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## Health status of college students as assessed through BMI

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### Abstract

Youth is the true wealth of any nation. The youth are critical for a nation's continued economic development and demographic evolution. With India, projected to be the youngest nation in coming decade, health of its youth becomes even more important. The present study was planned with the objective to assess health status of female students in universities of Hisar city. BMI was chosen as indicating parameter. Majority of subjects belonged to general category (56.6%); had private schooling (68.3%); belonged to nuclear families (71.1%) and had a family income of Rs. 10-30,000/month (46.1%). Total respondents under study had mean height of  $157.47 \pm 12.60$  cm, mean body weight  $48.52 \pm 7.51$  kg, mean BMI  $19.44 \pm 2.92$  kg/m<sup>2</sup> and mean body fat per cent  $24.61 \pm 5.46$ . Of the total 180 subjects; 42.2, 52.8, 3.3 and 1.7 per cent were underweight, normal, overweight and obese respectively.

**Keywords:** Adults, Anthropometrics, BMI, India, Socio economic status.

### 1. Introduction

Youth is the true wealth of any nation. The youth are critical for a nation's continued economic development and demographic evolution. The youth population, which typically constitutes the entering cohort in the country's labour force, is expected to bring in freshly learned and updated skills that will help renew and improve the country's stock of human capital. Education, employment, and health are all key elements of youth empowerment. India's population trend shows that people in the age group 15-65 constitute the 'majority', thereby reducing the size of the dependent population. It is projected that by 2025 the dependency ratio will fall to 48 per cent, from the current 60 per cent. With India, projected to be the youngest nation in coming decade, health of its youth becomes even more important. Government of India has been making several efforts in developing health and population policies. However, there are several problems in the implementation of appropriate interventions due to poverty, illiteracy and gender discrimination.

The changes in diet and physical activity have resulted largely from epidemiological transition that is underway in most developing countries including India. The main driving forces of these epidemiological shifts are a globalized world, rapid and uneven urbanization, demographic shifts and inter- and intra-country migrations – all of which result in alterations in dietary practices (a shift from high fiber, vegetable and fruit-rich diets to diets rich in saturated fats, trans fats and high salt-containing processed foods) and a decrease in physical activity (due to availability of mass transport systems and mechanization of daily activities). Where scholars have tried to rigorously link dietary and activity changes with body composition changes among adults, the results have been persuasive. They have repeatedly shown in longitudinal studies of these relationships among children and adults that the dietary and activity patterns affect Body Mass Index [1, 2]. Also they have shown that these changes are dynamic and there appears a shift to be emerging toward greater overweight among the poor in some countries [3]. The income-dietary fat intake changes noted for developing countries indicate that they are in the early stages of shift toward an inverse income-BMI relationship [4, 5].

Most scientific focus today is towards the vulnerable groups mainly school going children, adolescent subjects and pregnant/lactating mothers. There is a dearth of data when it comes to the age group of 18-21, the young adults. With the new found freedom from parent's dictate, these young minds enter the college with false perception of adult maturity. Coming out of their parent's control, these young minds are exposed to new friends and new environment which includes increased pocket money and access to all kind of media. Food habits formed

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during school years under the supervision of parents are transformed under peer pressure. The youth studying in colleges today shall be the main workforce for coming two to three decades. Their present nutritional status might affect their work efficiency of tomorrow. Therefore it becomes imperative to study their nutritional status.

With above facts in mind, the present study was planned with the objective to assess health status of female students in universities of Hisar city. BMI was chosen as indicating parameter.

## 2. Materials and Methods

Keeping in view the objectives of study, questionnaire was developed and pretested. Appropriate changes were made in consultation with Statistician and subject experts. A total of 180 subjects were studied from three universities of Hisar (Haryana, India) viz. CCS Haryana Agriculture University, LLR University of Veterinary and Animal Science and Guru Jambheshwar University (hereafter abbreviated as HAU, LUVAS and GJU respectively). These universities were selected purposively for the ease of access. Students from these universities who volunteered for the study were chosen as subjects. College students in the age group 18-21 were assessed for their body weight, BMI and body fat per cent using Digital weighing scale (Omron HN 283), BMI and body fat monitor (Omron HBF 306, based on hand to hand BIA method) respectively. Height was measured in cm using the standard height measuring rod. The software SPSS 16.0 was used for statistical analysis.

## 3. Results

### 3.1 Socio-demographic profile

In the present study, overall 91 respondents (56.6%) belonged to general category while, 49 respondents (27.2%) were from backward caste. At the same time 29 respondents (16.1%) were from scheduled caste and 11 respondents (6.1%) were from other backward caste. Of the total, majority of respondents (83.89 per cent) were day scholars (Table 1).

Majority of respondents (68.3%) had private schooling, while 31.7% respondents were from govt. schools. Most of subjects (55%) belonged to the small cities; 38.3 per cent belonged to the rural areas and 6.7 per cent of the respondents belonged to the metropolitan areas. Of the total subjects, 95.6 per cent were Hindu, 3.9 per cent were Muslim and 0.6 per cent were Sikh. Data highlights that majority of the respondents (53.9 %) were religiously liberal, 37.8 per cent were strictly religious and 8.3 per cent were atheist.

Results depict that majority of subjects (71.1%) belonged to nuclear families and 28.9 per cent of subjects belonged to joint families. Overall, 26.7 per cent respondents were having family income below Rs.10,000/month followed by 46.1 per cent respondents with a family income of Rs.10-30,000/month, 19.4 per cent respondents with a family income of Rs.30-60,000/month. Equal percentages (3.9 per cent each) of respondents had a family income between Rs.60, 000-1 Lac/month and above Rs. 1 Lac/month respectively.

### 3.2 Mean anthropometric measurements of students

The data on anthropometric measurements of university

students has been presented in Table 2. Mean height of total respondents under study was  $157.47 \pm 12.60$  cm while that of respondents from HAU, GJU and LUVAS was  $156.93 \pm 6.90$ ,  $158.34 \pm 5.36$  and  $157.12 \pm 20.10$  cm respectively. Mean body weight of all the subjects was  $48.52 \pm 7.51$  kg. University wise comparison showed that the mean weight of HAU respondents was  $156.93 \pm 6.90$  and that of GJU and LUVAS was  $158.34 \pm 5.36$  and  $157.12 \pm 20.10$  respectively.

The mean BMI of respondents was  $19.44 \pm 2.92$  kg/m<sup>2</sup> and mean body fat per cent was  $24.61 \pm 5.46$ . The mean BMI of HAU respondents was found to be  $19.26 \pm 2.94$  while that of GJU and LUVAS was  $19.31 \pm 3.12$  and  $19.76 \pm 2.71$  respectively. Respective mean body fat per cent of HAU respondents was  $(24.15 \pm 4.76)$ ; and that of GJU and LUVAS was  $(24.7 \pm 6.12)$  and  $(24.99 \pm 5.47)$ . The mean waist-to-hip ratio of total respondents was  $0.85 \pm 0.05$ .

There were no significant ( $p \leq 0.05$ ) differences in mean anthropometric measurements of respondents from different universities.

### 3.3 Health status of subjects based on BMI

Based on BMI, subjects were classified as underweight, normal, overweight and obese [15]. Data shows that 42.2, 52.8, 3.3 and 1.7 per cent were underweight, normal, overweight and obese (Table 3)

When compared university wise 50, 45, 1.7 and 3.3 per cent respectively of respondents were underweight, normal, overweight and obese in HAU, while 40, 55, 3.3 and 1.7 per cent of respondents fell in the categories of underweight, normal, overweight and obese in GJU and there were 36.7, 58.3 and 5 per cent underweight, normal and overweight subjects in LUVAS while none fell in the category of obese.

### 3.4 Mean anthropometric measurements of subjects in different health categories

Table 4 presents mean anthropometric measurements of subjects belonging to different health categories based on BMI. One way ANOVA followed by Tukey Post Hoc was used to study the inter category differences. For the purpose of ANOVA, overweight and obese categories were combined together due to lesser number of respondents in these categories.

The body weight of subjects in different health categories were significantly ( $p \leq 0.05$ ) different from each other. The mean weight of respondents varied from  $71.67 \pm 15.28$  kg (obese) to  $43.75 \pm 4.42$  kg (underweight). The mean height of respondents varied from  $170.83 \pm 12.83$  cm (obese) to  $158.53 \pm 7.47$  cm (normal). There was no statistically significant ( $p \leq 0.05$ ) difference in height among different groups. As expected BMI of all four groups varied significantly ( $p \leq 0.05$ ) among themselves, it varied from  $30.27 \pm 0.25$  kg/m<sup>2</sup> for obese to  $17.09 \pm 1.26$  kg/m<sup>2</sup> for underweight category. The body fat per cent of all four groups also varied significantly among them. It varied from  $34.93 \pm 8.50$  for obese group to  $20.33 \pm 3.24$  for underweight. Tukey post hoc analysis depicted significant ( $p \leq 0.05$ ) difference among waist to hip ratio of underweight and overweight group. However, there were no significant differences in waist to hip ratio of underweight and normal weight categories.

**3.5 Tables****Table 1:** Socio-demographic profile of university students

S No.	Characteristics	Universities			Total
		HAU (n=60)	GJU (n=60)	LUVAS (n=60)	
<b>1</b>	<b>Caste</b>				
	General	28 (46.7)	28(46.7)	35(58.3)	91(50.6)
	SC	11 (18.3)	10(16.7)	8(13.3)	29(16.1)
	BC	16 (26.7)	17(28.3)	16(26.7)	49(27.2)
	OBC	5 (8.3)	5(8.3)	1(1.7)	11(6.1)
<b>2</b>	<b>Commutation</b>				
	Day scholar	20(33.33)	3(5.0)	6(10.0)	29 (16.11)
	Hosteler	40(66.67)	57(95.0)	54(90.0)	151(83.89)
<b>3</b>	<b>Schooling</b>				
	Private school	40(66.7)	46(76.7)	37(61.7)	123(68.3)
	Govt school	20(33.3)	14(23.3)	23(38.3)	57(31.7)
<b>4</b>	<b>Permanent residence</b>				
	Rural	27(45.0)	19(31.7)	23(38.3)	69(38.3)
	Small City	28(46.7)	36(60.0)	35(58.3)	99(55.0)
	Metropolitan	5(8.3)	5 (8.3)	2(3.3)	12(6.7)
<b>5</b>	<b>Religion</b>				
	Hindu	56(93.3)	58(96.7)	58(96.7)	172(95.6)
	Muslim	3(5.0)	2(3.3)	2(3.3)	7(3.9)
	Christian	1(1.7)	-	-	1(0.6)
	Sikh	-	-	-	-
<b>6</b>	<b>Religiosity</b>				
	Strictly religious	19(31.7)	23(38.3)	26(43.3)	68(37.8)
	Liberal	34(56.7)	31(51.7)	32(53.3)	97(53.9)
	atheist	7(11.6)	6(10.0)	2(3.4)	15(8.3)
<b>7</b>	<b>Family Type</b>				
	Nuclear	43(71.7)	40(66.7)	45(75.0)	128(71.1)
	Joint	17(28.3)	20(33.3)	15(25.0)	52(28.9)
<b>8</b>	<b>Monthly Family Income(Rs.)</b>				
	Below 10,000	23(38.3)	13(21.7)	12(20.0)	48(26.7)
	10-30,000	22(36.7)	30(50.0)	31(51.7)	83(46.1)
	30-60000	11(18.3)	9(15.0)	15(25.0)	35(19.4)
	60-1L	2(3.3)	4(6.7)	1(1.7)	7(3.9)
	Above 1L	2(3.3)	4(6.7)	1(1.7)	7(3.9)

Figures in parenthesis indicate percent of respective characteristic (column wise).

**Table 2:** Mean anthropometric measurements of university students

University	Body Weight (Kg)	Height (cm)	BMI (Kg/m <sup>2</sup> )	Body fat (%)	Waist/Hip
HAU (n=60)	47.10±7.26	156.93±6.90	19.26±2.94	24.15±4.76	0.85±0.05
GJU (n=60)	49.17±8.52	158.34±5.36	19.31±3.12	24.7±6.12	0.86±0.05
LUVAS (n=60)	49.30±6.54	157.12±20.10	19.76±2.71	24.99±5.47	0.85±0.04
Total (n=180)	48.52±7.51	157.47±12.60	19.442.92	24.61±5.46	0.85±0.05
<b>z-test</b>	NS	NS	NS	NS	NS

Values are mean ± standard deviation.

**Table 3:** Health status of university students based on BMI

Health Status	University			Total (n=180)
	HAU (n=60)	GJU (n=60)	LUVAS (n=60)	
Underweight (BMI≤18.4)	30 (50.0)	24(40.0)	22(36.7)	76 (42.2)
Normal weight (BMI18.5-24.9)	27 (45.0)	33(55.0)	35(58.3)	95 (52.8)
Overweight (BMI25- 29.9)	1 (1.7)	2(3.3)	3(5.0)	6 (3.3)
Obese (BMI ≥30)	2 (3.3)	1(1.7)	-	3 (1.7)

Figures in parenthesis indicate percent of respective university (column wise).

**Table 4:** Mean anthropometric measurements of university students in different weight categories

Characteristic	Underweight (BMI≤18.4) (n=76)	Normal weight (BMI18.5-24.9) (n=95)	Overweight (BMI25- 29.9) (n=6)	Obese (BMI ≥30) (n=3)
Body Weight (Kg)	43.75±4.42	50.66±5.20	63.50±10.05	71.67±15.28
Height (cm)	158.53±7.47	156.19±15.49	157.50±10.75	170.83±12.83
BMI (Kg/m <sup>2</sup> )	17.09±1.26	20.49±1.34	27.10±1.48	30.27±0.25
Body fat %	20.33±3.24	27. 11±3.95	34.28±3.78	34.93±8.50
Waist/Hip	0.85±0.05	0.85±0.04	0.90±0.04	0.91±0.06

Values are mean ± standard deviation.

#### 4. Discussion

Dual malnutrition has become the face of worldwide nutrition transition. In India, the issue of overweight/obesity was not even addressed during National Family Health Survey-1 in 1992-1993. In 1998-99, NFHS-2 depicted 16.6 per cent women in Haryana as underweight and 25.9 per cent as overweight/ obese [6]. As per NFHS-3 in 2005-2006, Haryana had 27.8 per cent of its women and 26.8 per cent male below normal weight [7]. At the same time the survey indicated prevalence of overweight/obesity in 21 per cent of females and 14.4 per cent males. The survey included female subjects in the age 15-49 and male subjects in the age 15-54. Subramanian *et al.*, [8] used the NFHS data and calculated a ratio of the number of underweight women to overweight women in India. They concluded that although the ratio of underweight to overweight women decreased from 3.3 in 1998-1999 to 2.2 in 2005-2006, there were still considerably more underweight women than overweight women.

Chatwal *et al.* [9] determined the prevalence of obesity in preadolescent and adolescent children of northern India. Using WHO references, overall prevalence of obesity and overweight was 11.1% and 14.2% respectively. The prevalence of obesity as well as overweight was higher in boys as compared to girls (12.4% vs 9.9%, 15.7% vs 12.9%). Sindhu [10] indicated existence of dual problem in young adults with 23.01 per cent of total subjects in underweight and 15.25 per cent in overweight/obese categories. Subjects under present study were also a mix of underweight (42.2 per cent) and overweight/obese (5.0 per cent) with only 52.8 per cent subjects having normal weight.

Freedman [11] reported that the accuracy of BMI varies according to the degree of body fatness. Among relatively fat subjects, BMI is a good indicator of excess adiposity, but differences in the BMIs of relatively thin subjects can be largely due to fat-free mass. He found that a high BMI-for-age has a moderately high (70%-80%) sensitivity and positive predictive value, along with a high specificity (95%). Sindhu [10] also reported that body fat per cent of young adults correlated well with BMI categories but waist to hip ratio was contained within normal limits in all BMI based weight categories. Results of Ngueta *et al.*, [12] and Sánchez *et al.*, [13] are also in agreement of above. A meta-analysis of per cent body fat association with BMI in Asian populations indicated a different relationship among Asians living in different countries [14].

Such anthropometric data on young Asians would be crucial for planning, prevention and treatment of various obesity-related metabolic diseases in the Asian Indian population.

#### 5. Conclusions

The results indicate emergence of overweight/obesity in a population with more than 40 per cent underweight subjects. There is a need to conduct wider, nationally representative studies and also create awareness regarding the emerging trend. Such studies would be instrumental in policy formulation for handling the malnutrition.

#### 6. References

1. Walsh Aoibéann, Roy Nelson. The link between diet and health: an exploratory study of adolescents in Northern Ireland using foodmaps. International Journal of Consumer Studies. 2010; 34(2):190-195.
2. Kimani-Murage, Elizabeth W *et al.* Predictors of adolescent weight status and central obesity in rural South Africa. Public health nutrition 2011; 14(6):1114-1122.
3. Monteiro Carlos A. Socioeconomic status and obesity in adult populations of developing countries: a review. Bulletin of the World Health Organization. 2004; 82(12):940-946.
4. Guo X, Mroz TA. Structural changes in the impact of income on food consumption in China, 1989-93. Econ. Dev. Cult. Change 2000; 48:737-760.
5. Popkin, Barry M. Contemporary nutritional transition: determinants of diet and its impact on body composition. Proceedings of the Nutrition Society 2011; 70(01):82-91.
6. Parasuraman, Sulabha P, Arokiasamy, Monica Kothari. Nutrition in India. International Institute for Population Sciences, 2009.
7. International Institute for Population Sciences. India National Family Health Survey (NFHS-3) 2005-06; 1. International Institute for Population Sciences, 2007.
8. Subramanian SV, Perkins JM. Do burdens of underweight and overweight coexist among lower socioeconomic groups in India? Am J Clin Nutr. 2009; 90:369-76.
9. Chhatwal Jugesh, Manorama Verma, Sandeep Kaur Riar. Obesity among pre-adolescent and adolescents of a developing country (India). Asia Pacific journal of clinical nutrition. 2004; 13:3231-5.
10. Sindhu Sangeeta C. Obesity assessment based on BMI in the young adults of Haryana-A state of India. Research Journal of Recent Sciences. 2013; 2:304-307.
11. Freedman, David S, Bettylou Sherry. The validity of BMI as an indicator of body fatness and risk among children. Pediatrics 124. Supplement 2009; 1:S23-S34.
12. Ngueta Gerard, Elhadji A, Laouan-Sidi, Michel Lucas. Does waist circumference uncorrelated with BMI add valuable information? Journal of epidemiology and community health. 2014; 68(9):849-855.
13. Sánchez-Cruz, José-Juan. Prevalence of child and youth obesity in Spain in 2012. Revista Española de Cardiología (English Edition) 2013; 66(5):371-376.
14. Deurenberg Paul, Mabel Deurenberg-Yap, Syafri Guricci. Asians are different from Caucasians and from each other in their body mass index/body fat per cent relationship. Obesity reviews 2002; 3(3):141-146.
15. WHO. Waist circumference and waist-hip ratio: report of a WHO expert consultation, Geneva, 8-11December. WHO Document Production Services, Geneva, Switzerland, 2008.