ORIGINAL RESEARCH ARTICLE

Exploring the Relationship Between Body Mass Index (BMI), Body Weight Perception, and Weight Change Behaviour Among University Students in Urban Gujarat, India: A Cross-Sectional Study

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ABSTRACT

Background: In the context of the rising trend of overweight and obesity, young people are more concerned about their weight. This study investigates the association between measured Body Mass Index (BMI), self-perception of body weight and weight change behavior among university students.

Methods: This cross-sectional study assessed a sample of 415 university students aged 18-23 years residing in urban areas of Anand. Measures included weight, height, BMI, body weight perception and weight change behavior. The data were analyzed through descriptive statistics, the student's t-test and Chi-square test.

Results: About 36.1% of the participants misclassified their weight category. More women than men felt overweight in relation to their actual body shape. Among normal-weight or underweight BMI participants, 44.4% of females and 31.8% of males were inappropriately trying to lose weight.

Conclusions: The study showed a higher prevalence of weight perception and inappropriate weight change behaviour. It also observed that the correct perception of body weight influences the willingness to lose or gain weight. It is important to consider these issues while designing a public health campaign targeting obesity and healthy lifestyles.

Keywords: Body image, Perceived body size, young adults

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INTRODUCTION

In India, like many other middle-income countries, the prevalence of overweight and obesity has been rising continuously in the past few decades, with a simultaneous presence of a high prevalence of undernutrition. According to the National Family Health Survey (NFHS) carried out in Gujarat, from 2006 (NFHS-3) to 2020 (NFHS-5), the prevalence of obesity and overweight has increased from 9% to 14.8% in women and 6.7% to 14% in men in the 20-29 years of age group.[1,2] Considering the increase in weight among the young population with the coexistence of undernutrition (around 28% as per NFHS-5), it is worth examining the issue of body weight perceptions and weight management behaviour among the undernourished and over nourished young population.

Numerous studies have demonstrated that young people misperceive their weight status.[3,4] Weight perception may be conceptualised as a person's perception of whether they are lighter than (underweight perception), heavier than (overweight perception) or about to equal to (right weight perception) the right body weight. Body weight perception is the subjective evaluation of actual weight status and is influenced by sociocultural and ethnic factors.[5] Evidence suggests that media exposure significantly impacts shaping awareness of the norms and trends in cultural appearance standards.[6,7] When the accuracy of body weight perception has been estimated, not just thin people perceive themselves as fat, but overweight or obese people also do not realise that their body weight is too high. This raises concerns because young people who do not perceive themselves as overweight or obese are less likely to engage in weight control behaviour. Conversely, overestimating their body size with normal weight may lead to engaging in inappropriate behaviour to modify their body weight and shape.[8]

Younger ages are critical in terms of being overweight or underweight. Obesity is still uncommon in late adolescence and early adulthood, so if overweight or obese people identify themselves at early stages, they may be able to halt the progression of obesity and related complications. The majority of research studies on similar topics have been conducted in the developed world. Limited studies are available in India targeting this issue. In addition, data are scarce, particularly among males. Hence, this study aims to examine the relationship between actual weight, perceived body size and weight change wishes among undergraduate university students.

METHODOLOGY

A cross-sectional study was performed between 2019-20 on a representative randomly selected sample of 415 apparently healthy university students of both sexes aged 18 to 23 years in the town of Anand district, Gujarat. The sampling procedure employed in the study was a two-stage stratified random sample design. The first sampling stage involved randomly selecting four science stream colleges from the available list of colleges located in the urban area of *Anand* and *Vallabh Vidyanagar*. The second sampling stage comprised, within each college selected, students enrolled from each year of the study. The sample size was calculated using the formula, $z^2p\ (1-p)/d^2$.[9] Considering the prevalence of weight misperception based on previous studies[10,11], 'p' at 37% and a permissible error 'd' of 5% with a 95% confidence interval, the minimum sample size was calculated as n = 359. However, to accommodate a non-response rate and considering the study design final sample size was fixed at 415. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all the participants about the anonymity of their participation and ensured that it was voluntary.

Data relevant to the present study were obtained from the participants' college premises and included demographic characteristics, questions on body image, weight change goals, and anthropometric measurements. The questionnaire was pretested and partially self-administered in a bilingual language consisting of English and the local vernacular language. Body weight and height were measured using standard procedures of the WHO STEPwise approach to Surveillance and calibrated instruments by well-trained personnel.[12] Height was measured to the closet 0.1 cm using a stadiometer. For height measurement, we asked each participant to remove footwear or any headgear, stand on a hard floor with feet together, heels against the wall and knees straight, look straight ahead and not tilted, and keep eyes at the same level as the ears. Weight was measured to the nearest 0.1 kg using a salter scale while they were wearing light clothes, no shoes, standing still, facing forward and placing arms on the side. Body Mass Index (BMI) was calculated by dividing body weight in kilograms by body height in squared meters. BMI was categorized in weight classes in accordance with the WHO definition for the Asian population using the following cut-points: underweight (<18.5 kg/m^2), normal (18.5 to 23 kg/m^2) and overweight or obese (≥ 23 kg/m^2).

Body image (weight) perception was measured using the narrative description of weight using structured closed-ended questions. Participants responded to the question, 'How do you describe your weight?' choosing a response out of the following levels- 'Very underweight', 'Slight underweight', 'Perfect', 'Slightly overweight', and 'Very overweight'. However, for analysis, these five levels were collapsed into three, 'Underweight', 'Perfect or Right weight' and 'Overweight'. Weight change behaviours were determined by the question 'What are you trying to do about your weight?' followed by the response options 'Lose weight', 'Gain weight', and 'Stay the same weight, or No weight change wish'. Physical activity was meas-

ured with the question: 'During the past seven days, how many days were you physically active (running, cycling, etc.) for a total of 30 minutes per day?'. Response choices were their respective days.

Means and standard deviation were calculated for quantitative variables like age, weight, BMI etc. The student's t-test and one-way ANOVA were used to estimate the differences between continuous variables. The Chi-square test was used to examine the differences between categorical variables. Statistical significance was considered significant at a two-tailed P-value < 0.05. All statistical analyses were carried out using STATA version 16.

RESULTS

The basic characteristics of the participants are shown in **Table 1**. The mean age was 19.5±1.6, and the mean BMI was 19.8±3.9. Among all the participants, 43.3 % were underweight, and 18.8% were overweight or obese, with no significant difference between males and females. Overall, more females were trying to lose weight compared to the males (20% vs 15.2% respectively), and more males were trying to gain weight compared to the females (27.6% vs 19.6% respectively).

The level of concordance between measured weight status and self-reported weight perception is presented in **Table 2**. It shows the percentages of participants according to their body weight perception stratified by sex, BMI category and weight change goals. Overall, 36.1% of the participants misclassified their weight status, irrespective of their measured BMI and of those who misclassified their weight, around 27.3% inaccurately perceived themselves to be overweight and 15.3% to be underweight. Among the underweight BMI category, a larger number of the participants (around 82.7%) accurately perceived their underweight status. About half of the participants who identified themselves as being in the 'right weight' category correctly perceived their measured BMI weight category. There was more number of actually overweight or obese males who perceived themselves in the 'right weight' group than females (14.7% vs 9.1 %, respectively). In contrast, 38.3 % of females and 28 % of males perceived themselves as the 'right weight', but as per calculated BMI, they were underweighted. Among the perceived overweight group, more percentages of females (46.2%) misperceived their actual weight status compared to the males (37%). Overall, it seems that females were likelier to overestimate their weight, while males were likelier to underestimate their body weight. A higher percentage of females, compared to males (46.3% vs 22.2%), were perceived as overweight but not involved with physical activity on any day of the last week (of the interview). On the other hand, more males than females (78% vs 47%) participated at least a day in the last week.

Table 3 describes what males and females attempted to do about their weight according to measured BMI categories. Among normal-weight or underweight BMI participants, 44.4% of females and 31.8% of males were inappropriately trying to lose weight. While among normal-weight BMI participants, 13.2% of females and 25% of males were improperly attempting to gain weight. None of the overweight BMI participants was trying for weight gain. Among the overweight BMI participants, more males reported 'no weight change wish' (16.9% males and 11.7% females). Among the students attempting to lose weight, around 46.3% of females did not participate in any form of physical activity. In comparison, 77.3% of males had engaged in physical activity for at least one day in the last week.

Table 1: **Descriptive anthropometric characteristics, weight perception and weight change behaviour of the study population stratified by sex**

Characteristics	Females (N=270)	Males (N=145)	Total (N=415)	P value
Anthropometric characteristics				
Age, years, mean ± SD (standard deviation)	19.7±1.7	19.2±1.5	19.5±1.6	<0.01
Weight, Kg, mean ± SD	48.9±9.7	57±11.8	51.7±11.2	<0.0001
Height, Cm, mean ± SD	157.5±6.5	169.2±8	161±9	<0.0001
BMI, Kg/m2, mean ± SD	19.7±3.8	19.9±4.1	19.8±3.9	0.58
Age groups in years, n (%)				
18-19	113 (41.9)	84 (57.9)	197 (47.5)	0.005
20-21	101 (37.4)	43 (29.7)	144 (34.7)	
>=22	56 (20.7)	18 (12.4)	74 (17.8)	
Body Mass Index (BMI), Kg/m², n (%)				
Underweight (<18.5)	119 (44)	61 (42)	180 (43.4)	0.878
Normal (18.5-23)	102 (37.8)	55 (37.9)	157 (37.8)	
Overweight or Obesity (≥ 23)	49 (18.2)	29 (20)	78 (18.8)	
Self-perceived weight status, n (%)				
Underweight	83 (30.7)	50 (34.5)	133 (32)	0.344
Right weight	120 (44.4)	68 (46.9)	188 (45.3)	
Overweight	67 (24.8)	27 (18.6)	94 (22.7)	
Weight change behaviours, n (%)				
Try to lose weight	54 (20.0)	22 (15.2)	76 (18.3)	0.134
Try to gain weight	53 (19.6)	40 (27.6)	93 (22.4)	
No weight change wish	163 (60.4)	83 (57.2)	246 (59.3)	

Table 2: Self-reported perception of body weight according to age, measured weight status, weight change goals and physical activity stratified by sex

Variable	Females -Perception of weight				Males -Perception of weight			
	UW	RW	OW	P value	UW	RW	OW	P value
Sample (n)	**83**	**120**	**67**		**50**	**68**	**27**	
Age in years, mean (SD)	19.9± 1.6	19.5± 1.8	19.8± 1.6	0.381	19.3± 1.7	19.3± 1.6	19.0± 1.0	0.687
Age Group in years								
18-19	21 (25.3)	60 (50)	14 (20.9)	0.172	7 (14)	10 (14.7)	1 (3.7)	0.601
20-21	29 (34.9)	39 (32.5)	24 (35.8)		27 (54)	40 (58.8)	17 (63)	
>=22	33 (39.8)	21 (17.5)	29 (43.2)		16 (32)	18 (26.5)	9 (33.3)	
BMI, Kg/m²								
Underweight (<18.5)	69 (83.1)	46 (38.3)	4 (5.9)	<0.001	41 (82)	19 (28)	1 (3.7)	<0.001
Normal (18.5-23)	12 (14.5)	63 (52.2)	27 (40.3)		7 (14)	39 (57.4)	9 (33.3)	
Overweight/ Obesity (≥ 23)	2 (2.4)	11 (9.2)	36 (53.8)		2 (4)	10 (14.7)	17 (63.0)	
BMI, mean (SD)	16.8± 2	19.5± 2.5	23.8± 3.7	<0.001	16.9±2.3	19.9± 2.5	25.3± 4.7	<0.001
Weight misperception	14 (16.9)	57 (47.5)	31 (46.2)		9 (18)	29 (42.7)	10 (37)	
Weight change behaviour								
Try to lose weight	0	15 (12.5)	39 (58.2)	<0.001	0	4 (5.9)	18 (66.7)	<0.001
Try to gain weight	47 (56.6)	4 (3.3)	2 (3)		30 (60)	8 (11.8)	2 (7.4)	
No weight change wish	36 (43.4)	101 (84.2)	26 (38.8)		20 (40)	56 (82.4)	7 (25.9)	
Number of days physically active during the last seven days								
None	44 (53)	47 (39.2)	31 (46.3)	0.112	11 (22)	24 (35.3)	6 (22.2)	0.398
1-3/week	26 (31.3)	35 (29.2)	21 (31.3)		18 (36)	25 (36.8)	11 (40.7)	
>3/week	13 (15.7)	38 (31.7)	15 (22.4)		21 (42)	19 (27.9)	10 (37)	

UW- Underweight; RW – Right weight; OW – Overweight
Data are expressed as the Mean ± SD and n, %. BMI, body mass index; SD, standard deviation

Table 3: Gender wise weight change behaviour according to age, BMI and level of physical activity

Variable	Females - Weight change behaviour				Males - Weight change behaviour			
	Try to lose weight	Try to gain weight	Not wish to change weight	P value	Try to lose weight	Try to gain weight	Not wish to change weight	P value
Sample (n)	**54**	**53**	**163**		**22**	**40**	**83**	
Age (yrs) mean±SD	19.6 ± 1.5	19.9 ± 1.6	19.7 ± 1.7	0.533	19.0 ± 1.2	19.6 ± 1.9	19.1 ± 1.4	0.171
Age Group in years								
18-19	25 (46.3)	19 (35.9)	69 (42.3)	0.810	14 (63.6)	18 (45)	52 (62.7)	0.248
20-21	20 (37)	22 (41.5)	59 (36.2)		7 (31.8)	14 (35)	22 (26.5)	
>=22	9 (16.7)	12 (22.6)	35 (21.5)		1 (4.6)	8 (20)	9 (10.8)	
BMI, Kg/m²								
Underweight(<18.5)	6 (11.1)	46 (87)	67 (41.1)	<0.001	1 (4.6)	30 (75)	30 (36.1)	<0.001
Normal (18.5-23)	18 (33.3)	7 (13.2)	77 (47.2)		6 (27.3)	10 (25)	39 (47)	
Overweight/ Obesity (≥ 23)	30 (55.6)	0	19 (11.7)		15 (68.2)	0	14 (16.9)	
BMI, mean ± SD	23.6 ± 4.1	16.6 ± 1.8	19.4 ± 2.9	<0.001	25.9 ± 4.8	17.1 ± 1.8	19.7 ± 3	<0.001
Number of days physically active during the last seven days								
None	25 (46.3)	31 (58.5)	66 (40.5)	0.177	5 (22.7)	14 (35)	22 (26.5)	0.213
1-3/week	14 (25.9)	14 (26.4)	54 (33.1)		7 (31.8)	10 (25)	37 (44.6)	
>3/week	15 (27.8)	8 (15)	43 (26.4)		10 (45.5)	16 (40)	24 (28.9)	

Data are expressed as the Mean ± SD and n, %. BMI, body mass index; SD, standard deviation

DISCUSSION

This study examined the association among weight perception, measured weight status, and weight change behaviour among undergraduate students. The present study shows a high prevalence of body weight misperception, with as much as 36.1% of young participants. An almost similar level of misperception was reported by Vijayalakshmi et al. from Bangalore (37.6%)[10] and Narasimmal et al. from Tamil Nadu (38%).[11] Developing countries like China (50.2%)[13] and Pakistan (42.2%)[14] have reported a higher level of misperception than ours among youths. Our study has observed a certain extent of an inaccurate perception of one's own body weight, predominantly among the perceived 'overweight' and 'right weight' subgroups. Less than half of the participants who were actually normal weight according to measured BMI perceived that they were overweight. In comparison, 38.3% of females and 28% of males were actually underweight but classified themselves in the perceived 'right weight' category. Across the sample, compared to males, females were more likely to perceive themselves as fatter than their actual body shapes. These gender differences are consistent with findings from other studies.[15,16] Wardle et al. observed a similar trend across many countries.[17] This may be due to prevalent cul-

tural norms women are more likely to experience pressure to be thin from family, friends and the media. This reflects the interaction of sociocultural factors, which play a pivotal role in determining body image perception and associated body dissatisfaction.[18,19]

This imprecise weight perception is of serious concern since individuals who would not recognize that they are overweight less likely to initiate any steps to reduce their weight and therefore are at risk of developing obesity. On the other hand, the normal or underweight subgroup who overestimate their body size may unnecessarily engage in weight-reducing activities like dieting, meal skipping, and vigorous exercise, putting them at risk of developing nutritional deficiencies and deterioration of health.[20]

Participants who perceived themselves as 'underweight' appeared to assess their weight status more accurately (83% in males and 82% in females). In contrast, those students who perceived themselves in the 'right weight' and 'overweight' subgroups were more prone to overestimate their body size. This could be explained by the social comparison process, which determines what is considered normal or culturally acceptable body weight and shape in society. This process suggests that individuals with thin bodies in their social contacts or neighbourhoods are associated with a higher likelihood of normal or overweight individuals inaccurately classifying their weight categories. When family, relatives or friends are undernourished, and a person is exposed to such an environment, a thinner body image may become normalised and increase the tendency to overestimate their body size and shape.[21,22] Bordeleau et al. reported a more accurate perception of overweight and obesity due to the higher prevalence of overweight and obesity in the community.[23] Jayawardena et al. from Sri Lanka, where undernutrition is widely prevalent, reported comparable findings to the present study.[24]

In this study, less than half of the participants wished for weight change, either in the form of weight gain or loss. Interestingly, a high proportion of normal-weight BMI and underweight-BMI females were trying to lose weight, while more males were attempting to gain weight without perceiving themselves as underweight. It indicates that being underweight generally is not desirable for males, while females prefer a thin body image derived from socio-cultural norms and Western ideals. Generally, females are more sensitive to their weight status and are frequently criticised for being excessively thin or obese by family or peers. These observations are consistent with many previous research studies.[15,25] Young people frequently come into contact with the Western world through globalization and the widespread and easily accessible Internet. Westernized culture is popularised through social media platforms like Instagram, movies, and aggressive brand advertisements on television, print media and billboards. These media depict thinner body figures for women and influence the proliferation of slim body ideals, while men are portrayed as having slender but muscular body image.[5,26,27] Young students who fail to meet these standards may increase their concerns, which can be related to overestimation and dissatisfaction with body image.

We observed that participants who had perceived themselves as overweight and were actually overweight were more likely to try to lose weight. Similarly, participants who perceived themselves as thin and, in reality, were underweight more likely to try for weight gain. It could be concluded that motivation for weight change behaviour was positively correlated to the perception of body weight. The result reported in this study are consistent with the current literature.[20,28] The findings from the longitudinal CARDIA study are also comparable to the present study. [29] Perhaps more noteworthy was our finding that trying weight gain by some of the normal-weight BMI and many underweight BMI participants (both males and females) is an important observation of this study. These findings demonstrate that societies with a long history of poverty and food scarcity are often associated with undernutrition and thinness. In such communities, cultural attitudes view plumpness as a positive sign of good health and prosperity, while thinness indicates poverty and ill health.[6,14,30] In contrast to other studies conducted in developed regions, we observed that gaining weight is as important as losing weight for the participants.

Almost half of the females perceived themselves as overweight, and nearly the same proportion of females who were trying to lose weight was not engaged in any form of physical activity. In contrast, more than 80% of males perceived their weight to be underweight or overweight seem to be involved at least one day during the last week (of the interview) in physical activity, irrespective of their weight change preferences. It is possible that females' desire to lose weight would not translate into healthier practices like participating in physical activity.[31] Also, gender norms restrict their freedom of movement and get them less involved in physical activity.[25] Generally, men are more concerned with muscularity[32] and try to achieve it through greater involvement with moderate to strenuous exercises.

The present study has several limitations and should be kept in mind while interpreting the results. First, the study design is based on cross-sectional data; therefore, any inferences about causality cannot be established. Secondly, study participants were college graduates, hence the generalizability of our findings to comparable age groups with limited educational exposure. It has been well established that the level of education influences the perception of body image. Thirdly, weight perception was measured using a single question. This did not allow a thorough evaluation of the weight appropriateness, although several studies were conducted similarly. Finally, the use of BMI as a measure of body weight does not take

into account body fatness and body fat distribution. It also could not differentiate lean mass and fat mass.

The strength of this study includes that weight and height were actually measured through trained personnel with standardized techniques. A further strength of our study is that it provides data on young adults, particularly males, a relatively understudied group in this area, with a correlation between self-perception of body image and weight control behaviour.

Conclusion

Findings from this study indicate that the presence of inaccurate perception of body weight or shape and wish for weight change is relatively high among university students. Moreover, an accurate perception of one's own body weight is a crucial driving force for initiating weight change behaviour. Public health interventions targeting obesity and healthy lifestyles among underweight and overweight youths could be more effective by incorporating gender-specific body image training and educating them on a healthy way of losing or gaining weight.

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