction of
13 relative deprivation measures. Our first measure of relative deprivation is the Yitzhaki
14 (1979) index, which is based on the difference between individual *i*'s achievement and the
15 achievements of better-off individuals in her reference group. We use a geographical
16 criterion for the definition of the reference group (people in the same state, so that there are
17 32 reference groups), and carry out robustness checks narrowing down this criterion further
18 by age and by gender – results are qualitatively unchanged and are made available in the
19 supplementary online material. Denoting individual *i*'s and individual *j*'s levels of wealth
20 with y_i and y_j , respectively, we use the Yitzhaki index
21
$$RDY(y_i, y_j) = \sum_j (y_j - y_i) / N, \forall y_j > y_i$$
, where N is the size of the reference group. The

22 Yitzhaki index has been extensively used in health research, and we refer the reader to
23 Adjaye-Gbewonyo and Kawachi (2012) and Côté-Lussier (2016) for the discussion of a
24 number of important issues (alternative normalizations, inclusion of the cumulative
25 distribution, etc.). A remark worth noting is that, while Yitzhaki (1979) does build upon
26 Runciman's (1966) theory of relative deprivation, in his approach 'there are no individual

1 comparisons' – as the author himself clarifies (Yitzhaki 1980, p. 575). In Yitzhaki's
2 framework, each level of income represents the ability to consume a certain bundle of
3 commodities and individual i 's relative deprivation is the aggregate value of the bundles she
4 is not able to consume. This means that, strictly speaking, the adoption of the Yitzhaki's
5 framework is not necessarily dependent on the idea that people actively engage in
6 interpersonal comparisons, which is instead the alternative motivation for the Yitzhaki's
7 framework proposed by Hey and Lambert (1980) – see also Esposito (2017).

8 The second measure we employ is a 'frugal' version of *RDY*, which we derive by simply
9 averaging higher wealth levels in the reference group rather than wealth differences:

$$10 \quad RDF(y_i, y_j) = \sum_j y_j / N, \forall y_j > y_i. \text{ Several papers have used simple reference group}$$

11 aggregates rather than $(y_j - y_i)$ or $[f(y_j) - f(y_i)]$ differences (e.g. Ferrer-i-Carbonell
12 2005; Luttmer 2005). However, these papers typically employ mean achievements of the
13 whole reference group while *RDF* focuses on better-off individuals in the reference group,
14 hence accommodating the 'focus' property for the measurement of relative deprivation – for
15 the role of this property in axiomatic characterizations of relative deprivation measures see,
16 *inter alia*, Ebert and Moyes (2000) and Bossert and D'Ambrosio (2014). Importantly, *RDF*
17 is a linear transformation of *RDY* and the way relative deprivation varies at different levels of
18 reference wealth is not affected (the partial derivatives of *RDY* with respect to y_j are in fact
19 independent of y_i). At the same time, however, due to this manipulation, in the formula for
20 *RDF* own wealth y_i features at the identification stage but not at the quantification stage.
21 This enables us to obtain a sizeable reduction in the correlation with absolute wealth
22 (specifically, from -.895 for *RDY* to -.796 for *RDF*).

23 We derive two additional measures which are concave rather than linear in y_j (i.e. their first
24 order derivatives with respect to y_j is positive, as for linear measures, but the second order
25 derivative is negative rather than being zero). Concave measures of relative deprivation
26 satisfy the so-called 'proximity' property (Esposito 2010; Bossert and D'Ambrosio 2014),

1 which is based on the sociological insight that a given additional achievement of a better-off
2 individual is felt more strongly the closer j is to i (Festinger 1954). For example, the reference
3 group of an assistant professor may well be the whole academic body, but the incremental
4 effect on her relative deprivation at the news of a colleague's important publication is likely
5 to be greater if that colleague were an associate professor than if she were a full professor or
6 a Nobel laureate. The desirability of concave measures has also been advocated for the
7 importance attributed by Runciman (1966) and Gurr (1968) to the notion of feasibility, with
8 concavity as a way of progressively deflating higher reference achievements to account for
9 their more difficult attainability. Finally, concavity has been argued for on account of an
10 interpretation of relative deprivation as social exclusion as in Sen (2000), the intuition being
11 that the increase in someone's sense of isolation or exclusion would be greater if closer rather
12 than more distant better-off individuals enjoy further advancements.

13 The two concave measures we employ are simple transformations of RDF , namely its
14 logarithm ($RDFlog$) and its square root ($RDFsr$). These measures serve well our purpose
15 because, whilst they both enable us to incorporate the 'proximity' and 'feasibility' insights
16 discussed above into our estimations, $RDFlog$ is less correlated than RDF with absolute
17 wealth (-.747) whereas $RDFsr$ is more correlated (-.799). We exploit this difference to shed
18 light on how functional form (linearity vs concavity) and collinearity contribute to the
19 performance of alternative measures employed as regressors. On the basis of the correlation
20 with absolute wealth and of the resulting collinearity, we would expect a better performance
21 of $RDFlog$ as a predictor for BID compared to RDF , but not of $RDFsr$. Details on the
22 derivation of our measures and Stata codes are available in the supplementary online
23 material.

24 **2.3 Covariates**

25 We derived our measure of absolute wealth by combining 38 indicators of dwelling
26 characteristics, access to services and durable goods ownership into a single metric. We did
27 this by following a widely used methodology based on principal component analysis (PCA)

1 for the calculation of asset indices (Filmer and Pritchett 2001). PCA uses the indicator's
2 covariance matrix to produce a series of orthogonal weights (components) for each indicator.
3 As is customary (Filmer and Scott 2012), we use the weights from the first component to
4 generate our asset index.

5 Given that 36 of 38 indicators included were collected as either binary (ownership vs not
6 ownership) or categorical (e.g. 'type of floor', 'type of roof'), we construct our index using
7 the polychoric correlation matrix – which according to Kolenikov and Angeles (2009) is
8 particularly suitable for discrete data. The list of indicators and the weights produced by
9 PCA can be found in the supplementary online material. By construction, the asset index has
10 a mean of zero and we rescaled it so that zero represents the worst-off household and around
11 14 the best-off household, whilst maintaining the original standard deviation. We note that
12 our index includes ownership of second homes, cars, motorcycles, speedboats, computers
13 and cable TV, items which closely match the notion of 'affluence' which has been found
14 useful for the study of relative deprivation (e.g. Elgar et al. 2016) and has been argued by
15 Côté-Lussier (2016) to well represent the notions of prestige and power stressed by
16 Runciman (1966).

17 Other variables we control for in each of our models are gender, level of education (no
18 education/primary, secondary, or post-secondary), age, age squared, whether the respondent
19 is married, whether she is employed and three health status variables – whether she had a
20 health problem in the last two weeks of the survey, number of limitations in performing daily
21 life activities and presence of a chronic illness. Due to space limitation, in the paper we
22 report only regression results for our explanatory variables of interest – full tables are made
23 available in the supplementary online material.

24 ***2.4 Empirical strategy***

1 Binary and multinomial logit models are employed to study the probability of our two
2 outcomes $BIDb$ and $BIDp$ as a function of relative deprivation and the above-mentioned
3 covariates. Formally, our base model is:

$$4 \Pr(Y_i = O_o | RD_i, X) = \alpha + \beta RelativeDeprivation_i + \gamma X + \varepsilon_i, \text{ where}$$

$$5 o = 0,1 \text{ for } BIDb;$$

$$6 o = 0,1,2 \text{ for } BIDp,$$

7 where dependent variable Y_i denotes individual i 's dissatisfaction with own body image for
8 our logit models ($o = 0,1$) and the type of her dissatisfaction for our multinomial logit
9 models ($o = 0,1,2$). X is the vector of control variables and γ the relevant vector of estimated
10 coefficients, expressed as odds ratios (OR henceforth) as is the case for relative deprivation's
11 coefficient, β ; α is the constant term and ε_i is the random-error term.

12 We first estimate binary and multinomial logit models for all four measures of relative
13 deprivation to study their performances as predictors of BID. Then we explore the existence
14 of gender-specific patterns in the role of relative deprivation by using female and male
15 subsamples separately and by introducing an interaction term between gender and relative
16 deprivation. For the study of gender patterns we display results for $RDFlog$ as this is the
17 least collinear among our measures – results using other measures are qualitatively similar
18 and are made available in the supplementary online material. Our calculations were carried
19 out in Stata 13.1 with standard errors clustered at state level, and statistical significance is
20 set at p -values of 0.05 and 0.01 (indicated with * and ** in regression tables, respectively).

21 We assess collinearity using the Variance Inflation Factor (VIF) and goodness of fit using
22 the Bayesian Information Criterion (BIC). The BIC is chosen because it penalizes models
23 more heavily than other criteria for the introduction of additional regressors (Kass and
24 Raftery 1995), and therefore it is a stricter yardstick for evaluating the introduction of an
25 interaction term in our gender analysis.

1 Our results are robust to Stata's *svy* estimations accounting for complex survey designs,
2 which are made available in the supplementary online material. In the paper we display
3 ordinary binary and multinomial logits because in the presence of weighted data (as in
4 the *svy* estimations) the likelihood function no longer reflects the joint probability
5 distribution of the data and therefore goodness of fit statistics based on the log-likelihood
6 such as the BIC are not valid (Stata 2013). We also use Stata's multiple imputation routine
7 to explore potential biases created by the 1,618 missing observations on our dependent
8 variables (3.52% of the total sample size). We obtained twenty alternative distributions for
9 such missing values by using our set of independent variables except for relative deprivation,
10 with and without absolute wealth, for both our binary and multinomial logit models. Results
11 are qualitatively unchanged using these newly generated data.

13 **3. Results**

14 Table 1 summarizes our dependent variables and their frequencies (overall and by gender).
15 Overall, only around 36% of respondents are satisfied with their body figure, and over half
16 (55%) feel larger than desired. Only 29% of the females in our sample are satisfied with their
17 body shape whilst over 45% of males are. Most females feel they are larger than desired
18 (65%) whilst for males this figure reduces to 43%. Almost 12% of males see themselves as
19 smaller than desired while among females this percentage halves.

20 *[Table 1]*

21 Table 2 presents descriptive statistics for our explanatory variables. Our absolute wealth measure
22 has a mean value of 6.9 and a standard deviation of 2.1, and the domains of our relative
23 deprivation measures span the 0-8.1 range (we rescaled *RDFlog* so that the whole domain is
24 positive). The sample consists of individuals with mean age of 43 where around 57% are female,
25 53% are employed and roughly 50% are married. Nearly 46% have an educational level that does
26 not go beyond primary school, while 28% and 26%, respectively, achieved secondary school and

1 post-secondary or university degrees. In terms of our health variables, around 15% reported
2 having some health problem, 10% has a chronic condition and the mean limitation in daily
3 activities is 0.16.

4 [Table 2]

5 In Table 3 we present regression results for the whole sample and without interaction terms.
6 Specifications (1)-(4) refer to logit models for *BIDb* and differ in the relative deprivation
7 measure used. *RDY* in specification (1) is not statistically significant but in specifications
8 (2)-(4) our alternative measures of relative deprivation are and indicate relative deprivation
9 as a risk factor for BID – OR are 1.06, 1.14, and 1.24 for *RDF*, *RDFlog* and *RDFsr*,
10 respectively. Specifications (5)-(8) employ the same set of explanatory variables in
11 multinomial logit models for *BIDp*. Relative deprivation is confirmed as a risk factor for
12 feeling smaller than desired, regardless of the measure used (OR ranging between 1.09 and
13 1.33), as well as for feeling larger than desired except for *RDY* which is not significant (OR
14 for *RDF*, *RDFlog* and *RDFsr* are 1.06, 1.17 and 1.26, respectively). The worst performance
15 of *RDY* is in keeping with its highest collinearity statistics and correlation with absolute
16 wealth, which are displayed in Table 4. Interestingly, in predicting feeling larger than
17 desired, for both *RDFlog* and *RDFsr* statistical significance is at 1% while for *RDF* it is only
18 at 5%, despite that correlation and collinearity statistics are worse for *RDFsr* than for *RDF*.
19 For females, the odds of feeling smaller than desired are 28% lower than for males while the
20 odds of feeling larger than desired are 137% higher. Absolute wealth is not associated with
21 feeling smaller than desired, but it predicts feeling larger than desired – OR ranging from
22 1.13 to 1.19. BIC statistics suggest that, for both the binary and the multinomial logits, the
23 ability to fit the data improves for specifications employing *RDF* rather than *RDY* and for
24 specifications using concave rather than linear measures.

25 [Tables 3 and 4]

1 In Table 5 we explore gender heterogeneity in the role of relative deprivation as a risk factor
2 for BID. Subsample analysis suggests that for females relative deprivation is a risk factor for
3 both feeling larger and feeling smaller than desired (OR are respectively 1.23 and 1.19),
4 while for males it is only for feeling smaller than desired with OR=1.14). The more pervasive
5 role relative deprivation plays for females is evident also from the introduction of an
6 interaction term in specifications (11) and (14). Since graphical analysis offers a clearer
7 interpretation of interaction terms in non-linear models (Greene 2010), in Figure 2 we plot
8 predicted probabilities of the three *BIDp* outcomes at different levels of relative deprivation
9 for specification (14). Gender heterogeneity in the role of relative deprivation is particular
10 evident in Panel *a* and Panel *c*, illustrating, respectively, how the probability of being
11 satisfied and the probability of feeling larger than desired vary over the relative deprivation
12 domain; it can be appreciated that, while for both genders the probability curves decrease in
13 Panel *a* and increase in Panel *c*, in both panels the slope is steeper for females. Panel *b* shows
14 that probability of feeling smaller than desired increases with relative deprivation, with
15 similar slopes for females and males.

16 *[Table 5]*

17 *[Figure 2]*

19 **4. Discussion**

20 The offer of this study is twofold. First, we provide methodological insights by adopting
21 measures of relative deprivation based on alternative functional forms (linear as well as
22 concave) and by addressing the issue of collinearity between absolute and relative indicators
23 of standard of living. Second, we add to the empirical literature on relative deprivation by
24 studying its association with of BID. Controlling for absolute wealth, our evidence indicates
25 relative deprivation as a risk factor for feeling smaller than desired (for both females and
26 males) and for feeling larger than desired (for females but not for males). Absolute wealth is

1 positively associated with feeling larger than desired, in line with a body of literature
2 describing how the concern for thinness and slenderness is more prevalent among
3 individuals of higher socioeconomic background (McArthur et al. 2005; Chen and Jackson
4 2008; Mintem et al. 2015; Swami 2015). By disentangling the roles played by absolute and
5 relative standards of living, we shed new light upon the social determinants of BID and show
6 that, at a given standard of living, a separate and detrimental role on the susceptibility to BID
7 is played by relative deprivation.

8 We employed four measures of relative deprivation, namely the Yitzhaki (1979) measure
9 (*RDY*) and three other measures which differ from it for employing own wealth for the
10 identification of richer individuals but not for the calculation of one-to-one relative
11 deprivation magnitudes – a technical device which enabled us to lower the correlation with
12 absolute wealth. *RDF* inherits *RDY*'s linear functional form (hence maintaining *RDY*'s
13 reference-wealth slopes) while *RDFlog* and *RDFrs* are based on concave functional forms
14 (positive first order derivative and a negative second order derivative in reference wealth)
15 reflecting the 'proximity' and 'feasibility' beliefs discussed above. *RDFlog* and *RDFrs* were
16 developed in a very simple way by applying less-than-linear transformations on individual
17 *i*'s total relative deprivation – other approaches to obtain concavity entail the modelling of
18 each achievement gap and/or of individual achievements themselves (Esposito 2010; Bossert
19 and D'Ambrosio 2014). We have chosen the above measures because they are simple indices
20 and they well illustrate the tension between statistical concerns (the correlation/collinearity
21 problem) and normative concerns (e.g. linearity vs concavity). While *RDFlog* has better
22 correlation/collinearity statistics than *RDF*, the opposite applies to *RDFrs*. Therefore, if
23 collinearity may be used to explain the better performance of *RDFlog* as an explanatory
24 variable for BID compared to *RDF*, the reason for the better performance of *RDFrs* must be
25 looked for elsewhere. Collinearity is undoubtedly a challenge for the simultaneous use of
26 absolute and relative indicators as predictors of social outcomes, yet this is not the sole issue

1 which needs to be taken into account. The functional form and the related properties adopted
2 for the quantification of the way relative deprivation impinges on individuals also matter.

3 It is important to stress that this does not mean that concavity is ‘inherently better’ than
4 linearity for the measurement of relative deprivation. While proximity and feasibility are
5 potentially important aspects of interpersonal comparisons, relative deprivation is not a
6 monolithic phenomenon for which an ‘exact’ measure exists. Relative deprivation may
7 trigger an array of emotions or states of mind, which include envy, anger, injustice, exclusion
8 and inadequacy. Runciman (1966) himself argues that there is a distinction between “those
9 feelings of relative deprivation which can and which cannot be properly described as a sense
10 of envy rather than the perception of unfulfilled right” (p. 252). The idea that a single metric
11 can capture at once the diverse implications that comparisons with more successful others
12 may have on the individual, or the way these implications are associated with different social
13 outcomes, is at best a simplification. Smith and Pettigrew (2014) stress that the ability to
14 measure relative deprivation more precisely, depending on type of emotions and outcomes
15 of interest, is paramount to fully understand how individual-level inequalities shape our
16 social experiences and affect our lives.

17 The potential pathways through which such a multifaceted phenomenon like relative
18 deprivation may lead to BID are multiple, complex and interrelated. For example, by
19 lowering people’s sense of self-worth, relative deprivation may trigger negative evaluations
20 of their personal qualities, even distorting objective circumstances, in a variety of
21 dimensions including physical attractiveness. It is also possible that being relatively deprived
22 in socioeconomic domains may increase the pressure for affirmation of the self through an
23 attractive body figure in order to gain some social recognition – hence leading those lower
24 down the socioeconomic ladder to adopt stricter evaluative standards for their physical
25 appearance. Relative deprivation may also foster unhealthy behaviors or eating patterns (as
26 Elgar et al. 2016 find for risk factors of obesity in adolescents), ranging from compulsive
27 eating to extreme dieting, leading to objective overweight or underweight statuses. Finally,

1 if a low position in society decreases people's ability to exercise control over their lives and
2 act on behalf of what matters to them (Marmot 2004), relative deprivation may be linked to
3 BID through weakening people's agency and ability to achieve the desired body figure.

4 Gender emerges as an important dimension in terms of both susceptibility to BID and
5 potential role of relative deprivation. Females are more dissatisfied than males with their
6 body image overall and they are more likely to feel larger than desired; by contrast, the
7 likelihood of feeling smaller than desired is greater among males. This is in line with the
8 large evidence of females being strongly concerned with adhering to an ideal of slimness
9 and slenderness whilst males with an ideal of a muscular and strong body (Silberstein et al.
10 1988; Furnham et al. 2002; Cafri and Thompson 2004; Smolak and Murnen 2008). We also
11 find gender heterogeneity in the predictive role of relative deprivation. In the health
12 literature, results on this vary depending on the specific health domain under study – for
13 example, a significant role of relative deprivation has been found for females but not for
14 males (mental health, Wildman 2003), for males but not for females (mortality, Kondo et al.
15 2015) or for both (self-rated health, Kondo et al. 2008). We find that relative deprivation is
16 a risk factor for both types of BID for females and for feeling smaller than desired (but not
17 for feeling larger than desired) for males. A more pervasive role of relative deprivation for
18 females is in accordance with the evidence that, compared to males, females have a more
19 relativist attitude to wellbeing (Corazzini, Esposito and Majorano 2012; Guven and Sørensen
20 2012) and to other domains related to inequality aversion (Croson and Gneezy 2009). The
21 fact that for males relative deprivation is a risk factor for feeling smaller than desired is
22 interesting, in particular because in males smaller-than-desired BID relates to muscular
23 inadequacy and powerlessness and therefore it assumes connotations of inferiority and
24 subordination which echo the feelings triggered by low socioeconomic position.

25 Strengths of this paper include methodological insights, their illustration using a large dataset
26 and novel empirical findings indicating relative deprivation as a risk factor for BID with
27 nuances across gender. At the same time, there are important limitations which should be

1 taken into account. A first limitation resides in the cross-sectional nature of our data, which
2 hinders the scope for causal claims. Beyond the inability to assert that relative deprivation
3 does effectively cause BID, a further challenge is the possibility of reverse causality – for
4 example through adverse effects of BID on self-confidence, leading in turn to poor
5 achievements in socioeconomic domains. An additional limitation of this paper is the
6 inability to shed light on the specific pathways described above potentially linking relative
7 deprivation and BID. A further challenge for studying the relationship between relative
8 deprivation and BID resides in the fact that physical attractiveness is itself a highly positional
9 aspect of our existence – people want to be ‘better looking than others’ rather than simply
10 ‘good looking’ (Solnick and Hemenway 1998; Bogaerts and Pandelaere 2013). Unfavorable
11 comparisons (both through media and in person) influence people’s levels of satisfaction
12 with their bodies (Fardouly et al. 2017), with the strength of the influence differing across
13 genders and ages (Myers and Crowther 2009). Relative deprivation and BID therefore share
14 a common element, which is the role of the reference group in shaping individuals’
15 evaluation of their own situations. The reference group for evaluating socioeconomic
16 circumstances may or may not coincide with the reference group for aesthetic evaluative
17 purposes, and different people have different reference groups in both the socio-economic
18 and aesthetic domains (Stouffer et al 1949; Franzoi and Klaiber 2007). Having information
19 on these aspects of interpersonal comparisons would enable a more detailed analysis.

20 In conclusion, our work paves the way for new avenues in the study of relative deprivation
21 as a predictor of social and health outcomes. Future empirical research should consider the
22 estimation improvements obtainable through measures which incorporate nuanced insights
23 on the way inequality impinges on the individual and/or which are less affected by
24 collinearity. At a theoretical level, it is crucial to develop a more precise characterization of
25 the absolute and of the relative dimensions, and to gain a fuller understanding of how much
26 these overlap with the notions of objective and subjective (Popham 2015). Not only would
27 this warrant more conceptual clarity on what these domains represent for the individual,

1 but it would also foster a more precise identification of potentially diverse dynamics
2 leading to health inequalities – within, and perhaps beyond, those known as material and
3 psychosocial pathways (Marmot and Wilkinson 2001). Finally, our evidence that lower
4 standing in the socioeconomic hierarchy is associated with higher risk of BID adds to the
5 literature showing a socioeconomic gradient in health. Inequality gets under our skin, and
6 it does so also through the mirror.

8 **Declaration of interest**

9 The authors have no interests to declare.

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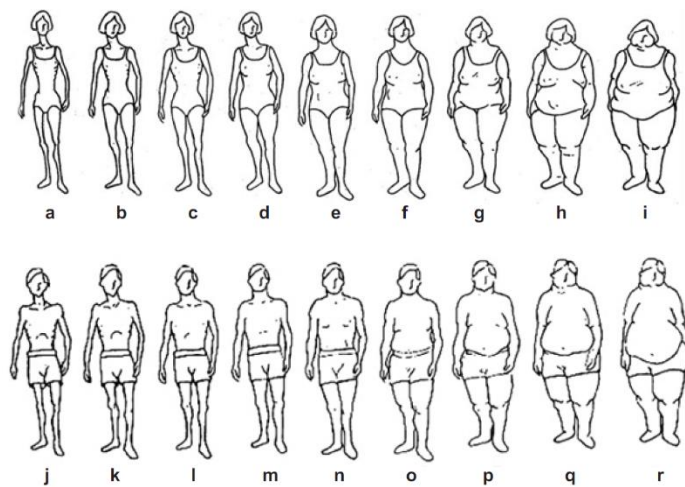
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Figure 1. Contour Drawing Rating Scale



Source: ENSANUT 2012 Questionnaire

Table 1. Dependent Variables, total and by gender (%).

	<i>BIDb</i>		<i>BIDp</i>		Row Total
		All	Females	Males	
Satisfied with body image	36.34 (16,069)	36.34 (16,069)	46.37 (8,621) 29.35	53.63 (7,448) 45.7	100 (16,069)
Dissatisfied with body image	63.66 (28,145)		63.66 (17,907) 70.65	36.34 (10,238) 54.30	100 (28,145)
Dissatisfied - Smaller than desired		8.44 (3,730)	41.15 (1,535) 6.06	58.85 (2,195) 11.65	100 (3,730)
Dissatisfied - Larger than desired		55.22 (24,415)	67.06 (16,372) 64.69	32.94 (8,043) 42.65	100 (24,415)
Column total	100 (44,214)	100 (44,214)	100 (25,355)	100 (18,859)	

BIDp=Binary outcome; BIDp=Polytomous outcome.

Number of observations in parentheses. For Females and Males columns, the top and the bottom figures indicate, respectively, row and column percentages.

Table 2. Independent Variables Descriptive Statistics

	Mean (SD)	Range	95% CI
Absolute Wealth	6.92 (2.15)	0, 13.99	6.90,6.94

RDY	1.09 (1.11)	0, 7.49	1.08,1.10
RDF	3.93 (2.07)	0, 8.10	3.91,3.95
RDFlog	5.72 (0.90)	0, 6.70	5.71,5.73
RDFsr	1.88 (0.61)	0, 2.85	1.88,1.89
Age	43.36 (15.76)	20, 101	43.23,43.52
Number of Physical Limitations	0.16 (0.49)	0, 7	0.16,0.17

Percentage
(Binary Variables)

Female	57.35 %
No Edu / Primary	45.61 %
Secondary	28.32 %
Post-Secondary	26.07 %
Married	50.93 %
Employed	52.70 %
Health problems	15.19 %
Chronic Illness	12.74 %

N 44,214

RDY=Relative Deprivation (Yitzhaki Index); RDF='frugal' specification of RDY; RDFlog and RDFsr=logarithm and square root of RDF, respectively.

Table 3. Logit and Multinomial Logit on BID. Odds Ratios

	<i>BIDb (Binary Logit)</i>				<i>BIDp (Multinomial Logit)</i>			
	Base Category: Satisfied				Base Category: Satisfied			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
						Feels Smaller than Desired		
Absolute wealth	1.13** (0.03)	1.15** (0.02)	1.14** (0.02)	1.15** (0.02)	1.03 (0.03)	1.01 (0.02)	0.99 (0.02)	1.01 (0.02)
RDY	1.05 (0.05)				1.15** (0.05)			
RDF		1.06** (0.02)				1.09** (0.02)		

RDFlog			1.14** (0.04)				1.16** (0.06)	
RDFsr				1.24** (0.08)				1.33** (0.11)
Female	1.97** (0.05)	1.98** (0.05)	1.97** (0.05)	1.98** (0.05)	0.72** (0.03)	0.72** (0.03)	0.72** (0.03)	0.72** (0.03)
Feels Larger than Desired								
Absolute wealth					1.13** (0.04)	1.18** (0.03)	1.18** (0.02)	1.19** (0.03)
RDY					0.99 (0.05)			
RDF						1.06* (0.03)		
RDFlog							1.17** (0.05)	
RDFsr								1.26** (0.10)
Female					2.36** (0.07)	2.37** (0.07)	2.37** (0.07)	2.37** (0.07)
N	44,214	44,214	44,214	44,214	44,214	44,214	44,214	44,214
BIC ^a	55,711	55,668	55,659	55,660	75,689	75,649	75,636	75,639

Logit and multinomial models with standard errors clustered at state level. * and ** denote significance at 0.05 and 0.01 levels.

Additional regressors: age, age squared, education, civil status, employment status, health problem in the last two weeks, number of daily life activities limitations and presence of chronic illness.

^a Bayesian Information Criterion.

RDY=Yitzhaki index; RDF='frugal' specification of RDY; RDFlog and RDFsr=logarithm and square root of RDF, respectively.

Table 4. Correlation and Variance Inflation Factor

	<i>Correlation Absolute Wealth and RD</i>	<i>VIF (only Absolute Wealth and RD in model)</i>	<i>VIF Absolute Wealth (full model)</i>	<i>VIF RD (full model)</i>
(I) RDY	-0.895	5.00	5.60	5.06
(II) RDF	-0.796	2.72	2.93	2.83
(III) RDFlog	-0.747	2.26	2.47	2.39
(IV) RDFsr	-0.799	2.77	2.95	2.92

VIF=Variance Inflation Factor

RDY=Yitzhaki Index; RDF='frugal' specification of RDY; RDFlog and RDFsr=logarithm and square root of RDF, respectively.

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Table 5. Logit and Multinomial Logit on BID by gender. Odds Ratios

	<i>BIDb (Binary Logit)</i>			<i>BIDp (Multinomial Logit)</i>		
	Base Category: Satisfied			Base Category: Satisfied		
	(9) Female	(10) Male	(11) Interaction	(12) Female	(13) Male	(14) Interaction
				Feels Smaller than Desired		
Absolute Wealth	1.17** (0.02)	1.11** (0.02)	1.14** (0.02)	0.99 (0.03)	0.99 (0.02)	0.99 (0.02)
RDFlog	1.21** (0.04)	1.08 (0.04)	1.09* (0.04)	1.19* (0.09)	1.14** (0.06)	1.11 (0.07)
Female			1.16 (0.18)			0.39** (0.12)
Female* RDFlog			1.10** (0.03)			1.11* (0.06)
				Feels Larger than Desired		
Absolute Wealth				1.20** (0.02)	1.17** (0.03)	1.18** (0.02)
RDFlog				1.23** (0.05)	1.10 (0.05)	1.08 (0.04)
Female						1.01 (0.16)

Female* RDFlog

1.16**
(0.03)

N	25,355	18,859	44,214	25,355	18,859	44,214
BIC ^a	30,003	25,634	55,653	39,938	35,751	75,617

Logit and multinomial models with standard errors clustered at state level. * and ** denote significance at 0.05 and 0.01 levels. Additional regressors: age, age squared, education, civil status, employment status, health problem in the last two weeks, number of daily life activities limitations and presence of chronic illness.

^a Bayesian Information Criterion.

RDY=Yitzhaki Index; RDF='frugal' specification of RDY; RDFlog and RDFsr=logarithm and square root of RDF, respectively.

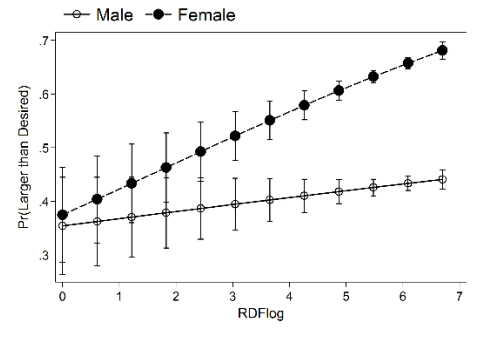
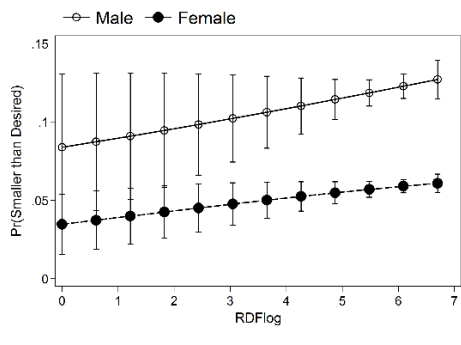
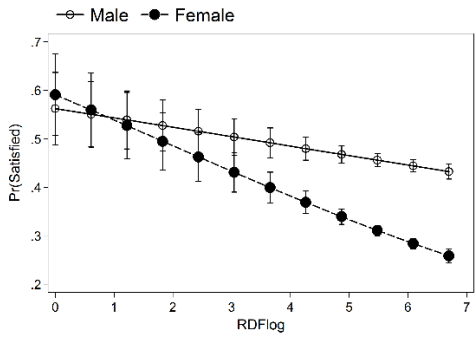
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Figure 2 Relative Deprivation and BID by Gender

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