ASSESSMENT OF MAGNITUDE AND THE CO-MORBIDITIES OF OVERWEIGHT AND OBESITY IN URBAN AND RURAL AREAS OF KANPUR

Naresh Pal Singh[1], Pankaj K Jain[2], R P Sharma[3], Suresh Chandra[4], Seema Nigam[4], Anamika Singh[5]

Author's Affiliation:
[1]Associate Professor; [2]Additional Professor, Dept. of Community Medicine, UP RIMS & R, Saifai, Etawah, U.P; [3]Professor and Head, [4]Professor, Dept. of Community Medicine, GSVM Medical College, Kanpur, U.P; [5]Lecturer, Dept. of Physiology, UP RIMS & R, Saifai, Etawah, U.P.

Correspondence:
Dr. Naresh Pal Singh,
Email: nareshpalsingh@gmail.com

ABSTRACT

Background: Obesity is emerging as a global epidemic with growing threat to health in both developed and developing countries. It has become a major health concern for almost all the age groups of the society. Objectives of the study is assess the prevalence and co-morbidities of overweight and obesity among persons 15 years and above in urban and rural areas of Kanpur, UP.

Methods: For this cross-sectional study, multistage random sampling technique was used to select one colony in urban and one village in rural area of Kanpur district. The desired sample size was 2200. Detailed socio-demographic information was collected on a pre-designed and pre-tested questionnaire. After anthropometric examination, Body Mass Index (BMI) was used to assess the overweight and obesity status. Random blood sugar was measured using a portable glucometer. Data thus collected was analyzed using Chi-square test and percentage.

Results: Statistically significant higher trend of obesity (BMI $\geq$ 30.0 kg/m^2) was observed in urban population with total 2.9% (1.2% in males and 4.8% in females) in comparison to rural population with total 0.6% (0.4 % in males and 0.8% in females).

Conclusions: Overweight and obesity is a complex multi-factorial disease developing from interactive influences of numerous factors in urban and rural settings.

Keywords: Overweight, Obesity, Body Mass Index

INTRODUCTION

Since ancient times, weight gain and 'fatness' have been viewed as a sign of health, prosperity and beauty. But now, overweight and obesity are posing a growing threat to health in both developed and developing world and adversely affecting the adults as well as children.

Overweight is the precursor of obesity.WHO[1] defines obesity as "abnormal or excessive fat accumulation in adipose tissue, to the extent that health is impaired" and leading to reduced life expectancy and/or increased health problems[2].On average, obesity reduces life expectancy by six to seven years;[2,3] a BMI of 30–35 kg/m^2

reduces life expectancy by two to four years,[4] while severe obesity (BMI > 40 kg/m²) reduces life expectancy by ten years.[4]Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis.[2] Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications, or psychiatric illness. These health problems are responsible for high morbidity and mortality in both urban and rural communities. Overweight and obesity are essentially due to energy imbalance. Evidence to support the view that some obese people eat little yet gain weight due to a slow metabolism is limited. On average, obese people have greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass.[5,6]

Obesity is one of the leading preventable causes of death worldwide.[7,8,9]Obesity is emerging as a global epidemic. It is estimated that about 315 million people worldwide fall into the WHO-defined obesity categories with BMI ≥ 30 kg/m². A further 750 million people are estimated to be overweight in the BMI 25.0 - 29.9 kg/m² category. This figure can double by year 2025 if no action is taken against this threat.National Family Health Survey (2005-06) of India, revealed prevalence of overweight/obesity to be 12.1% in males and 16.0% in females with Punjab ranking first and Tripura last.[10]

Life runs in its full spectrum of riches and rags in Kanpur with population of over 50 lacs and is one of the greatest industrial giants of northern India. Surrounding the Kanpur Nagar, there is a big belt of rural settlement engaged in agriculture, farming, dairy work and forestry. In the race of urbanization and industrialization, both urban and rural inhabitants are bound to share various associated factors of overweight and obesity. Hence, this study was conducted to ascertain the magnitude and the co-morbidities of overweight and obesity in urban and rural community of Kanpur.

METHODS

The present study was carried out in the Vishnupuri colony of urban area while in rural area; the study was conducted in Baniyapur and Dur-

gapur village of Kanpur to study the required sample size from March 2005 to July 2006.

All the persons aged 15 years and above were considered as a sampling unit for this study. Sample size (n) was calculated by taking prevalence (p) of obesity approximately 15% and with margin of error (d) as 10% of prevalence by formula: $n = Z_{\alpha/2}^2 \frac{p(1-p)}{d^2}$

Minimum sample size was calculated to be 2177 and it was approximated to the nearest hundred, i.e. 2200 for conducting the study. The study population was selected by using multistage random sampling technique. For urban area, firstly, all the 110 wards of Kanpur Nagar were listed and one ward was randomly selected. In the second stage, all the colonies/ mohallas in the selected ward were listed down and one colony, Vishnupuri, was randomly selected. Similarly for rural area, all the 10 blocks in first stage were listed and one block, Kalyanpur, was randomly selected. In the second stage, all the villages in the selected block were listed down and one village, Baniyapur, was randomly selected. To cover the required sample size, adjoining village, Durgapur, was also covered.

Systematic sampling method was used to achieve the desired sampling size. First lane was randomly selected by lottery method. The first household of that lane was selected by using the last digit of randomly chosen currency note. The purpose of the study was explained to the head of the family and informed consent taken. All the family members were listed and the detailed information with regards to their name, age, sex, religion, caste, marital status, address, education, occupation, income, weight and height was elicited and collected. Simultaneously BMI (Body Mass Index) values of eligible persons i.e. aged 15 years and above were calculated using the formula: BMI= Weight in Kg / (Height in meter)²

WHO[1] (2000) has recommended the following criteria for classification of obesity:

Classification	BMI (Kg/m²)	Risk of co-morbidities
Underweight	< 18.5	Low
Normal range	18.5 -- 24.9	Average
Overweight	≥ 25.0	
Pre-obese	25.0 -- 29.9	Mildly increased
Obese	≥ 30.0	
Class-I	30.0 -- 34.9	Moderate
Class-II	35.0 -- 39.9	Severe
Class-III	≥ 40.0	Very severe

The study subjects comprised of all members who were overweight (BMI ≥ 25.0Kg/m²) and aged 15 years and above. They were interviewed personally for history of associated diseases supplemented with clinical and anthropometrical examination of individuals. The hypertension was assessed by measurement of two readings of blood pressure, at an interval of five minutes each; by a standard mercury sphygmomanometer with the cuff size 12.5 cm. The target individuals were classified into pre-hypertensive and hypertensive according to the criteria by "The Seventh Report of the Joint National Committee (JNC VII, 2003) on detection, Evaluation, and Treatment of High Blood Pressure" (Chobanian, 2003)[11]. Overweight and obese persons were screened for diabetes mellitus by checking their random blood sugar level. RBS was measured using a portable glucometer. A drop of blood was put on the glucometer strip and the digital reading of RBS shown by glucometer was recorded. Classification of Diabetes Mellitus laid down by American Diabetic Association (ADA)[12], 2000was used. Data thus collected was analyzed using Chi-square test and percentage.

RESULTS

A total of 2256 persons of urban area and 2220 from rural areas aged 15 years and above were studied to conform the computed sample size. It was observed that 52.1% in the urban area and 51.7% in the rural area were males. The sex ratio was computed as 918 females per 1000 males in urban area and 933 in rural area. It was observed that the age-group 15-24 years in both the areas comprised maximum people (33.5% in the urban and 34.0% in rural) followed by 25-34 years age group (23.0% in urban and 26.6% in rural area). It was seen that 45.8% of urban and 0.7% of rural study population belonged to social class I (Modified B.G. Prasad's Classification). The decreasing trend in the percentage of population, from social class I to class IV, has been observed in urban area while it was in increasing order in rural area.

Table 1 depicts the sex wise distribution of study population according to their BMI status. A higher prevalence of overweight (BMI ≥ 25.0 - 29.9 Kg/m²) was observed in urban study population with total 13.6% (12.1% in males and 15.2% in females) as compared to total of 4.0% (3.3% in males and 4.7% in females) in rural area. Higher trend of obesity (BMI ≥ 30.0 kg/m²) was observed in urban population with total 2.9% (1.2% in males and 4.8% in females) in comparison to rural population with total 0.6% (0.4 % in males and 0.8% in females). It was observed that 11.7% in urban and 21.8% in rural area were underweight (BMI < 18.5 Kg/m²) while three fourth of the study population were having normal BMI (BMI 18.5- 24.9 Kg/m²) in both the areas.

Table 2 shows that in urban area, more than half of the overweight and obese subjects taken together were pre-hypertensive and approximately one-fifth were hypertensive. On the contrary, in the rural area, 46.0% of overweight and obese subjects taken together were normotensive, 38.0% pre hypertensive and 16.0% were hypertensive.

Table 1: Distribution of study population according to their Body Mass Index (BMI)

BMI (Kg/m²)	Urban			Rural			Odds ratio (95% CI)
	Males (n=1176) (%)	Females (n=1080) (%)	Total (n=2256) (%)	Males (n=1148) (%)	Females (n=1072) (%)	Total (n=2220) (%)	
< 18.5	128 (10.9)	136 (12.6)	264 (11.7)	286 (24.9)	198 (18.5)	484 (21.7)	0.55 (0.46-0.65)
18.5-24.9	892 (75.9)	728 (67.4)	1620 (71.8)	820 (71.4)	816 (76.1)	1636 (73.7)	1
25.0-29.9	142 (12.1)	164 (15.2)	306 (13.6)	38 (3.3)	50 (4.7)	88 (4.0)	3.5 (2.7-4.5)
≥ 30.0	14 (1.2)	52 (4.8)	66 (2.9)	4 (0.4)	8 (0.8)	12 (0.6)	5.6 (2.9-10.3)

P value for BMI vs. Sex in Urban area; BMI vs. Sex in rural area; and Urban/Rural vs. BMI was <0.05, significant

Table 2: Blood pressure pattern observed in study subjects

Blood pressure Pattern	Urban			Rural			Odds ratio (95% CI)	p-value
	Overweight (n=306)	Obese (n=66)	Total (n=372)	Overweight (n=88)	Obese (n=12)	Total (n=100)		
Normal	92 (30.0)	15 (22.7)	107 (28.8)	41 (46.6)	5 (41.7)	46 (46.0)	1	
Pre hypertension	156 (51.0)	37 (56.1)	193 (51.8)	34 (38.6)	4 (33.3)	38 (38.0)	2.2 (1.3 - 3.5)	<0.05
Stage I hypertension	37 (12.1)	9 (13.6)	46 (12.4)	6 (6.8)	1 (8.3)	7 (7.0)	2.8 (1.2 - 6.7)	<0.05
Stage II hypertension	21 (6.9)	5 (7.6)	26 (7.0)	7 (8.0)	2 (16.7)	9 (9.0)	1.24 (0.54 - 2.8)	>0.05

Figure in parenthesis indicate percentage

Table 3: Random Blood Sugar pattern observed in study subjects of urban and rural population

Random Blood Sugar (mg/dl)	Urban			Rural			Odds ratio (CI)	p-value
	Overweight (n=306)	Obese (n=66)	Total (n=372)	Overweight (n=88)	Obese (n=12)	Total (n=100)		
< 140	225 (73.5)	49 (74.2)	274 (73.7)	70 (79.6)	9 (75.0)	79 (79.0)		
≥ 140 -- 199	29 (9.5)	6 (9.1)	35 (9.4)	7 (7.9)	1 (8.3)	8 (8.0)	1.3 (0.6 - 2.9)	> 0.05
≥ 200	52 (17.0)	11 (16.7)	63 (16.9)	11 (12.5)	2 (16.7)	13 (13.0)	1.4 (0.7 - 2.7)	> 0.05

Figure in parenthesis indicate percentage

Table 4: Distribution of study subjects according to the history of associated diseases

Associated diseases*	Urban			Rural		
	Over weight (n=306)	Obese (n=66)	Total (n=372)	Over weight (n=88)	Obese (n=12)	Total (n=100)
Hypertension	51 (16.7)	13 (19.7)	64 (17.2)	12 (13.6)	2 (16.7)	14 (14.0)
Diabetes mellitus	49 (16.0)	11 (16.7)	60 (16.1)	5 (5.7)	2 (16.7)	7 (7.0)
Cardiovascular disease	12 (3.9)	4 (6.1)	16 (4.3)	1 (1.1)	0 (0.0)	1 (1.0)
Gall bladder disease	17 (5.6)	9 (13.6)	26 (7.0)	2 (2.3)	1 (8.3)	3 (3.0)
Musculoskeletal problem	93 (30.4)	32 (48.5)	125 (33.6)	22 (25.0)	5 (41.7)	27 (27.0)
Abdominal hernia	8 (2.6)	3 (4.6)	11 (3.0)	4 (4.6)	2 (16.7)	6 (6.0)
Varicose vein	4 (1.3)	4 (6.1)	8 (2.2)	2 (2.3)	1 (8.3)	3 (3.0)
Hypothyroidism	2 (0.7)	0 (0.0)	2 (0.5)	1 (1.1)	0 (0.00)	1 (1.0)
Bronchial asthma	10 (3.3)	4 (6.1)	14 (3.8)	7 (8.0)	2 (16.7)	9 (9.0)
Chronic skin diseases	5 (1.6)	2 (3.0)	7 (1.9)	3 (3.4)	1 (8.3)	4 (4.0)

* Multiple Responses; Figure in parenthesis indicate percentage

Table 3 reveals that among overweight and obese subjects, 73.7% in urban area and 79.0% in rural area, had their random blood sugar (RBS) values less than 140 mg/dl, i.e., within normal limits. 9.4% in urban and 8.0% in rural had RBS in the range of 140-199 mg/dl indicating impaired glucose tolerance, while 16.9% urban respondents and 13.0% rural respondents had frank diabetes (RBS ≥ 200 mg/dl).

Table 4 shows the distribution pattern of prevalence of various associated diseases in the study subjects on the basis of history given by them. It was observed that musculo-skeletal problem was the most prevalent problem in both the areas i.e. 33.6% in urban and 27.0% in rural respectively followed by hypertension (17.2% in urban area and 14.0% in rural area) and diabetes mellitus (16.7% in urban and 7.0% in rural area). Bronchial asthma (9.0%), chronic skin diseases (4.0%) were more common in rural area. Gall bladder diseases were more in urban subjects (7.0%) compared to 3.0% in rural.

DISCUSSION

In our study, a statistically significant (p ≤ 0.05) difference in the distribution of BMI was observed among males and females in both the urban and rural study population. Similarly, statistically significant difference in the prevalence of overweight/obesity was observed in urban and rural areas. Shukla et al[13]found 19.0% of males and 30.0% of females to be overweight in age group 35 years and above. Kamboj[14]found higher prevalence of overweight (36.0%) and obesity (8.0%) in urban adult population of Meerut city. Obesity was found more in females (10.2%) as compared to males (5.9%). Nutritional Foundation of India[15]found overweight in 29.2% of men and 45.6% in women of middle class of urban Delhi. The lower prevalence observed in the present study as compared to above studies, could be because of inclusion of lower age group population in our study.

The difference in prevalence of hypertension between urban and rural study population was found to be statistically significant (p< 0.05). Sood[16]also reported that prevalence of hypertension in obese male and female was significantly higher than non-obese males and females. Gopinath[17], in his study observed that obesity is a major cause for pre hypertension. Goel[18] has observed the prevalence of hypertension three times more in obese as compared to non obese in Ludhiana, Punjab. Kumar[19]also has reported higher prevalence of hypertension among overweight people than non-overweight rural population of Meerut.

Usually increasing trend of body weight runs parallel with increase in blood sugar level. Recorded random blood sugar pattern in study subjects of urban and rural population has confirmed this fact. Kamboj[14] found the prevalence of overweight was very high (54.4%) in diabetics.

CONCLUSION

The present study has revealed that overweight and obesity is a complex multi-factorial disease developing from interactive influences of numerous factors in urban and rural settings and leads to development of various co-morbidities. Therefore, multidimensional approach is needed for prevention and control of overweight and obesity.

REFERENCES

1. WHO. Obesity, Preventing and managing the Global Epidemic: understanding how overweight and obesity develop. Tech Rpt Ser. 2000; 894:8-9.

2. Haslam DW, James WP. Obesity. Lancet. 2005; **366** (9492):1197–209.

3. Peeters A, Barendregt JJ, Willekens F, Mackenbach JP, Al Mamun A, Bonneux L. Obesity in adulthood and its consequences for life expectancy: A life-table analysis. Annals of Internal Medicine. 2003; 138 (1):24–32.

4. Whitlock G, Lewington S, Sherliker P, Clarke R, Emberson J, Halsey J, Qizilbash N, Collins R, Peto R. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009; 373 (9669):1083–96.

5. Kushner, Robert. Treatment of the Obese Patient (Contemporary Endocrinology). Totowa, NJ: Humana Press. 2007; p- 158.

6. Adams JP, Murphy PG. Obesity in anaesthesia and intensive care. Br J Anaesth. 2000; 85 (1):91–108.

7. Barness LA, Opitz JM, Gilbert-Barness E. Obesity: genetic, molecular, and environmental aspects. American Journal of Medical Genetics. 2007; 143(24):3016–34.

8. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA. 2004; 291 (10):1238–45.

9. Allison DB, Fontaine KR, Manson JE, Stevens J, Vanitallie TB. Annual deaths attributable to obesity in the United States. JAMA. 1999; 282(16):1530–8.

10. National Family Health Survey, 2005-06. Mumbai: International Institute for Population Sciences. 2007.

11. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA. The seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure. JAMA. 2003; 289(19):2561.

12. American Diabetes Association (ADA). Tests of glycemia in diabetes. Diabetes Care. 2000; 23(Suppl 1):80-2.

13. Shukla HC, Gupta PC, Mehta HC, Hebert JR. Descriptive epidemiology of body mass index of an urban adult population in western India. J Epidemiol Community Health. 2002; 56(11):876-80.

14. Kamboj A. An epidemiological study of overweight and obesity among above 18 years in an urban population of Meerut. Unpublished Thesis submitted to CCS University, Meerut, Uttar Pradesh, MD (Community Medicine), 2003.

15. Nutrition Foundation of India. Obesity in the urban middle class in Delhi. Scientific Report. 1999; 15:6-10.

16. Sood AK, Kapil U and Gupta MC. An epidemiological study of obesity in an urban community of Malviyanagar, South Delhi. Indian Journal of Nutrition and Diet. 1985; 22: 42-48.

17. Gopinath N, Chaddha SL, Sood AK. Epidemiological study of hypertensives in young (15-24 years) Delhi urban population. Indian Jour of Med Research. 1994; 99: 32-37.

18. Goel P: A study of prevalence of obesity and its epidemiological correlates in adult Punjabi population. Unpublished Thesis submitted to University, Ludhiana, Punjab, MD (Community Medicine), 2005.

19. Kumar S. An epidemiological study of overweight and obesity among above 18 years in rural population of Meerut. Unpublished Thesis submitted to CCS University, Meerut, Uttar Pradesh, MD (Community Medicine), 2006.