

Assessment of Overweight and Obesity According to Body Mass Index among College-Going Girls and Boys of Urban and Rural Background of District Gurdaspur, Punjab

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ABSTRACT The present study was undertaken on 710 college students, with 377 subjects from urban and 333 from rural background, including 407 boys (194 urban; 213 rural) and 303 girls (183 urban; 120 rural) belonging to middle class and lower middle class economic strata. For assessment of nutritional status, measurements of height and weight were taken for each subject to calculate body mass index (BMI). According to latest BMI criteria, 57.25 percent of boys maintained normal nutritional status compared to 54.13 percent of girls who were significantly underweight while boys were significantly obese to level-I. A larger number of college-going individuals (i.e. boys and girls clubbed together) of rural area (57.36 percent) were normal compared to urban ones (54.64 percent), while a higher number of urban boys were overweight (12.73 percent) and significantly obese to level-I (8.75 percent) and level-II (1.86 percent). A comparison among urban and rural boys indicated that a higher percentage of urban boys was significantly obese to level-I (13.40 percent) whereas urban girls were significantly overweight (12.02 percent) compared to rural girls. Analysis of the data based upon the latest WHO standards recognizes more of the subjects as overweight and obese, which otherwise were categorized as normal when previous standards were taken into consideration.

INTRODUCTION

Malnutrition means impairment of health arising either from deficiency, or excess, or imbalance of nutrients in the body. Adolescents and young adults (ranging between 13-35 years) constitute about 41.05% of the Indian population (Census 2001) and form an important physiological group whose nutritional needs demand special attention (Visweswara Rao 1987). India is a young country compared to the graying western world and the potential of a country is adjudged by its adolescents and youngsters. Youth of a country is an untempered work force which has an impact on its immediate social and economic well-being. Changing global scenario highlights its importance to a considerable extent, where all major economic sections of society are being held and headed by people in their early or mid-twenties. Health and demography of a country are affected by the population of youth, as healthy youth is an indicator of health status of forthcoming generations. According to Dasgupta et al. (2010), inadequate nutrition in adolescents and young adults can put them at a high risk of chronic diseases, particularly if combined with

other adverse lifestyle behaviour. The problem of malnutrition received recognition of planners and policy-makers right from the inception of five-year planning. A large number of national nutritional programmes were implemented to combat the menace of malnutrition, however, malnutrition still persists. Another malnutritive problem cropping up its head, in the modern generation, is being overweight and obese which needs to be tackled at the earliest. Therefore, in the present study, an attempt has been made to investigate the nutritional status of young boys and girls of urban and rural background.

MATERIAL AND METHODS

The data for the present study was collected from students attending local colleges in the township of Batala and Qadian having their niche in urban areas and various villages of near and far vicinity and even from the deeper rural pockets. A sample of 710 students (407 males, 303 females) in the age range of 16-22 years was undertaken for study. Details of the sample are shown in Table 1.

Table 1: Number and percentage distribution of college-going boys and girls

Sex	Area of distribution					
	Rural		Urban		Total	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Boys	213	63.96	194	51.46	407	57.32
Girls	120	36.04	183	48.54	303	42.68
Total	333	46.90	377	53.10	710	100.00

For the assessment of nutritional status, height and weight measurements were taken for each subject using the standard methodology of Weiner and Lourie (1981). The data was analyzed to establish the nutritional status using body mass index (BMI). Body mass index (BMI) has been calculated by the following formula:

$$\text{BMI} = \text{Weight (kg)} / \text{Height}^2 \text{ (m)}$$

The individuals were categorized for their BMI status as per WHO (1998) standard which are displayed in Table 2. The data were also subjected to a comparative analysis using revised standards of WHO (2000) to establish the difference in the level of malnutrition. Standardization as per WHO (2000) is shown in Table 2

Table 2: BMI Standards as per WHO (1998) WHO 2000 criteria

BMI kg/m ² (1998)	Category
<i>WHO (1998) Criteria</i>	
≤ 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0-34.9	Obese-I
35.0-39.9	Obese-II
≥ 40.0	Obese-III
<i>WHO (2000) Criteria</i>	
≤ 18.5	Underweight
18.5-22.9	Normal
23.0-24.9	Overweight
25.0-29.9	Obese-I
≥ 30.0	Obese-II

RESULTS AND DISCUSSION

Body mass index (BMI) is commonly used to assess the current form of malnutrition, that is, under nutrition and over nutrition. According to WHO (2000) criteria of BMI, 55.91% of the study sample were normal, 26.06% suffered from underweight conditions and 18.03% were categorized as overweight and obese (Table 3). A large number of girls (33%) were underweight com-

pared to boys (20.88%), and the difference between boys and girls was statistically significant ($\chi^2=9.7906$) at 1% level of probability. Overweight (12.28%), obese-I (8.85%) and obese-II (0.74%) conditions were more pronounced in boys compared to girls (8.25%, 3.30% and 1.32%, respectively), but a significant difference was observed only in obese-I category ($\chi^2=8.2410$; $p<0.01$). A higher number of boys (57.25%) maintained a normal nutritional status than the girls (54.13%). There is a clear indication of boys being in a better flux of nutritional status which could be because of a difference in the attitude towards the upbringing of male and female children in our society. Boys are provided with better food and are excessively fed, which is quite obvious from the data since the percentage of underweight conditions is higher in girls and that of being overweight in boys. Dolly et al. (2000) in a study of adult Punjabi males ranging from 19 to 21 years, observed that BMI <20 kg/m² was present in 12.61% of males, between 20-25 kg/m² was present in 61.51%, between 25.0-29.9 kg/m² was present in 13.54% and BMI >30 was present in 0.32% individuals, with an average BMI for 18-30 years of male individuals standing at 22.70 kg/m² level.

A comparison of individuals of urban and rural background depicted that a significant number of subjects of rural background (30.63%) were underweight than their urban counterparts (22.02%) with a statistical difference ($\chi^2=5.0345$) at a probability level of 0.05. A higher number of urban young adults (that is, both boys and girls when grouped together) were overweight (12.73%), obese to level-I (8.75%) and level-II (1.86%) as compared to rural ones (8.11%, 3.90% and 0%, respectively) with a significant difference in obese-I ($\chi^2=6.4159$) as well as obese-II ($\chi^2=6.1720$) categories at 5% level of probability. A comparison of urban and rural boys also predicted that urban boys were significantly obese to level-I ($\chi^2=8.7017$; $p<0.01$). The reason for this can be attributed to the sedentary lifestyle and changing food habits which is indicative of a rising trend of obesity in urban population.

A still adverse condition was observed when comparison was made amongst urban and rural girls, where 45.83% of rural females were underweight compared to 24.59% of urban females, and the difference was statistically significant ($\chi^2=9.9154$ at $p<0.01$). Urban girls also showed a tendency of being overweight (12.02%; $\chi^2=7.9621$

Table 3: Distribution of number, percentage and χ^2 values of college-going boys and girls as per Body Mass Index (BMI) using WHO (2000) criteria

Nutritional	Total N=710	Boys N=407		Girls N=303		χ^2 value	Urban N=377		Rural N=333		χ^2 value	Boys N=194		Girls N=183		χ^2 value
		N	%	N	%		N	%	N	%		N	%	N	%	
Underweight	185 (26.06)	85 (20.88)	100 (33.00)	83 (22.02)	102 (30.63)	9.79*	38 (19.59)	47 (22.07)	38 (19.59)	45 (24.59)	0.30	26 (13.40)	22 (11.27)	45 (24.59)	55 (45.83)	5.03**
Normal	397 (55.91)	233 (57.25)	164 (54.13)	206 (54.64)	191 (57.36)	0.30	101 (26.80)	132 (36.63)	101 (26.80)	105 (31.53)	1.74	101 (52.06)	132 (61.97)	105 (57.38)	59 (49.17)	0.23
Overweight	75 (10.56)	50 (12.28)	25 (8.25)	48 (12.73)	27 (8.11)	2.68	26 (6.92)	13 (3.50)	27 (7.24)	13 (3.90)	3.58	26 (13.40)	10 (4.69)	22 (12.02)	3 (2.50)	0.38
Obese-I	46 (6.48)	36 (8.85)	10 (3.30)	33 (8.75)	13 (3.90)	8.24*	7 (1.86)	7 (1.92)	7 (1.92)	7 (2.10)	6.42**	3 (1.55)	4 (1.86)	7 (3.82)	3 (2.50)	8.70*
Obese-II	7 (0.99)	3 (0.74)	4 (1.32)	7 (1.86)	-	0.60	3 (0.81)	-	3 (0.90)	-	6.17**	3 (1.55)	-	4 (2.19)	-	3.29*

*Significant at p<0.01.

**Significant at p<0.05.

Table 4: Distribution of number, percentage and χ^2 values of college-going boys and girls as per Body Mass Index (BMI) using WHO (1998) criteria

Nutritional	Total N=710	Boys N=407		Girls N=303		χ^2 value	Urban N=377		Rural N=333		χ^2 value	Boys N=194		Girls N=183		χ^2 value
		N	%	N	%		N	%	N	%		N	%	N	%	
Underweight	184 (20.64)	84 (20.64)	100 (33.00)	82 (21.75)	102 (30.63)	10.25*	37 (9.81)	47 (12.47)	37 (9.81)	45 (13.51)	0.44	26 (6.63)	22 (5.73)	45 (12.79)	55 (15.93)	5.38**
Normal	475 (66.90)	286 (70.26)	189 (62.39)	257 (68.17)	218 (65.47)	1.62	130 (34.48)	156 (41.38)	130 (34.48)	127 (38.14)	0.19	130 (34.48)	156 (41.38)	127 (34.99)	62 (17.23)	0.56
Overweight	44 (6.20)	34 (8.35)	10 (3.30)	31 (8.22)	13 (3.90)	7.16*	24 (6.36)	10 (2.70)	24 (6.36)	10 (2.97)	5.33**	24 (6.14)	10 (2.70)	7 (1.93)	3 (0.81)	7.15*
Obese-I	6 (0.84)	3 (0.74)	3 (0.74)	6 (1.59)	-	0.13	3 (0.79)	-	3 (0.90)	-	5.29**	3 (0.77)	-	3 (0.81)	-	3.29
Obese-II	1 (0.14)	-	1 (0.33)	1 (0.27)	-	1.33	1 (0.27)	-	1 (0.30)	-	0.88	-	-	1 (0.27)	-	-

*Significant at p<0.01.

**Significant at p<0.05.

at 1% probability level), obese to level-I (3.82%) and level-II (2.19%) compared to their rural cohorts (2.50%, 2.50% and 0%, respectively). The number of rural girls (49.17%) belonging to normal level of nutritional status was again lesser than urban girls (57.38%), thereby indicating a discriminatory behaviour being meted out to the girls of rural background whereas cultural development in urban areas makes the conditions better for their urban peers. It has been noticed that girls of both urban and rural areas maintained low body mass indices and there was a trend in young girls to remain reed thin as per the modern standards. Although overweight and obesity are on rise but at the same time underweight conditions are also prevalent in the studied population thereby creating a double burden of nutrition related ill health.

Deshmukh et al. (2000) studied adolescents of rural Wardha and reported that majority (53.8%) of the adolescents were thin, only 2.2% were overweight while 44% were normal. Thinness was significantly higher in early adolescence (57%) than the late adolescence (48.5%). Choudhary et al. (2003) reported that 68.52% of adolescents had BMI less than 18.5 kg/m² in rural areas of Varanasi. Based upon BMI standards, increasing overweight and obesity have been reported in various populations across middle-east countries (Janghorbani et al. 2007; Hosseinpanah et al. 2009; El Mouzan et al. 2010) and Nigeria (Odenigbo et al. 2011). The survey carried out by NFHS-2 (2001) indicated that BMI <18.5, that is, underweight, conditions were prevalent in 22.1% of urban and 19.6% of rural females in age range of 18 to 45 years. A normal

BMI range of 18.5 to 25.0 was reported in 48.1% of urban and 52.6% of rural women and overweight conditions, that is BMI >25 was present in 29.3% of urban and 6.8% of rural areas. A similar kind of trend has been observed in the female subjects of the present study.

The data was also subjected to carry out a comparison between WHO (1998) and WHO (2000) analysis. Although the number of cases for underweight category were comparable, but the data showed a variation in dispersion in normal category and at various obesity levels (Table 4). A higher number of subjects were categorized as normal on the basis of WHO (1998) standards, with more of urban children (68.17%) than rural (65.47%), while the condition was reverse as per the WHO (2000) analysis which placed more number of rural children (57.36%) in normal category compared to urban ones (54.64%). Further, as per WHO (1998) standards, maximum number of subjects analyzed for obesity were found to be covered under the overweight category, with boys being significantly overweight ($\chi^2=7.1614$ at $p<0.01$) than girls. The boys and girls of urban area when considered collectively were significantly overweight ($\chi^2=5.3267$; $p<0.05$) and obese-I ($\chi^2=5.2853$; $p<0.05$), and a pronounced significant expression was especially observed in urban boys ($\chi^2=7.1547$) compared to their rural counterparts at 1% level of probability. As per the WHO (1998) criteria, out of the total sample, 6.20% were overweight, 0.84% were obese to level-I and 0.14% were obese to level-II whereas 10.56%, 6.48% and 0.99% respectively, were overweight, obese-I and obese-II as per the WHO (2000) standards. It reveals that in the

Table 5: Distribution of χ^2 values depicting the difference in Body Mass Index (BMI) as per WHO (2000) and WHO (1998) criteria

	Category	No. of subjects	Underweight (χ^2 value)	Normal (χ^2 value)	Nutritional status overweight (χ^2 value)	Obese-I (χ^2 value)	Obese-II (χ^2 value)
Boys	Urban	194	0.0134	3.6406	0.0800	18.2414*	3.0000
	Rural	213	0.0000	2.0000	5.7646**	10.0000*	1.0000
Girls	Urban	183	0.0000	2.0862	7.7586*	1.6000	1.8000
	Rural	120	0.0000	2.0744	0.0000	3.0000	-
Total		710	0.0028	6.9770*	8.0756*	30.7692*	4.5000**
Urban		377	0.0060	5.6178**	3.6582	18.6924*	4.5000**
Rural		333	0.0000	1.7824	4.9000**	13.0000*	-
Boys		407	0.0060	5.4124**	3.0476	27.9230*	3.0000
Girls		303	0.0000	1.7706	6.4286**	3.769	1.8000

*Significant at $p<0.01$. **Significant at $p<0.05$.

pooled sample, the prevalence of obesity in terms of number of people almost doubled according to the new classification.

Chi-square test was implied to find out a difference in the distribution of sample depending upon the BMI standards of WHO (1998) and WHO (2000). Table 5 illustrates that the overall pooled sample reflected a significant difference in the categorization of subjects in normal ($\chi^2=6.9770$; $p<0.01$), overweight ($\chi^2=8.0756$; $p<0.01$), obese-I ($\chi^2=30.7692$; $p<0.01$) and obese-II ($\chi^2=4.5000$; $p<0.05$) levels. Based upon the two criteria, again a significant difference was observed when the data was sub grouped at gender level and urban and rural background. This observation clarifies that as per the WHO (1998) criteria of BMI analysis, the individuals which were grouped as normal can in fact be categorized to various obesity levels using latest standards of WHO (2000), and the dispersion of data for overweight, obese-I and obese-II was significantly different on the basis of these standards. Therefore, the changed perception about BMI classification has drawn a drastic scenario of obesity among urban/rural young adults of present study.

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Table 3: Distribution of number, percentage and χ^2 values of college-going boys and girls as per Body Mass Index (BMI) using WHO (2000) criteria

Nutritional	Total N=710		Boys N=407		Girls N=303		χ^2 value		Urban N=377		Rural N=333		χ^2 value		Boys		Girls				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	Urban N=194	Rural N=213	χ^2 value	Urban N=183	Rural N=183		
Underweight	185	(26.06)	85	(20.88)	100	(33.00)	83	(22.02)	102	(30.63)	38	(19.59)	47	(22.07)	38	47	0.30	45	45	(24.59)	(24.59)
Normal	397	(55.91)	233	(57.25)	164	(54.13)	206	(54.64)	191	(57.36)	101	(52.06)	132	(61.97)	101	132	1.74*	105	105	(57.38)	(57.38)
Overweight	75	(10.56)	50	(12.28)	25	(8.25)	48	(12.73)	27	(8.11)	26	(13.40)	24	(11.27)	26	24	0.37	22	22	(12.02)	(12.02)
Obese-I	46	(6.48)	36	(8.85)	10	(3.30)	33	(8.75)	13	(3.90)	26	(13.40)	10	(4.69)	26	10	8.70*	7	7	(3.82)	(3.82)
Obese-II	7	(0.99)	3	(0.74)	4	(1.32)	7	(1.86)	-	-	3	(1.55)	-	-	3	-	6.17**	4	4	(2.19)	(2.19)

*Significant at p<0.01.

**Significant at p<0.05.