

Correlates of body mass index (BMI) with their socio-economic status of urban and rural adults of Varanasi district

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■ **ABSTRACT** : Nutritional status the condition of health of an individual and it can be evaluated in many ways, but BMI is the most established anthropometric indicator used for assessment of adult nutritional status. Objectives of the present study are to assess the nutritional status (BMI) of urban and rural adults of Varanasi district and to determine the association between BMI and socio-economic status. A community based crosssectional study was undertaken on 304 adults (Urban 152, Rural 152), 18-60 years of age group. A pre-tested and pre-designed questionnaire was used to collect the information for the study. Socio-economic and demographic information of study subject was assessed by interview technique. BMI was calculated using the formula [weight(kg)/height (m)²]. Both the community was the hindu dominant out of which majority of proportion are GEN caste. Rural subjects have significantly low educational status and low socio-economic status as compare to urban subjects. The proportions of rural males were significantly more than the urban males in case of doing heavy work. There was no significant difference in average BMI, between urban and rural areas of male as well as female subjects. Only 11.1 per cent and 9.8 per cent of urban and rural males and 25.8 per cent and 30.8 per cent of urban and rural females are in underweight category of BMI. There is no significant difference in average BMI of male as well as female subjects between urban and rural locality with reference to their various socio-economic and demographic variables with the exception of high socio-economic status, among male subjects, among heavy type of work, among low and medium socio-economic status in females, respectively.

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Nutrition is the key factors which helps each person to attain his her full potential as an adult and it depends to a great extent on the quality and

quantity of foods (Sachdeva *et al.*, 2003). Nutritional status or nutriture is the condition of health of an individual as influenced by the nutrient intake and utilization in the

body. It can be determined with the help of anthropometry, dietary intake, clinical examination of symptoms of nutritional deficiencies and laboratory investigation. Although adult nutritional status can be evaluated in many ways, the BMI is most widely used because its use is inexpensive, non-invasive and suitable for large-scale surveys. BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries (Ferro-Luzzi *et al.*, 1992).

India is the second most populous country in the world that comprises ~17 per cent of the world's population and contributes to 16 per cent of the world's deaths. Nutritional status of the Indian population varies significantly across the regions. Certain regions are associated with extremely prevalence of adult under nutrition (>50). India is currently facing the double burden of under nutrition as well as over nutrition. Data regarding the nutritional status of adults, as determined by body mass index (BMI), indicate that 50 per cent of Indian adults suffer from different types of chronic energy deficiency, in that they have a BMI < 18.5 kg/m². In the same survey, it was observed that the BMI values were similar in men and women; however, there were more overweight/obese (BMI ≥ 25 kg/m²) women (6.6 %) than men (3.5 %). In certain regions, obesity and consequent diseases are posing an enormous public health problem (Pednekar, 2008). Malnutrition (under nutrition and over nutrition) exist as a shift away from relatively monotonous diets of varying nutritional quality toward an industrialized diet that is usually more varied, includes more pre-processed food, more food of animal origin, more added sugar and fat and often more alcohol. This is accompanied by shift in the structure of occupations and leisure toward reduced physical activity (Bulatao and Stephens, 1992). The pattern of nutritional disorders in the developing world is further complicated by sociological changes which are taking place due to urbanization and changing lifestyles (WHO, 2000).

There are a very few comparative studies exists the that assess the nutritional status through BMI of adults men and women of urban and rural areas. Therefore, the present study was conducted to assess the nutritional status (BMI) of adults of Varanasi district and to determine the association between BMI and socio-economic status.

■ RESEARCH METHODS

Study design :

A community based cross-sectional design was adopted for this study.

Study sample :

Male and female adults age group 18-60 were considered for this study.

Sample size :

The sample size is calculated on the basis of knowledge regarding calcium, phosphate and oxalate which are major constituent of stone formation in urban as well as rural adults. The proportion of adults had knowledge about stone constituent is decided after pilot survey in urban as well as rural community which comes out 40 per cent and 25 per cent, respectively. The determination of sample size is fixed considering 1:1 ratio between urban and rural adults, level of significance at 5 per cent ($\alpha = 0.05$) and 80 per cent of power of test ($1 - \beta = 0.80$), therefore, after computing sample size come 304 which is decided into two equal part. Therefore, 152 adults from rural as well as 152 adults from urban were selected.

Sampling methodology :

Varanasi district has been divided into 8 blocks (namely Cholaipur, Chiragaon, Kashi Vidyapeeth, Harahua, Baragaon, Pindra, Sivapur and Arazi Line) and 90 wards. Among 8 blocks Kashi Vidyapeeth block has been selected randomly and in 90 wards Nariya ward has been selected randomly. In Kashi Vidyapeeth block there are 122 villages and among these villages Susuwahi and Madhopur villages has been selected randomly. In Nariya ward, households of Saket Nagar, Bhogabeer and nearest households of Sankat Mochan were included in the study. Only one male or female adult was selected from each households alternatively.

Tools of study :

Pre-tested and pre-designed questionnaire was used for this study.

Technique of the study :

The adults was personally informed the purpose of the study and their consent obtained prior to data collection. Socio-economic and demographic information

of study subject was assessed by interview technique. For BMI calculation height and weight were measured of 304 adults. Height was measured with the help of measuring scale fixed to wall of the nearest one millimetre then it converted in metre for BMI calculation. Weight was recorded in kilogram with the help of weighing machine (Libra) to the nearest half kilogram (Jelliffe, 1996). BMI was calculated using following formula:

$$\text{BMI} = \frac{\text{Weight (kg.)}}{\text{height(Mt.)}^2}$$

Analysis of data :

Data thus, generated was analysed with the help of Microsoft excel 2007 and SPSS version 16th software. Appropriate table were generated, statistical test χ^2 , F

test, post hoc and t, test applied.

RESEARCH FINDINGS AND DISCUSSION

Table 1 shows that majority of respondent (41.8 %) were from the age group 31-45 yrs., followed by younger age group in both type of localities. The average age was (38.01 \pm 12.51) in urban respondents and it was (38.74 \pm 11.43) in rural, but statistically this difference is not significant. In urban community, male respondents (59.2 %) were selected in more proportion than the rural male respondents (40.1 %) whereas, it was just in reverse proportion in female respondents. The difference in proportion of male and female respondent between urban and rural community is found to be statistically significant.

In urban and rural community both had the hindu

Age (years)	Region				Total (304)	
	Urban (152)		Rural (152)		No.	%
	No.	%	No.	%		
≤ 30	56	36.8	42	27.6	98	32.2
31 – 45	55	36.2	72	47.4	127	41.8
> 45	41	27.0	38	25.0	79	26.0
Total	152	100.0	152	100.0	304	100.0
Average age \pm SD	38.01 \pm 12.51		38.74 \pm 11.43		38.38 \pm 11.97	
	$t = 0.53, df = 302, p > 0.05$					
Sex						
Male	90	59.2	61	40.1	151	49.7
Female	62	40.8	91	59.9	153	50.3
	$\chi^2 = 11.07, df = 1, p < 0.01$					
Religion						
Hindu	149	98.0	151	99.34	300	98.7
Muslim	03	2.0	01	0.66	04	1.3
Total	152	100.0	152	100.0	304	100.0
	$\chi^2 = 1.01, df = 1, p > 0.05$					
Caste status						
SC/ST	25	16.4	56	36.8	81	26.64
OBC	50	32.9	69	45.4	119	39.15
GEN	77	50.7	27	17.8	104	34.21
Total	152	100.0	152	100.0	304	100.0
	$\chi^2 = 38.94, df = 2, p < 0.001$					
Family type						
Joint	53	34.9	69	45.4	122	40.1
Nuclear	99	65.1	83	54.6	182	59.9
Total	152	100.0	152	100.0	304	100.0
	$\chi^2 = 3.51, df = 1, p > 0.05$					

41.4 per cent of respondents had their monthly per capita income in the range of Rs. (1000-2500) and more than one third (38.8 %) were in below poverty line. Statistically, the difference in average monthly per capita income between urban and rural respondent is obtained to be highly significant. In urban community majority of respondents 47.4 per cent belong to high socio-economic status followed by 39.5 per cent to medium socio-economic status, whereas, in rural area 50.0 per cent and 35.5 per cent belong to medium and low socio-economic status, respectively (Table 3). The difference in proportion in connection to various socio-economic status between urban and rural areas is statistically highly significant.

It depicts that out of total urban male respondents more than half 55.6 per cent were moderate worker followed by 33.3 per cent sedentary, whereas its proportion was 52.5 per cent and 21.3 per cent in rural male respondents, respectively. This difference in proportion between urban and rural community is found to be statistically significant. It is also observe that majority of urban female respondents (67.7 %) were sedentary worker where it was little more (69.2 %) in rural region. Only 3.2 per cent and 8.8 per cent female were doing heavy work and moderate female workers were 49 per cent and 22 per cent in urban and rural community, respectively but statistically this difference is not significant (Table 4).

The BMI index is categorise into three major groups and analyses reveals that majority of urban (64.4 %) and rural (54.1 %) male respondents had normal BMI and minimum 11.1 per cent and 9.8 per cent were underweight whereas 51.6 per cent and 49.5 per cent of urban and rural female had normal BMI and 25.8 per cent and 30.8 per cent were underweight but statistically there is no significant difference in BMI level of male as well as female respondents between urban and rural community (Table 5). The percentage of underweight, urban and rural male was nearly same in the study conducted by

Midha *et al.* (2009). The percentage of obese urban female was similar to Hussain *et al.* (2008).

Out of total urban male subjects the average BMI was 23.94 and 22.56 in joint and nuclear type of family while in the rural area it was 22.24 and 24.02, respectively statistical test predicts that there is no significant difference between type of family in the respondents belong to urban and rural community. The average BMI of male urban respondent involved in sedentary, moderate and heavy type of work had in decreasing order in the range of maximum 23.39, to minimum 22.42 whereas, in rural community it was maximum 23.73 in sedentary type of work followed by heavy 23.53 and minimum 22.94 in moderate type of work but the difference is not statistically significant. It is also seen that there is no significant difference between BMI of urban and rural male respondents in connection to different type of work status (Table 6).

Socio-economic status wise distribution of average BMI reflects that there is no significant difference between urban and rural respondents connected with low and medium socio-economic status and significant in high socio-economic status. Statistical test also shows that there is no significant difference in average BMI of the male respondents belong to urban community among various level of socio-economic status and significant in rural community. The average BMI is higher 24.01 in the urban respondents also had higher education and the minimum 21.58 in medium educational group while in rural area maximum 24.87 in higher educational group and minimum 22.55 in low education group of male respondents. There is significant difference in average BMI among different educational group of male respondents but insignificant in rural areas. The findings of Sen *et al.* (2013) is also significant in respect to education. It is also seen that there is no significant difference in each education group of male respondent between urban and rural community. It is observed that the average BMI of male respondent is found to be in

Table 5 : Region wise distribution of BMI level on male and female respondents

BMI level	Male					Female						
	Urban		Rural		Total	Urban		Rural	Total			
Under weight	10	11.1	6	9.8	16	10.6	16	25.8	28	30.8	44	28.8
Normal	58	64.4	33	54.1	91	60.3	32	51.6	45	49.4	77	50.3
Obese	22	24.4	22	36.1	44	29.1	14	22.6	18	19.8	32	20.9
Total	90	100.0	61	100.0	151	100.0	62	100.0	91	100.0	153	100.0

$$\chi^2 = 2.39, df = 2, p > 0.05$$

$$\chi^2 = 0.49, df = 2, p > 0.05$$

increasing order in both urban and rural region with increase of their monthly per capita income but that increase is not statistically significant. Statistical test also signifies that there is no significant difference between urban and rural male respondents among each economic groups.

The average BMI of females belong to nuclear type of family had higher average BMI in both urban (21.52) and rural 22.03 region while it was 21.09 and 20.54 in the females of joint family, respectively but this difference between joint and nuclear female is not significant in urban as well as rural community. Likewise there is no

significant difference between urban and rural female belong to different types of family. The average BMI of females in urban area is found to be in decreasing order with increase of their work load in the range of maximum 22.25 to minimum 17.79, whereas, it was just in reverse order among rural females *i.e.* minimum 20.64 in sedentary and maximum 23.03 in female connected with heavy work but this increase or decrease according to type of work in urban as well as rural is not significant. It is seen that there is no significant difference in sedentary and moderate female subjects and significant difference in heavy work related females between urban and rural

Table 6 : Region wise distribution of average BMI of male Subjects on the basis of various major social factors

Social factors	Region			Statistics
	Urban	Rural	Total	
	Mean ± SD	Mean ± SD	Mean ± SD	
Family type				
Joint	23.94 ± 3.90	22.24 ± 3.55	23.16 ± 3.80	t = 1.70, df = 55, p >0.05
Nuclear	22.56 ± 4.62	24.02 ± 4.49	23.11 ± 4.60	t = 1.49, df = 92, p >0.05
Total	23.04 ± 4.41	23.26 ± 4.18	23.13 ± 4.31	t = 0.31, p >0.05, df=149
	t = 1.41, df = 88, p>0.05	t = 1.67, df = 59, p>0.05	t = 0.08, df = 149, p>0.05	
Type of work				
Sedentary	23.39 ± 2.80	23.73 ± 3.48	23.49 ± 2.98	t = 0.34, df = 41, p >0.05
Moderate	22.95 ± 5.22	22.94 ± 4.84	22.95 ± 4.06	t = 0.01, df = 80, p >0.05
Heavy	22.42 ± 4.07	23.53 ± 3.35	23.10 ± 3.61	t = 0.75, df = 24, p >0.05
	F = 0.19, p>0.05	F = 0.21, p>0.05	F = 0.23, p>0.05	
SES				
Low	23.36 ± 4.58	22.51 ± 2.54	22.89 ± 3.52	t = 0.59, df = 23, p >0.05
Medium	22.24 ± 4.91	22.68 ± 3.71	22.48 ± 4.26	t = 0.43, df = 67, p >0.05
High	23.48 ± 4.04	26.90 ± 6.30	24.02 ± 4.57	t = 2.13, df = 55, p <0.05
	F = 0.78, p>0.05	F = 4.45, p<0.05	F = 2.08, p>0.05	
		Sign. pairs 3 vs 1,2		
Education				
Low	23.12 ± 4.43	22.55 ± 3.75	22.73 ± 3.90	t = 0.34, df = 23, p >0.05
Medium	21.58 ± 3.88	22.78 ± 3.71	22.13 ± 3.82	t = 1.23, df = 59, p >0.05
High	24.01 ± 4.55	24.87 ± 5.14	24.22 ± 4.68	t = 0.64, df = 63, p >0.05
	F = 3.15, p<0.05	F = 1.66, p>0.05	F = 4.01, p<0.05	
Income				
≤ 1000	21.92 ± 4.75	21.89 ± 2.67	21.91 ± 3.78	t = 0.02, df = 26, p >0.05
1000 – 2500	23.36 ± 4.11	23.48 ± 4.44	23.42 ± 4.26	t = 0.11, df = 58, p >0.05
>2500	23.17 ± 4.52	24.08 ± 4.68	23.39 ± 4.54	t = 0.67, df = 61, p >0.05
	F = 0.54, p >0.05	F = 1.08, p >0.05	F = 1.39, p >0.05	

community (Table 7).

The average BMI of female is found to be in increasing order from minimum 6.28 to maximum 23.99 in relation to increase of their socio-economic status in urban community but in the rural area minimum average BMI was 19.33 in low and maximum 23.35 in medium socio-economic status and this increase or decrease in average BMI among various SES is highly significant in urban as well as rural community. Also there is significant difference between urban and rural females connected with low and medium socio-economic status but no significant difference in high socio-economic status group. Likewise socio-economic status in educational status also an increasing trend is observed in average BMI of female with increase of their educational status in urban as well as in rural area with range of minimum

18.74 and 20.97 to maximum 22.49 and 22.27, respectively but this decrease or increase in the basis of their educational status in urban and rural community is not significant. Also no significant difference in each educational status of females between urban and rural not significant monthly per capita income wise distribution of average BMI reveals that there is increasing trend is observed with increase of their economic status with minimum 19.35 and 20.55 to maximum 23.45 and 22.77 in urban and rural community, respectively but significantly increase in BMI is observed only in urban females. It is also seen that in all the MPCCI group there is no significant difference in BMI between urban and rural females. Singh and Singh (2013) worked on the anthropometric assessment and BMI index of obese children in Kanpur district and Tripathi and Chakravarty

Table 7 : Region wise distribution of average BMI of female subjects on the basis of various major social factors

Social factor	Region		Total	Statistics
	Urban	Rural		
	Mean \pm SD	Mean \pm SD	Mean \pm SD	
Family type				
Joint	21.09 \pm 3.80	20.54 \pm 4.87	20.73 \pm 4.51	t = 0.46, df = 63, p >0.05
Nuclear	21.54 \pm 6.18	22.03 \pm 5.36	21.81 \pm 5.72	t = 0.40, df = 86, p >0.05
Total	21.38 \pm 5.42	21.33 \pm 5.16	21.35 \pm 5.25	
	t = 0.32, df = 60, p >0.05	t = 1.38, df = 89, p >0.05	t = 1.26, df = 151, p >0.05	
Type of work				
Sedentary	22.25 \pm 5.43	20.64 \pm 4.91	21.28 \pm 5.16	t = 1.57, df = 103, p >0.05
Moderate	19.76 \pm 5.13	22.81 \pm 5.75	21.37 \pm 5.69	t = 1.70, df = 36, p >0.05
Heavy	17.79 \pm 0.01	23.03 \pm 5.04	21.98 \pm 4.96	t = 2.94, df = 8, p <0.05
	F = 1.83, p >0.05	F = 1.86, p >0.05	F = 0.08, p >0.05	
Socio-economic status				
Low	16.28 \pm 3.66	19.33 \pm 3.94	18.77 \pm 4.03	t = 2.12, df = 47, p <0.05
Medium	20.80 \pm 4.39	23.35 \pm 5.75	22.25 \pm 5.32	t = 2.01, df = 65, p <0.05
High	23.99 \pm 4.67	21.60 \pm 4.59	23.15 \pm 5.38	t = 1.30, df = 35, p >0.05
	F = 8.65, p <0.001	F = 6.67, p <0.01	F = 10.16, p <0.001	
	Sign. Pairs; 1 vs 2,3; 2 vs 3	Sign.pairs; 1 vs 2	Sign.pairs; 1 vs 2,3	
Education				
Low	18.74 \pm 4.86	20.97 \pm 5.01	20.48 \pm 5.03	t = 1.54, df = 67, p >0.05
Medium	21.79 \pm 3.23	21.73 \pm 5.51	21.75 \pm 4.71	t = 0.06, df = 44, p >0.05
High	22.49 \pm 6.38	22.27 \pm 5.31	22.44 \pm 6.08	t = 0.10, df = 36, p >0.05
	F = 2.57, p >0.05	F = 0.36, p >0.05	F = 1.91, p >0.05	
Income				
\leq 1000	19.35 \pm 6.59	20.55 \pm 4.58	20.26 \pm 5.09	t = 0.76, df = 57, p >0.05
1000 – 2500	20.23 \pm 3.19	21.77 \pm 6.30	21.13 \pm 5.26	t = 1.06, df = 51, p >0.05
>2500	23.45 \pm 5.75	22.77 \pm 3.97	23.20 \pm 5.10	t = 0.41, df = 39, p >0.05
	F = 3.66, p <0.05	F = 1.22, p >0.05	F = 4.01, p <0.05	
	Sig. pairs 1 vs 3; 2 vs 3		Sig. pairs 1 vs 3	

(2013) worked on the assessment of height, weight and BMI of school going children in Varanasi and results found were more or less similar to the present investigation.

Conclusion :

It may be concluded that in both the studied community majority of the respondents belong to 31-45 years of age group while the percentage of male was higher than female in urban and it was just reverse in rural community. Both areas are the hindu dominant out of which majority of proportion are GEN caste followed by OBC in urban and just reverse in rural area. Majority of urban respondents belong to nuclear family while maximum subjects of rural area were of joint family but this difference is not significant. Rural subjects have significantly low educational status and low socio-economic status as compare to urban subjects. It is also seen that the proportion of rural males are significantly more than the urban males in case of doing heavy work but no significant difference is observed among females in connection to type of work.

It is calculated that there is no significant difference in average BMI, between urban and rural areas of male as well as female subjects. Only 11.1 per cent and 9.8 per cent of urban and rural males and 25.8 per cent and 30.8 per cent of urban and rural females are in underweight category of BMI. There is no significant difference in average BMI of male as well as female subjects between urban and rural locality with reference to their various socio-economic and demographic variables with the exception of high SES, among male subjects, among heavy type of work, among low and medium SES in females, respectively.

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