



The Association between BMI and Body Weight Perception among Children in Turkey: A Cross-Sectional Study

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Abstract

Background: There is a complex relationship between body mass index (BMI) and body weight perception. The present study aimed to determine the relationship between BMI and body weight perception among middle-aged children.

Methods: This study was cross-sectional, and conducted among 333 children (9-11 yr) from the largest public school in Istanbul, Turkey between Oct 2019 and Jan 2020. BMI was calculated as weight divided by height squared (kg/m²). Body weight perception was determined using a photograph figure rating scale. Data were analyzed using SPSS version 24.0.

Results: Overall, 325 children (mean age 10.01 ± 0.99 yr) completed the study. According to the BMI classification, 8.6% of children were severely underweight, 4.9% underweight, 68.0% normal weight, 8.3% overweight, and 10.2% obese. However, 38.8% of the children perceived themselves as overweight, 21.2% as underweight, 20.3% as normal, 10.3% as overweight, and 9.4% as obese. 59.1% of children underestimated their current body weight. On the other hand, 14.2% of children overestimated their current body weight. There were statistical differences between body weight perception and BMI ($P < 0.001$).

Conclusion: There was a discrepancy between body weight perception and BMI among middle-aged children. More than half of the children tend to underestimate their actual body weight. Therefore, evaluating the nutritional status of children and learning which body type children perceive can guide the preparation of individual nutrition programs.

Keywords: Body weight perception; Body size; Children; Body mass index

Introduction

In Europe, the incidence of childhood obesity is gradually increasing (1). Childhood obesity, which was first observed in developed countries, has emerged as a major public health concern in de-

veloping and low-income countries due to advances in technology and the expansion of the food industry (2,3). Evaluating childhood obesity is important since obesity has adverse physical as



well as psychosocial consequences (4). Psychosocial consequences of obesity are a concern due to a positive correlation with eating disorders, depression, anxiety, and body dissatisfaction (5,6). Therefore, body image is a considerable factor for mental health in overweight and obese children (7).

The role of body weight perception is important in weight management (8). Body weight perception is the personal estimation of a person's body weight as "underweight", "normal weight", or "overweight", independent of actual body weight and body mass index (BMI) (9,10). Many factors affect body weight perception such as age, gender, family, peers, and social media (11,12). Girls are more likely than boys to be concerned about their body weight, and therefore estimate their weight more accurately (13,14). In parallel with the increase in age, the correct perception of body weight increases (12). Furthermore, families, especially mothers, influence the children's nutritional behaviors, and children tend to mimic parents' nutritional habits, physical activity, and other weight-related behaviors (15). Therefore, children who have an overweight or obese parent are more likely to become overweight or obese adults (16).

Body weight perception does not reflect reality all the time (11). Body image dissatisfaction is defined as inconsistency in body weight perception (17). According to the literature, body image dissatisfaction can occur even before puberty, and in up to 50% of children and adolescents (9,18,19). Individuals who are either healthy or overweight but believe they are overweight or obese tend to lose weight, however, obese individuals who do not consider themselves to be overweight or obese will be unlikely to lose weight (20).

The relationship between body image and BMI is complex. Obese children report higher body dissatisfaction than normal-weight children (21,22). In some studies, the prevalence of children who underestimated themselves according to their BMI was found to be higher. There may be an inconsistency between body weight perception and BMI among children (13,23,24). This study aimed to determine the relationship between BMI and

body weight perception among middle-aged children.

Materials and Methods

Participants

In this study, school-based cross-sectional research was conducted between Oct 2019 and Jan 2020 in the largest public school in the Avclar district of Istanbul province of Turkey.

G-power analysis was used to select the sample, and the study included a minimum of 270 children, with a 20% prevalence, type 1 error rate (α) = 0.05, type 2 error rate (β) = 0.20, and test power $1 - \beta$ = 0.80. Overall, 333 children (9-11 yr) were included in this study with the permission of their families. Inclusion criteria were middle childhood (9-11 yr). Because children at this age become more aware of their bodies. Body image and eating problems begin at this age (25).

A face-to-face questionnaire was used with demographic characteristics (e.g. gender and age) and some anthropometric measurements (body weight, height, waist and hip circumferences).

Ethical approval

Ethics Committee approval dated 29/09/2018 and numbered 77366270-199-E.9089 was obtained from Istanbul Gelisim University Non-Interventional Clinical Research Ethics Committee. Written and verbal informed consent was obtained from all subjects.

Anthropometric Measurements

Anthropometric measurements were taken by a trained researcher using standardized protocols to eliminate bias. A stadiometer was used to measure height to the nearest 0.1 cm. Body weight was measured with the Inbody 120, a calibrated electronic scale. Waist and hip circumferences were taken using a non-stretchable tap to the nearest 0.1 cm. These processes were completed in a classroom determined by the school administration. Body mass index (BMI) was calculated by weight divided by height squared (kg/m^2). We classified BMI <3 percentile indicated severely underweight,

BMI 3 to <15 underweight, and BMI ≥ 85 overweight, ≥ 97 obese. BMI values between 15 and 85 percentiles are referred to as normal weight (26).

Body Weight Perception

To assess children's perceptions of body weight, a modified photographic figure rating based on the Stunkard Figure Rating Scale was used (27). The original rating scale is made up of silhouette drawings of boys or girls' bodies ranging from emaciated to very large. In this study, a photographic figure grading was developed using 5 images of

faceless body photographs represented by numbers 1 to 5 from left to right (Fig. 1). Accordingly, A: very thin, B: underweight, C: normal weight, D: overweight, and E: obese child. This photographic figure rating for body weight perception was created by the Graphic Design Department. Then, the opinions of 3 experts from the field were taken for the rating scale and its final form was given (Fig. 1). To assess body image perceptions among children, we asked the children: 'Which photograph do you think your own body looks like?'

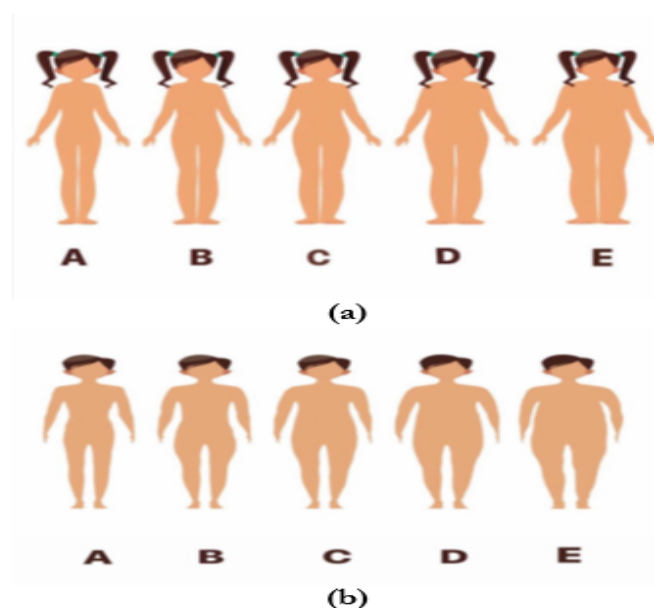


Fig. 1: A modified photograph figure rating scale for (a) girls (b) boys

Additionally, we used three categories for evaluating the relationship between BMI and body weight perception: 1) Underestimation, 2) Consistency (defined as underweight - perceived underweight, normal weight - perceived normal weight, overweight - perceived overweight, obese - perceived obese, or extremely obese - perceived extremely obese), 3) Overestimation.

Data Analysis

SPSS 24.0 (IBM Corp., Armonk, NY, USA) was used to analyze the data. Statistical difference in categorical data expressed as a frequency (percentage) was analyzed with the square test. Quantitative variables were expressed as the mean \pm SD

(standard deviation). A *P*-value less than 0.05 was considered to be statistically significant.

Results

Three hundred twenty five (162 boys, and 163 girls) children completed the study. The children's mean age was 10.01 ± 0.99 yr. The majority of the children (94.8%) did not have any other disease. The mean body weight of the boys was 27.33 ± 6.64 kg, and the girls were 30.97 ± 9.61 kg, and their heights were 126.78 ± 7.43 cm and 129.85 ± 9.22 cm, respectively (Table 1).

Table 1: Anthropometric and demographic sample characteristics (n = 325)

<i>Variables</i>	<i>Boys (n = 162)</i>	<i>Girls (n = 163)</i>	<i>Total (n = 325)</i>
Age, yr	10.93 ± 1.00	10.00 ± 0.99	10.01 ± 0.99
Disease			
No	157 (96.9)	151 (92.6)	308 (94.8)
Yes	5 (3.1)	12 (7.4)	17 (5.2)
Body weight (kg)	27.33 ± 6.64	30.97 ± 9.61	27.56 ± 6.33
Height (cm)	126.78 ± 7.43	129.85 ± 9.22	126.63 ± 7.71
BMI (kg/m ²)	17.09 ± 2.52	16.88 ± 2.72	17.01 ± 2.59
BMI classification			
<3 percentile (severely underweight)	13 (4.0)	15 (4.6)	28 (8.6)
3-15 percentile (underweight)	9 (2.8)	7 (2.2)	16 (4.9)
15-85 percentile (normal weight)	113 (34.8)	108 (33.2)	221 (68.0)
85-97 percentile (overweight)	8 (2.5)	19 (5.8)	27 (8.3)
≥97 percentile (obese)	19 (5.8)	14 (4.3)	33 (10.2)
Waist circumference (cm)	58.70 ± 6.83	60.57 ± 8.58	58.58 ± 6.70
Hip circumference (cm)	68.95 ± 7.82	72.26 ± 9.62	69.16 ± 7.32

BMI: body mass index.

The characteristics of the children in terms of body weight perception and BMI classification are shown in Table 2. There were statistical differences between BMI and body weight perception

($P < 0.001$). Additionally, there were no statistical differences between gender and body weight perception ($P = 0.446$).

Table 2: Percentages of self and ideal self-figures selected of children choosing each figure as representative of their actual body image

<i>BMI Classification</i>							<i>P¹</i>	<i>P²</i>
Body weight perception	Severely Underweight	Underweight	Normal weight	Overweight	Obese	TOTAL	<i>value</i>	<i>value</i>
Boys							<.001*	.446
A- severely underweight	7 (4.3)	6 (3.7)	43 (26.5)	3 (1.9)	2 (1.2)	61 (37.7)		
B- underweight	3 (1.9)	2 (1.2)	31 (19.1)	1 (0.6)	3 (1.9)	40 (24.7)		
C- normal weight	2 (1.2)	1 (0.6)	24 (14.8)	3 (1.9)	4 (2.5)	34 (21.0)		
D- overweight	1 (0.6)	-	3 (1.9)	1 (0.6)	8 (4.9)	13 (8.0)		
E- obese	-	-	12 (7.4)	-	2 (1.2)	14 (8.6)		
Girls								
A- severely underweight	9 (5.5)	6 (3.7)	48 (29.4)	2 (1.2)	-	65 (39.9)		
B- underweight	5 (3.1)	1 (0.6)	21 (12.9)	1 (0.6)	1 (0.6)	29 (17.8)		
C- normal weight	1 (0.6)	-	26 (16.0)	4 (2.5)	1 (0.6)	32 (19.6)		
D- overweight	-	-	5 (3.1)	8 (4.9)	7 (4.3)	20 (12.3)		
E- obese						17 (10.4)		

* $P^1 < .001$, the differences

According to Table 3, 59.1% of children underestimated their true body image, 26.8% accurate

their weight status, and 14.2% overestimated their body image ($P < 0.001$).

Table 3: Percentage of children underestimating, accurately identifying and overestimating their body size using visual ratings

<i>Variable</i>	<i>Choosing a thinner figure (underestimation)</i>	<i>Choosing the correct figure (accurate)</i>	<i>Choosing a fatter figure (overestimation)</i>	<i>P¹ value</i>	<i>P² value</i>
BMI Classification				<.001*	.385
Boys					
Severely Underweight	-	8 (4.9)	5 (3.1)		
Underweight	5 (3.1)	3 (1.9)	1 (0.6)		
Normal weight	73 (45.1)	24 (14.8)	16 (9.9)		
Overweight	7 (4.3)	1 (0.6)	-		
Obese	16 (9.9)	2 (1.2)	1 (0.6)		
Girls					
Severely Underweight	-	9 (5.5)	6 (3.7)		
Underweight	6 (3.7)	1 (0.6)	-		
Normal weight	69 (42.3)	26 (16.0)	13 (8.0)		
Overweight	7 (4.3)	8 (4.9)	4 (2.5)		
Obese	9 (5.5)	5 (3.1)	-		
TOTAL	192 (59.1)	87 (26.8)	46 (14.2)		

* $P^1 < .001$, the differences between BMI and body weight perception, P^2 , the differences between gender

Discussion

Children in middle childhood become more aware of their body and body image problems are reported to occur at this age (25,28,29). In our study, we determined the association between the accuracy of body weight perception and BMI among middle-aged children. Our findings revealed a significant relationship between body weight perception and BMI among Turkish children aged 9–11. 38.8% of the children evaluated themselves as being severely underweight, 21.2% underweight, 20.3% normal weight, 10.3% overweight, and 9.4% obese. Furthermore, almost a third of children underestimated their true body image.

Body image includes two components: perceptual and subjective. The perceptual component is strongly associated with the accuracy of body size estimation, whereas the subjective component is associated with body satisfaction or dissatisfaction

(30). The perceptual component often refers to an incorrect perception of body size such as underestimating or overestimating (31). Overestimation is related to anorexia nervosa, whereas underestimation is related to being overweight (24). Over the last few decades, the prevalence of childhood overweight or obesity has risen in Turkey (32). It is important to learn how children perceive their bodies. 86.3% of overweight and 62.3% of obese children underestimated their body size, whereas this prevalence was 14.9% among normal-weight children (15). About 36% of children did not have an accurate perception of their weight (13). Children were more likely to underestimate compared to overestimate their body weight (24). In our study, 59.1% of children underestimated their accurate body weight, while 14.2% overestimated their body weight. Body weight underestimation may be an impediment to making the necessary lifestyle changes to achieve a healthy weight (24).

There is a negative association between BMI and underestimation (e.g. underestimation predicts BMI) (24). In the literature, many overweight and obese youth underestimate their weight. Because not estimating his/her overweight may act as a buffer against psychosocial consequences of obesity (33,34). However, studies on this subject in middle childhood are limited (13,21,24). We found that only 26.8% of children estimated accurately their body weight. Body weight misperception among children can lead to adverse health outcomes. Therefore, it is important to take measures to improve the health awareness of children.

Many factors affect body weight perception (11,12). Gender is one of these factors, and research on the role of gender is inconsistent. Some studies reported higher accuracy in girls (13,14), and other studies reported higher accuracy in boys (13,14,35). We stated that there were no statistical differences between gender and estimation of body weight. Our result showed that gender is not related to the mechanism of underestimation of body weight. Considering the inconsistency of studies on this subject, future studies are needed to confirm

There are some limitations to the current study. First, this was a cross-sectional study. A cause-effect relationship could not be determined. Second, the sample size may not be representative of all middle-aged children. Future studies should investigate the link between weight dissatisfaction, concerns and psychological symptoms.

Conclusion

The current study found an inconsistency between BMI and body weight perception. Children can estimate their body image using a photograph figure rating scale with some accuracy, but children have a tendency to overestimate their weight status. The present study suggests that underestimated body weight is widespread in school-aged children. In addition, this tendency of children may cause obesity and not need behavioral treatment. Learning about children's body perceptions while evaluating

nutritional status during childhood can help to establish and monitor nutrition programs.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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