

# Prevalence of Obesity among Rehabilitated Urban Slum Dwellers and Altered Body Image Perception in India (PRESUME)

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## Abstract

**Background:** An understudied risk factor for overweight/obesity in our population is distorted body image perception where studies from the west have proved a clear association between the two. We therefore aimed to evaluate the same and document the prevalence of overweight/obesity among rehabilitated slum dwellers. **Materials and Methods:** It was a cross-sectional study conducted during February 2015. The participants were recruited from among permanent residents of Tamil Nadu Slum Clearance Board residential apartment blocks. Systematic random sampling followed by cluster sampling was done. All consenting individuals above 18 years of age were included. Pregnant women, bed-ridden patients, and those who had an acute illness in the last 2 weeks were excluded. Data were collected using a semi-structured standardized pilot-tested questionnaire which included Stunkard's figure rating scale. **Results:** Number of families included was 170 comprising 315 individuals. Prevalence of overweight was 36.5% and prevalence of obesity was 12.4%. Prevalence of body image dissatisfaction was 68.3% (women 68.9% and men 67%), and prevalence of body image distortion was 59% (women 57.5% and men 62.1%). Distorted body image (adjusted odds ratio [aOR]; 95% confidence interval [95% CI]: 1.927; 1.057, 3.514) and underestimating body image size (aOR; 95% CI: 8.001; 4.223, 15.159) were highly significant predictors of obesity as estimated by logistic regression. **Conclusion:** Although majority of population belonged to daily wage laborer workforce, prevalence of overweight is high. Distorted ideal and current body image perception is also significantly high and is a definite risk factor for obesity.

**Keywords:** Body image, obesity, overweight, perception, risk factors

## INTRODUCTION

Obesity is defined by the World Health Organization (WHO) as abnormal or excessive fat accumulation that presents a risk to health.<sup>[1]</sup> Body mass index (BMI) is a crude measure of overweight/obesity, and BMI  $\geq 25$  kg/m<sup>2</sup> is considered as overweight whereas BMI  $\geq 30$  kg/m<sup>2</sup> is obesity.<sup>[2]</sup> However, the WHO recommended two additional trigger points for public health action among Asians at BMI  $\geq 23$  kg/m<sup>2</sup> and BMI  $\geq 27.5$  kg/m<sup>2</sup>, where BMI  $\geq 23$  kg/m<sup>2</sup> is associated with increased comorbidity risk and BMI  $\geq 27.5$  kg/m<sup>2</sup> with high risk.<sup>[3]</sup> The rationale behind redefining action points among Asian populations is that the percentage body fat and fat distribution in body are different among different population groups, and there was an increased prevalence of diabetes mellitus and cardiovascular risk factors among Asians when BMI was  $>25$  kg/m<sup>2</sup>.<sup>[4]</sup> The global burden of obesity among

adults in 2014 was quite high, with 39% of all adults being overweight/obese and 13% obese,<sup>[5]</sup> and in India, 11.48% of adults were overweight/obese and 2.2% obese in 2005–2006.<sup>[6]</sup> In the south Indian state of Tamil Nadu, the prevalence of Overweight and obesity is on the rise over the last decade. In 2006, the prevalence of overweight among men and women were 14.5% and 20.9% respectively. Whereas in 2014–2015, it increased to 28.2% and 30.9% respectively.<sup>[7]</sup> With such a rampant rise in prevalence rates of overweight and obesity, the emphasis is to look out for various risk factors for the same. One such understudied risk factor for overweight/obesity in our population is distorted body image perception where

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studies from the west have proved a clear association between the two.<sup>[8]</sup> Therefore, this study was performed to assess the prevalence of overweight/obesity among rehabilitated slum dwellers in a South Indian city and to evaluate if altered perception of body image is a risk factor for overweight.

## MATERIALS AND METHODS

It was a cross-sectional study conducted over a period of 1 year from February 2015. The participants were recruited from the permanent residents of Tamil Nadu Slum Clearance Board residential apartment blocks. They are previous slum dwellers who have been rehabilitated under the government initiative and relocated from urban slums. Systematic random sampling followed by cluster sampling was done. Assuming an estimated prevalence of overweight individuals to be 24.26% based on the National Family Health Survey 3 (NFHS-3) data,<sup>[9]</sup> the sample size calculated with an absolute precision of 5% was 294. To account for clustering, the calculated sample size was multiplied by design effect (DE) where  $DE = 1 + \rho$  (cluster size - 1);  $\rho$  is correlation coefficient which is arbitrarily taken as 0.1. A family was considered as the cluster, and we assumed that on an average, a family would have two adults, and therefore, our cluster size was 2. Thus, the final calculated sample size was 323 individuals, which correspond to 162 families. However, to account for nonresponse, it was decided to include 170 families.

Two streets were randomly chosen and every  $n^{\text{th}}$  apartment block was systematically selected (n chosen randomly between 2 and 5 by picking lots). Ten households in each of the selected apartment block, chosen randomly using a random number table, were included in the study. Written informed consent was obtained and all consenting individuals above 18 years of age who were permanent residents of the area were included. Pregnant women, bed-ridden patients, and those who had an acute illness in the last 2 weeks were excluded. Data were collected by trained student nurses (final-year diploma nursing students) who were split into six groups for the purpose of data collection. All six groups of data collectors were given hands-on training by the study investigators over 2 days, on standard methods of measuring subject's height and weight. Each group also individually piloted the questionnaire to a minimum of at least three households within the institution in the presence of one of the investigators before going out into the community. In the community, one of the investigators was present in the field throughout to monitor data collection, clarify doubts arising during data collection, and ensure proper sampling methodology as per the approved protocol. At the end of each day, the data collected were validated by another investigator by randomly verifying with one-household members for each group.

Weight was measured using standardized weighing scale with an accuracy of 0.1 kg. Height was measured using regular measuring tape with an accuracy of 0.1 cm. Thereby, BMI was calculated using values for height and weight.

Perceptions regarding body weight were assessed using the validated Stunkard's chart.<sup>[10]</sup> It was also used to assess the prevalence of body image dissatisfaction (BIDS) and body image distortion (BID). BIDS is defined as any individual despite their BMI category wanting to change their body image, whereas BID is defined as those individuals who perceived their body image differently that what in reality it is, based on their BMI. Demographic factors and knowledge regarding the hazards of obesity and benefits of weight loss were assessed using a semi-structured pretested questionnaire. Socioeconomic status (SES) was calculated using the modified Kuppaswamy's SES scale that was adapted to the income range for 2015 after adjusted accordingly with the current consumer price index.<sup>[11,12]</sup> Physical activity levels which are a significant predictor of obesity were assessed using the International Physical Activity Questionnaire-short form.<sup>[13]</sup> The examples of moderate and vigorous physical activities were explained using the show cards published by WHO for Global Physical Activity Questionnaire.<sup>[14]</sup> Data entry was done in Epi Info™ version 7. (Publisher: CDC, USA, 2011) and analysis was performed with IBM SPSS Statistics for Windows, Version 20.0 (Publisher: IBM Corp., USA, 2011). Demographic characteristics were summarized using descriptive statistics. Prevalence of overweight/obesity was reported as proportions with 95% confidence intervals (CIs). Perceptions as risk factors and other covariates were subjected to univariate analysis using simple logistic regression and those with a significance value  $<0.2$  were subjected to multivariate binary logistic regression. Statistical significance was set at 0.05. Ethics approval was obtained from the Institutional Ethics Committee (Ref No 104/273/2014).

## RESULTS

The total number of families approached was 170, wherein 347 individuals were screened and the number of consenting individuals who fulfilled the eligibility criteria was 315. This included 212 women and 103 men. The baseline demographic characteristics are given in Table 1. Most of the participants were married (92.7%). The mean (standard deviation) age of the study population was 35.57 (12.25). The study population had no professionals and nearly 40% of them were illiterate. Based on Kuppaswamy's SES scale, 71.7% of the participants belonged to upper lower SES class.

Prevalence of overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) among women was 43.9% and that of obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) was 13.7%. Prevalence of overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) among men was 21.4% and that of obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) was 9.7%. Overall prevalence of overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) in our study population was 36.5% and prevalence of obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) was 12.4%. Going by the Asia Pacific standards, those with BMI  $\geq 23$  kg/m<sup>2</sup> were 49.3% and those with BMI  $\geq 27.5$  kg/m<sup>2</sup> were 36.5%. The Stunkard's chart was used to gauge perceptual distortions of body image among participants where 26% identified an overweight image to be ideal, of which 1% identified a morbidly obese image as the ideal body

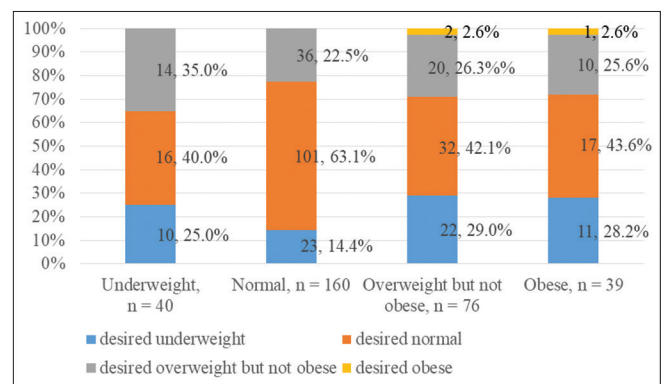
**Table 1: Demographic characteristics**

Variable	Entire study population			Overweight/obese		
	Women (n=212), n (%)	Men (n=103), n (%)	Total (n=315), n (%)	Women (n=93), n (%)	Men (n=22), n (%)	Total (n=115), n (%)
Age						
18-30	92 (43.4)	50 (48.5)	142 (45.1)	22 (23.7)	3 (13.6)	25 (21.7)
31-45	67 (31.6)	30 (29.2)	107 (34.0)	38 (40.9)	8 (36.4)	46 (40.0)
46-60	53 (25.0)	23 (22.3)	76 (20.9)	33 (35.5)	11 (50.0)	44 (38.3)
Marital status						
Married	206 (97.2)	86 (83.5)	292 (92.7)	92 (98.9)	22 (100)	114 (99.1)
Unmarried	6 (2.8)	17 (16.5)	23 (7.3)	1 (1.1)	0	1 (0.9)
Occupation						
Unemployed	120 (56.6)	20 (19.4)	140 (44.4)	41 (44.1)	2 (9.1)	43 (37.4)
Unskilled laborer	53 (25.0)	35 (34.0)	88 (27.9)	31 (33.3)	10 (45.5)	41 (35.7)
Semi-skilled laborer	32 (15.1)	25 (24.3)	57 (18.1)	20 (21.5)	5 (22.7)	25 (21.7)
Skilled laborer	2 (0.9)	16 (15.5)	18 (5.7)	0	2 (9.1)	2 (1.7)
Clerical/shop owner	2 (0.9)	3 (2.9)	5 (1.6)	1 (1.1)	1 (4.5)	2 (1.7)
Semi-profession	3 (1.4)	4 (3.9)	7 (2.2)	0	2 (9.1)	2 (1.7)
Education						
Illiterate	94 (44.3)	35 (34.0)	129 (41.0)	50 (53.8)	11 (50.0)	61 (53.0)
Primary school	42 (19.8)	16 (15.5)	58 (18.4)	20 (21.5)	3 (13.6)	23 (20.0)
Middle school	28 (13.2)	18 (17.5)	46 (14.6)	11 (11.8)	4 (18.2)	15 (13.0)
High school	25 (11.8)	12 (11.7)	37 (11.7)	6 (6.5)	1 (4.5)	7 (6.1)
Posthigh school diploma	12 (5.7)	12 (11.7)	24 (7.6)	4 (4.3)	0	4 (3.5)
Graduate	11 (5.2)	10 (9.7)	21 (6.7)	2 (2.2)	3 (13.6)	5 (4.3)
Kuppuswamy's SES						
Lower	7 (3.3)	2 (1.9)	9 (2.9)	7 (7.5)	0	7 (10.4)
Upper lower	155 (73.1)	71 (69.0)	226 (71.7)	71 (76.34)	13 (59.1)	84 (68.7)
Lower middle	30 (14.2)	15 (14.5)	45 (14.3)	12 (12.9)	7 (31.8)	19 (16.6)
Upper middle	17 (8.0)	13 (12.7)	30 (9.5)	2 (2.2)	2 (9.1)	4 (3.4)
Upper	3 (1.4)	2 (1.9)	5 (1.6)	1 (1.1)	0	1 (0.9)

Percentage corresponds to column percentages for each variable. SES: Socioeconomic status

image (IBI). Prevalence of BIDS was 68.3% (women 68.9% and men 67%) and of BID was 59% (women 57.5% and men 62.1%). The actual BMI versus the perceived IBI is shown in Figure 1. Among those who are overweight but not obese, 28.9% considered an overweight/obese image as the IBI and 28.2% of those who were obese felt the same way.

The distortions in perceived body image versus the actual BMI calculated are depicted in Figure 2. Among those who were overweight but not obese, 51.3% perceived themselves to be of normal body image and 5.3% actually felt themselves to be underweight. Similarly, among obese individuals, 38.5% perceived themselves to be of normal body image and 7.7% further considered them to be underweight. Figure 3 shows the actual BMI versus attempts to change weight. It is a measure of self-body image satisfaction which was calculated by subtracting the figure number corresponding to their actual BMI in the Stunkard's chart with the image number each participant identified to be their ideal choice of body image. Among those who were overweight but not obese, 47.4% felt that body size was ideal and there was no need to change their body weight while 11.8% of them actually wanted to increase their body weight further. On the other hand, among those who were already obese, only 59% of them wanted to tone down their body



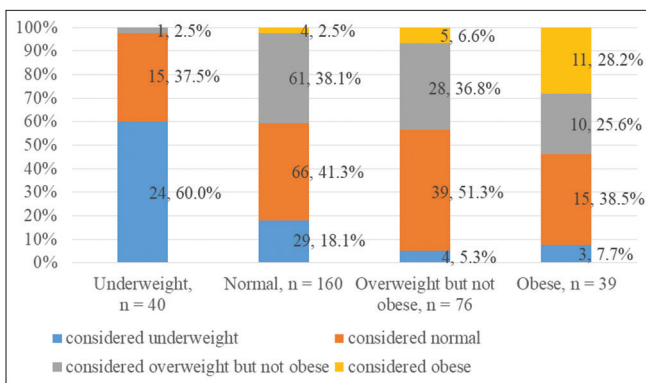
**Figure 1: Actual BMI versus Ideal Body Image**

weight. Established risk factors of overweight/obesity along with distorted perceptions of IBI and underestimating body image size as potential risk factors were estimated using univariate analysis, followed by a multivariate analysis using the logistic regression model. Those with a significance  $P < 0.2$  were included in the regression model. Distorted body image (adjusted odds ratio [aOR]; 95% CIs: 1.927; 1.057, 3.514) and underestimating body image size (aOR; 95%CI: 8.001; 4.223, 15.159) were highly significant predictors of obesity [Table 2].

**Table 2: Risk factors for overweight/obesity**

Variable	Univariate analysis		Multivariate analysis	
	Unadjusted OR	P	Adjusted OR (95% CI)	P
Distorted ideal body image	1.899	0.007	1.927 (1.057-3.514)	0.032
Underestimating body image size	9.515	<0.001	8.001 (4.223-15.159)	<0.001
Increasing age	1.074	<0.001	1.057 (1.026-1.089)	<0.001
Female sex	2.877	<0.001	4.919 (2.270-10.658)	<0.001
Being married	14.090	0.010	7.737 (.591-101.257)	0.119
Being employed	1.577	0.057	2.505 (1.239-5.064)	0.011
Illiteracy	2.193	<0.001	2.261 (1.095-4.670)	0.028
Low SES	1.089	0.006	1.037 (0.960-1.121)	0.357
Low physical activity	1.421	0.018	1.255 (0.836-1.882)	0.273
Poor knowledge	1.989	0.006	1.133 (1.014-1.267)	0.027

OR: Odds ratio, CI: Confidence interval, SES: Socioeconomic status

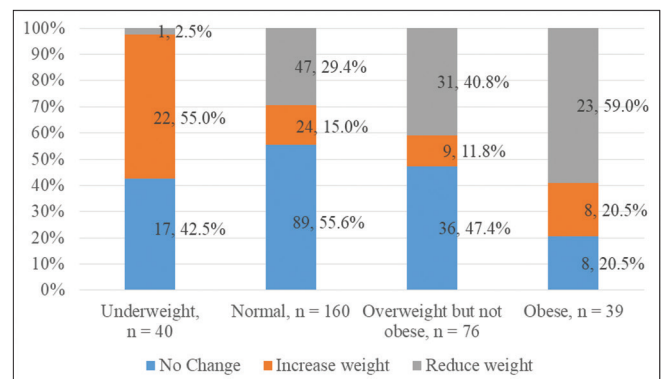


**Figure 2: Actual BMI versus Perceived Body Image**

## DISCUSSION

The prevalence of overweight/obesity among women in our study population was around 44% and among men was around 21%. This is a little different from the NFHS-4 estimates for the urban population of the district which marks 29.4% of women and 33.0% of men are overweight though the sample size of both studies is small.<sup>[15]</sup> When compared with the state figures of NFHS-4 for Tamil Nadu, 36.2% of women and 30.6% of men were overweight.<sup>[7]</sup> Thus, the other possibility is that our study included a homogenous population in terms of their culture and livelihood whereas the NFHS data incorporate various population types of the entire district. As described earlier, majority of our population belonged to the lower class with poor educational qualifications. They were once slum dwellers who have been provided with houses by the government in order to rehabilitate them from the slums, and hence, a large number of our study population was below poverty line with meagre income. Furthermore, around two-third of women were homemakers where only around one-third of men were unemployed. Among those who were overweight, about half of them were illiterate and one-third were either unemployed or employed as unskilled daily wage laborers.

Our study employed a figure rating scale to assess perceptions about one's own body image. A body image is a conscious representation of the body that is usually thought to rely on



**Figure 3: Actual BMI versus attempts to change weight (self- body image satisfaction)**

visual input to the brain.<sup>[16]</sup> Stunkard's scale is a psychometric measurement tool which was developed in 1983, and it consists of a series of nine male and female line drawings that increase in size gradually.<sup>[10]</sup> It is a visible measure of how an individual perceives his or her own physical appearance or that of his/her neighbor/relative, and it has been used in multiple studies from then on.<sup>[17]</sup> Using such visual figural stimuli is an established method in psychological research to assess ideal body size and current body size in adults and adolescents.<sup>[18,19]</sup> The participant was asked two questions from the Stunkard's chart as to which line drawing they perceive would be the IBI for a similar person like them and what would be their judgment on their current body image. This method has been widely used in research involving certain psychiatric disorders such as eating disorders and depression.<sup>[20,21]</sup> It has also been evaluated for its role in weight status of an individual in very few nationalities.<sup>[22]</sup> Prevalence of BIDS and BID was around 60% each in both men and women despite about half the participants were of normal BMI, suggesting that participants from all BMI categories suffer from some form of BIDS or BID. This is similar to the findings in other such studies published in the recent past. A study done among 184 adult female students in Iran showed that BIDS was 51.63% and BID was 64.13%.<sup>[23]</sup>

Our study revealed extremes of distortion such that those who were underweight or normal believing an underweight



image would be the ideal and those who were either obese or overweight considering an overweight or obese image to be that of an ideal image [Figure 1]. On the whole, only around 53% of the total study population had the right idea about an IBI. Furthermore, we noted that around one-third of those who were underweight desired an overweight image. This could probably be attributed to the frustration built over the years trying to put on more weight.<sup>[24]</sup> Studies have shown that emotions play a role in the intake of food. During negative emotional states, overweight people tend to eat more and vice versa for underweight people. However, during positive emotional states, underweight people tend to long for overweight body image.<sup>[24]</sup> We also report that about a quarter of them who were overweight but not obese and those who were obese felt that an overweight body image was ideal.

When tested about the perception on their current body image, around half of those in the overweight category and a little more than one-third of those in the obese category perceived themselves to be of normal body image. Similarly, around one-third of them with normal BMI perceived themselves to be overweight. Thus, we may conclude that distortion on perceived current body image is bidirectional. However, the number of overweight or obese people considering themselves to be of normal or underweight body image is considerably high. It is also surprising to note that 47.4% of overweight people and 20.5% of obese people did not feel the need to reduce weight. However, a small number of them who were overweight (11.8%,  $n = 9$ ) and obese (20.5%,  $n = 8$ ) contrarily wanted to increase their body weight. These individuals are at a much higher risk of gaining more weight. A larger longitudinal study was conducted in the year 2008 in the United States of America using Stunkard's figure rating scale. This study reported that obese women lost 0.09 BMI units annually if they actually perceive themselves to be obese. On the contrary, those who perceived themselves as normal gained weight at the rate of 0.31 BMI units per year. Similarly, overweight men who considered themselves to be of normal body image gained weight annually.<sup>[25]</sup> On the other hand, around half of them who were either underweight or normal did not want to make attempt to increase weight and around one-third of them who had normal body weight wanted to further reduce body weight. All these contribute to the fact that BID is quite prevalent in our population.

There have been contradictory findings on the role of BID in obesity. There are studies which claim that people who perceive themselves to be overweight or obese take necessary corrective measures to lose weight.<sup>[26]</sup> However, it has also been noted that when normal individuals misperceive themselves to be overweight or obese, they resort to unhealthy dieting practices and behavior that in turn favor obesity where the odds for men (1.89) was stronger than for women (1.29).<sup>[27]</sup> However, our study results favor the former school of thought, wherein the odds of being overweight or obese is eight times if an individual underestimates his/her body image and nearly two times if one has a distorted view on IBI after

it has been adjusted for other known factors that lead to overweight/obesity. A cross-sectional study done in Ghana in 2011 reports in a similar manner where BID is highly associated with obesity (Crude OR: 97.3).<sup>[28]</sup> There was also a large population-based study done among Japanese adolescents which proved that BID was associated with changes in the lifestyle practices that favor weight gain among already overweight individuals.<sup>[29]</sup>

Some of the other risk factors for obesity in our study population included increasing age, female sex, being employed, illiteracy, and poor knowledge on obesity and its ill effects. With every year of increasing age, there was a 6% increased chance of becoming overweight, and similarly, as already proved in multiple studies,<sup>[30,31]</sup> female gender had more probability of developing excessive weight gain. The odds of a woman becoming overweight was nearly five times in our study. Our study also pointed out that being employed had two times an increased probability of gaining excessive weight. This is probably due to the fact that city dwellers are left with job profiles that are mostly sedentary involving desk job and the actual physically exerting manual job has come down so much due to urbanization.<sup>[32]</sup> The WHO states that increased urbanization has multiple environmental factors that actually encourage physical inactivity. Some of which includes high-density traffic, low air quality and pollution, and lack of parks, sidewalks, sports, or recreational facilities.<sup>[33]</sup> In our study population, however, low physical activity had a 42% increased chance of developing overweight by univariate analysis, but it was not statistically significant in regression analysis probably due to smaller sample size of our study. A large study done in four states of India, namely, Tamil Nadu, Maharashtra, Jharkhand, and Chandigarh, showed that 54.4% of individuals were physically inactive which was attributed to the twin epidemic of diabetes and obesity in India.<sup>[32]</sup>

Illiteracy is another known factor for unhealthy lifestyle. Illiteracy can have a major impact on patient's understanding of the healthcare information provided to them.<sup>[34]</sup> In fact, literature reports very specifically that low numeracy skills and those unable to understand the label of content provided with the product were at a much higher risk of increased BMI. Numeracy was negatively and significantly correlated with BMI ( $\rho = -0.26$ ,  $P = 0.001$ ).<sup>[35]</sup> It has also been reported that poor parental knowledge and health illiteracy are associated with obesity in children.<sup>[36]</sup> The findings in our study are also in similar lines where the probability of someone being overweight/obese increases approximately two folds with illiteracy. With respect to the poor knowledge on excessive body weight and its ill effects, our study reports a 13% increased odds of becoming overweight with one unit of decrease in knowledge scores as assessed by the knowledge questionnaire. It is also well known that patients with poor knowledge on obesity have much poorer weight loss strategies when compared with their peers.<sup>[37]</sup> Thus, it is essential to tailor patient education and counseling for weight loss according to the existing knowledge base and literacy levels of the target

patients. The other factors which our study looked at were marital status and low SES, both of which were significantly associated with overweight/obesity in univariate analysis but lost their statistical significance during regression analysis.

## CONCLUSION

Prevalence of obesity in our study population was 12.4% and that of overweight was relatively high (36.5%). The number of overweight individuals was seen more among female participants than the men. Prevalence of BIDS and BID was also quite high (68.3% and 59%, respectively). The total number of participants who could correctly identify the IBI figure in the figure rating scale was just 53%. Extremes of distortion were noted among participants across all BMI classes. Distorted body image (aOR: 1.927) and underestimating body image size (aOR: 8.001) were highly significant predictors of obesity as estimated by logistic regression. Thus, we recommend policy-level interventions in the healthcare system to give equal importance in educating and training people to correctly identify the IBI and to rightly perceive their current body image figure. More importance is to be given to women and to the more vulnerable groups such as those with poor educational status, leading a sedentary lifestyle and those in the lower strata of SES. We also recommend initiatives to improve the health literacy among urban population which is tailored according to the understanding capability of the target audience and to enhance social responsibility among our Indian citizens to help in tiding over the looming threat of increasing burden of obesity through proper diet, adequate exercise, and physical activity.

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## Conflicts of interest

There are no conflicts of interest.

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