

**Original article:**

**Body mass index and weight status misperception among a sample of college students in Yogyakarta, Indonesia**

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**Abstract**

**Background:** Weight status perception associates with objective weight status and is important in the management of weight control. To date, perception of weight status among Indonesian youths has not been reported. **Objectives:** This study aimed to examine the association between body mass index and weight status perception in a sample of college students in Yogyakarta Province. **Materials and Methods:** A sample of 209 boys and 269 girls of college students in Yogyakarta Province were measured for their stature and body weight. Body mass index was calculated (BMI). Data of demographic, exercise, and diet were collected. Weight status perception was based on participant responses to a question regarding how they classified their own body size as underweight, normal, overweight, or obese. Ordinal regression analysis was performed to evaluate factors associated with weight status misperception among boys and girls. **Results:** Overall, 43.5% of boys and 37.5% of girls misclassified their own weight status by actual BMI. Of particular note, 75.9% of obese boys and 78.6% of obese girls underestimated their weight status as overweight or normal weight. Whereas, 9.1% and 23.4% of normal weight boys and girls respectively, overestimated their weight status. Ordinal regression analysis revealed that, weight status misperception from others was significantly contributed ( $p < 0.01$ ) to misperception of weight status among boys and girls with OR of 10.31 and 8.13 respectively. Diet practicing was significantly correlated with weight status misperception in boys ( $p < 0.05$ ) with an OR of 19.57. **Conclusions:** Weight status misperception was prevalent among normal weight and obese students. Obese students of both gender and normal weight boys tended to underestimate their weight status, whereas normal weight girls were likely to overestimate their weight status.

**Keywords:** body mass index; weight status misperception; underestimation; overestimation; Indonesian college students

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**Introduction**

Overweight and obesity prevalence globally increase at an alarming level. Data from the Ministry of Health, Republik Indonesia<sup>1,2</sup> showed that the prevalence of overweight and obesity increased from 18.9% in 2007 to 21.3% in 2013. It is widely known that overweight and obesity lead to some major diseases. World Health Organization reported

that increasing degrees of overweight, as measured by body mass index (BMI) increases co-morbidity risks including coronary heart disease (CHD), stroke, type 2 diabetes, and some cancers, and mortality rates<sup>3</sup>. Accordingly, public health action in the management of prevention and treatment efforts for obesity is straight away essential.

In attempt to design appropriate health advice to

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intervene obesity, understanding factors associated with obesity is necessary. Among the factors is body image, and body size perception is among body image interests, which has been studied in relation to obesity<sup>4-8</sup>. A number of studies have examined levels of overestimation and underestimation of body size in youths compared to their actual body size obtained from e.g. BMI. Reports indicated that a large proportion of boys and girls has misperception about their weight status.<sup>5</sup> Boys were likely than girls to classify their weight status lower than their weight status determined by actual BMI, hence, considered as underestimation of weight status. Whereas girls were more likely to classify their weight status higher than their actual weight status measured with BMI which considered as overestimation of weight status<sup>8</sup>. Some studies indicated that a substantial proportion of obese youths misperceived their weight status as overweight or normal weight instead their clinical obese category<sup>6,8,9</sup>. However, findings were not consistent that overweight youths rather than obese ones were more likely to underestimate their weight status<sup>7</sup>. Moreover, weight perception of being in the normal weight rather than weight misperception was associated with better health related quality of life among youths<sup>10</sup>. Perception of being overweight and underweight rather than weight status misperception were significant factors associated with psychological distress<sup>11,12</sup>. Meanwhile, perception of overweight is an important determinant of nutritional habits and weight management in youths, overweight youths who did not perceive themselves as such were unlikely to engage in weight control practice<sup>6</sup>.

Several factors were thought to influence weight misperception among youths. A study in Mexican youths found that over estimating was associated with female gender, younger age, lower level of parent education, and more hours of daily TV viewing, while, underestimating was associated with male gender and older age<sup>8</sup>. Obesity exposure increased acceptance of obesity in obese male gender<sup>13</sup>. Exposure to overweight or obese environment in which people they see on a daily basis predicted misperception of weight status<sup>9</sup>. Yet, no studies have examined weight status misperception among Indonesian youths and factors that might predict weight misperception. Therefore, the current study aims to investigate the association between perceived weight status and actual BMI in a sample of Indonesian college students, particularly those who were living in Yogyakarta Province. Demographic factors, information about exercise and dieting,

as well as weight perception from others were evaluated with regard to their contribution to weight misperception among Indonesian youths.

## Materials and Methods

### Participants

A number of 209 male and 269 female students of Universitas Gadjah Mada (UGM) and Universitas Teknologi Yogyakarta (UTY) living in Yogyakarta Province, aged 17-25 years participated in the present study. Participants were students of Grade 1<sup>st</sup> to 4<sup>th</sup> at the Faculty of Medicine and Faculty of Cultural Sciences UGM, and Faculty of Information Technology and Business UTY. Majority of the participants were Javanese (86.3%). Participants having physical disabilities or in pregnancy for female students were excluded from the study.

A structured questionnaire was administered to participants covering gender, background information (birth and place of date, ethnicity, school grade, parents' education, parents' income, diet experiences, engagement in regular physical activity, and perception of their weight status from other people (their peers or family). Parents' education level (father and mother) was categorized into high school or lower education levels and college graduation. Parents' income level (father and mother) was determined by less than or equal to IDR 2.5 million (approximately USD 200) monthly or more that value. Diet practicing and physical activity was observed by answering "yes or no" questions whether engage or not in those activities. Weight status from other people was the way of other people classified participants' weight status i.e. underweight, normal, overweight, or obese. Participants signed and returned an informed consent form. The study protocols have been approved by the Medical and Health Research Ethics Committee of Faculty of Medicine UGM.

### Measures

*Actual weight status.* Body weight and stature were measured using the standard protocol of the International Society for the Advancement of Kinanthropometry (ISAK). Stature was taken using an anthropometric set (GPM, Swiss, Ltd.) to the nearest 0.1 cm. Body weight was measured with the participant wearing light clothing with a Seca weight scale (Seca 803, Seca Deutschland) to the nearest 0.1 kg. BMI was calculated as  $\text{kg/m}^2$  and was used as the measure of actual weight status. Participants were categorized into underweight ( $<18.5 \text{ kg/m}^2$ ), normal ( $18.5\text{--}24.9 \text{ kg/m}^2$ ), and overweight ( $25.0\text{--}26.9 \text{ kg/m}^2$ ), and obese ( $\geq 27.00 \text{ kg/m}^2$ ). The classification is

adopted from World Health Organization adjusted for Indonesians<sup>14</sup>.

**Perceived Weight status.** Participants reported perception of their own weight status by answering a question “How do you classify your body at this moment?” Answers were chosen among four options: underweight, about normal weight, overweight, and obese. Participants were classified into three categories: about the right weight, overestimated, and underestimated weight status. Participants whose actual BMI category was greater than their perceived weight status were considered as “underestimated” weight status perception and vice versa. While, those who accurately perceived their selves as their actual BMI category were recognized as having “about the right weight”.

### Statistical Analysis

Differences of characteristics between boys and girls were determined using t-student test for continuum

scale and chi-square test for ordinal scale. Ordered regression analysis was performed to evaluate factors contributed to weight status misperception among boys and girls. A p-value of <0.05 was considered significant. Magnitude of association was expressed as an odd ratio with a 95% confidence interval. All statistical analyses were done using the SPSS program (version 20.0, SPSS Inc., 2011, Chicago, IL).

### Results

Characteristics of participants are summarized in Table 1. Boys were significantly taller, heavier, and greater BMI ( $p < 0.01$ ) than girls. Differences were also existed ( $p < 0.01$ ) in the distribution of BMI category, school grade, and engagement in regular physical activity. Obesity prevalence (including overweight and obese) was higher in boys (21.6% vs 8.2%), however, self-weight perception for obesity was almost similar in both genders.

**Table 1. Characteristics of participants by gender**

Characteristics	Boys (n= 209)		Girls (n= 269)		Significance
	Mean	(SD)	Mean	(SD)	
Age (year)	20.8	(1.20)	20.7	(1.20)	
Body weight (kg)	62.61	(14.12)	50.92	(8.60)	<0.001 <sup>a</sup>
Stature (cm)	167.35	(5.86)	155.25	(5.09)	<0.001 <sup>a</sup>
BMI (kg/m <sup>2</sup> )	22.27	(4.38)	21.10	(3.27)	<0.001 <sup>a</sup>
	N	(%)	N	(%)	
College grade					<0.001 <sup>b</sup>
1 <sup>st</sup> year	19	(9.1)	40	(14.9)	
2 <sup>nd</sup> year	60	(28.7)	76	(28.3)	
3 <sup>rd</sup> year	108	(51.7)	72	(51.7)	
4 <sup>th</sup> year	22	(21.4)	81	(10.5)	
BMI category (%)					<0.001 <sup>b</sup>
Underweight	19	(9.1)	50	(18.6)	
Normal	145	(69.4)	195	(72.5)	
Overweight	16	(7.7)	10	(3.7)	
Obese	29	(13.9)	14	(5.2)	
Weight status perception (%)					0.185 <sup>b</sup>
Underweight	58	(27.8)	58	(21.6)	
Normal	90	(43.1)	125	(46.5)	
Overweight	54	(25.8)	82	(30.5)	
Obese	7	(3.3)	4	(1.5)	
Father's education					0.500 <sup>b</sup>
≤High school	118	(58.7)	152	(59.1)	
College graduate	83	(41.3)	105	(40.9)	
Mother's education					0.372 <sup>b</sup>
≤High school	130	(66.0)	164	(64.1)	
College graduate	67	(34.0)	92	(35.9)	
Father's income					0.382 <sup>b</sup>
≤IDR 2.5 million	88	(44.4)	119	(46.3)	

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>IDR 2.5 million	110	(55.6)	138	(53.7)	0.233 <sup>b</sup>
Mother's income					
≤IDR 2.5 million	125	(67.6)	174	(71.3)	<0.001 <sup>b</sup>
>IDR 2.5 million	60	(32.4)	70	(28.7)	
Regular exercise					0.060 <sup>b</sup>
Yes	49	(23.4)	20	(7.5)	
No	160	(76.6)	249	(92.5)	0.383 <sup>b</sup>
Diet practicing					
Yes	19	(9.1)	38	(14.1)	
No	190	(90.9)	231	(85.9)	
Weight status perception by others					
Underweight	68	(32.5)	75	(28.0)	
Normal	93	(44.5)	133	(49.6)	
Overweight	45	(21.5)	59	(22.0)	
Obese	3	(1.4)	1	(0.4)	

IDR! .....

Table 2 displays the prevalence of weight status misperception among actual weight status classified according to BMI. Totally, 43.5% of boys and 37.5% of girls misclassified their weight status relative to these medical standards. A substantial percentage of boys classified themselves as having lower weight status than their actual weight category (32.5%), by contrast, girls showed a greater percentage of those who overjudged their weight status as heavier than their actual weight category (27.1%). However, with respect to those who were determined as obese according to actual BMI, most of them perceived their selves as overweight or even normal weight instead both in boys (75.9%) and girls (78.6%).

**Table 2. Prevalence of weight misperception by BMI category among boys and girls**

	Perceived weight status, n (%)			
	About the right weight	Underestimated	Overestimated	Total*
<b>Boys (n= 209)</b>				
Underweight	15 (7.2)	0 (0.0)	4 (7.2)	19 (9.1)
Normal	83 (39.7)	43 (20.6)	19 (9.1)	145 (69.4)
Overweight	13 (6.2)	3 (1.4)	0 (0.0)	16 (7.7)
Obese	7 (3.3)	22 (10.5)	0 (0.0)	29 (13.9)
Total	118 (56.5)	68 (32.5)	23 (11.0)	209 (100.0)
<b>Girls (n= 269)</b>				
Underweight	41 (15.2)	0 (0.0)	9 (3.3)	50 (18.6)
Normal	115 (42.8)	17 (6.3)	63 (23.4)	195 (72.5)
Overweight	9 (3.3)	0 (0.0)	1 (0.4)	10 (3.7)
Obese	3 (1.1)	11 (4.1)	0 (0.0)	14 (5.2)
Total	168 (62.5)	28 (10.4)	73 (27.1)	269 (100.0)

Contributions of some factors in the weight status misperceptions among boys and girls are presented in Table 3. This tables describes the results of ordinal regression analysis with weight misperception as independent factors and parents' education and income, diet practicing, physical activity, and weight status perception from others as dependent factors. Among those factors, weight status perception by others was a significant factor in both genders and diet practicing in boys. In boys, the odds of right perception by others considering misperception by self was 0.097 (95% CI, 0.046 to 0.204) times that of misperception by

others ( $p < 0.001$ ). Or, inversely, misperception by others was 10.31 times that of right perception by others considering misperception by self. The odds of diet experience considering misperception by self in boys was 4.766 (95% CI, 1.161 to 19.572) times that of not diet experience ( $p < 0.05$ ). Whereas, in girls, the odds of right perception by others considering misperception by self was 0.123 (95% CI, 0.065 to 0.234) times that of misperception by others ( $p < 0.001$ ). Or, inversely, misperception by others was 8.130 times that of right perception by others considering misperception by self.

**Table 4. Ordinal logistic regression analysis of factors contributed to weight misperception in boys and girls**

Variable	Boys			Girls		
	OR	95% CI	P-value	OR	95% CI	P-value
Father's education						
≤High school	1.601	0.616-4.160	0.334	0.565	0.248-1.290	0.176
College graduate	1.000			1.000		
Mother's education						
≤High school	0.903	0.326-2.498	0.844	1.401	0.604-3.246	0.432
College graduate	1.000			1.000		
Father's income						
≤IDR 2.5 million	0.773	0.326-1.833	0.559	1.134	0.567-2.269	0.722
>IDR 2.5 million	1.000			1.000		
Household income (mother)						
≤IDR 2.5 million	0.942	0.367-2.418	0.901	1.375	0.621-3.048	0.432
>IDR 2.5 million	1.000			1.000		
Regular exercise						
Yes	4.766	1.161-19.572	0.030	1.327	0.545-3.233	0.533
No	1.000			1.000		
Diet practicing						
Yes	1.111	0.472-2.615	0.809	0.708	0.210-2.390	0.578
No	1.000			1.000		
Weight status perception by others						
Right perception	0.097	0.046-0.204	0.000	0.123	0.065-0.234	0.000
Misperception	1.000			1.000		

### **Discussion**

This study examined the association between perceived weight status and actual BMI among college students in Yogyakarta Province, Indonesia. Findings indicate that a substantial number of boys and girls misperceived their weight status i.e. 33.5% and 37.5% in boys and girls, respectively. Boys showed a greater prevalence of underestimation, while, girls were more likely to overestimated their weight status. Of particular note, among obese students by medical category, only about one fourth in boys and one fifth in girls were correctly identified their weight status, while the rest were underestimated themselves as lower weight status.

Ordinal regression analysis reveals that misperception by others was 10.31 and 8.13 times that of right perception by others considering misperception by selves in boys and girls respectively ( $p < 0.001$ ). Diet practising was significantly associated with weight status misperception in boys only with an odds of 19.57 times ( $p < 0.05$ ) greater than those who did not involve in diet. Whereas, the other factors including parent's education and income, and engagement in regular physical activity were not significantly contributed to weight status misperception. Our study was consistent with previous research that higher incidence of girls of college students overestimated their weight status compared with boys (23.9% vs.

13.9%). By contrast, higher prevalence of boys was underestimated their weight status<sup>8</sup>,

The current study also indicated that agreement between actual BMI and weight status perception was high among underweight, normal, and overweight (62.4% to 91.7%), but poor among obese in both genders (23.3% males and 14.3% females). Overestimation of weight status existed among underweight and normal BMI categories in our samples with normal weight girls showing higher rate of overestimation than boys do. The mismatch of weight status perception and actual weight status was also reported among college students in previous studies in Nigeria<sup>15</sup> and Mexico<sup>8</sup>. McCabe and colleagues<sup>16</sup> suggested that perceptual accuracy of body image might highly associated with biopsychosocial influence. That sociocultural norms and media influences associated with overestimation of weight status has been acknowledged. Among girls, overestimation on weight status in girls was strongly influenced by high levels of depression, media, and peer influences to be thinner. Whereas boys experienced overestimation of body size were predicted by high BMI, media influences to lose weight and increase muscle, and peer influences to increase muscle<sup>16</sup>. Younger age, female gender, lower level of parent education, and daily TV viewing were also predicted overestimation<sup>8</sup>. Media influence and TV viewing were not observed in the current study, however, college students were highly expose with internet connectivity due to high load of assessment and learning material preparations which may potentially expose the students to media influence. It is required further study that a longer time of exposure to the internet connectivity was also suggested to influence weight status perception through sedentary life style or a standard of beauty that exaggerated slimness fashionable. Engagement in physical activity and diet practising were not significantly predicted overestimation of weight status in the present study, especially in girls. Low prevalence of girls who engage in those activities (7.5% in regular exercise and 14.1% in diet practicing) might influence these results.

An important finding of this study is the high prevalence of obese students (>75%) who misperceived their weight status as having lower weight category. It was suggested that underestimation of overweight was correlated with BMI, intense physical activity, knowledge of a healthy weight range, and body comparison<sup>17</sup>. More recent studies also indicate that exposure to heavier body weight increased the

acceptance of obesity, particularly in male gender. Exposure to obese people resulted in an obese male being judged more positively than after exposure to healthy weight<sup>13</sup>. There was also an evidence of a generational shift in social norms related to body weight resulted in people may be less likely to intend weight loss. This was shown on male gender that exhibited a highly decrease in feeling overweight than normal weight<sup>18</sup>. Congruently, in the current study, weight status perception from peers showed significant predictor of weight status misperception in both gender. This emphasized the importance of public health action to provide knowledge concerning the right weight status to overall youth population. The program should aims to educate youths to improve body image, besides emphasizing the health risks associated with excess body weight.

Nevertheless, several limitations should be kept in mind when interpreting these data. First, we cannot suggest that our data are representative of the overall Indonesian students, or Indonesian youths with similar age range, since association between BMI and weight status perception differ across ethnics<sup>19-21</sup>. Our samples are college students living in Yogyakarta Province which is only one among 33 provinces in Indonesia. However, due to a considerable number of ethnicities, most of the students in our samples are taken from Javanese population which represents the largest ethnicity in Indonesia. Second, our data have low prevalence of students with overweight and obese categories, especially female which is less than one third of the national prevalence of obesity<sup>2</sup>. This might be influenced by the small range of age (17-24 years) in the early adult. Increased BMI and age has been reported associated with body image<sup>4,22</sup>. Third, we did not investigate several factors that might associated with perception of weight status, such as psychological distress, media influence, and weight control behaviours. Evaluation on these factors might help formulating issues need to be addressed to prevent misperception of weight status and further risks. Lastly, it may also be a limitation of this study due to the less variability or small sample size. A nationally representative of sample size and Indonesian populations is substantial in advanced studies.

Despite those limitations, our study demonstrates essential evidence of misperception of weight status among Indonesian youths whose age period is susceptible to engage in dangerous behaviours leading to health risks related to weight status. A higher structured design and more comprehensive

study involves ethnic diversity is important to provide nationally representative data. Future studies should also include broader biopsychosocial assessment to identify factors associated with weight status misperception among Indonesian youths. Understanding factors that contribute to misperception of weight status in Indonesian youths from diverse ethnicities and sociocultural background is worthwhile to appropriate design intervention strategies to promote an understanding of healthy weight.

### **Conclusions**

The current study finds that a high percentage of boys and girls misperceived their weight status. Overall, boys in normal weight range according to their actual BMI show a greater prevalence of underestimation, while, girls in the same group are more likely to overestimate their weight status. An important finding is that among obese students by actual BMI category, about four in five in boys and three in four in girls misinterpret their weight status as being in

the lower category. Weight perception from other people is suggested to be the most responsible factor associated with weight status misperception among college students in Yogyakarta Province. Our finding recommends increased public health efforts to improve understanding a healthy body image among Indonesian youths.

### **Conflict of Interest**

The authors report no conflict of interests.

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