



Epidemiology of General Obesity and Abdominal Obesity among People in Hilly Areas of North India: A Hospital Based Study

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ABSTRACT

Background & objectives: In today's world, obesity is a lifestyle disease that can kill. This study was conducted to assess the prevalence of general and abdominal obesity among adult outdoor patient in Urban and Rural Health Training Centre, Department of Community Medicine, Veer Chandra Singh Garhwali Government Medical Sciences and Research Institute, Srinagar, Uttarakhand.

Methods: A total of 200 patients aged ≥ 20 years were randomly selected were studied. Simplified questionnaire was used for interviewing participant and anthropometric measurement was done. Definition of overweight and obesity given by the World Health Organization (WHO); Asia Pacific Guidelines; and WHO criteria for Europids were used.

Results: Participants aged from 20-74 years and 56.5% were females. Prevalence of abdominal obesity was found 38.5% (24.1% for men and 49.6% for women, $p < 0.05$) using WHO Asia Pacific Guidelines. By WHO obesity criteria for europids, the prevalence of abdominal obesity was 19.5% (11.5% for men and 25.7% for women, $p < 0.05$). Multiple logistic regression analysis showed women and not working patients had a higher risk of general obesity and abdominal obesity than working men with $p < 0.05$.

Conclusions: The prevalence of abdominal, as well as of general obesity, was high using WHO Asia Pacific Guidelines. Gender and occupation were risk factors associated with obesity. Suitable healthcare strategies are needed for combating obesity.

Keywords: Abdominal obesity, generalized obesity, India, Body Mass Index

INTRODUCTION

Obesity, a lifestyle disease, is abnormal or excessive fat accumulation that may impair health. Globally, it is one of the greatest causes of preventable death. However, it is also among the most neglected public health problems leading to raising burden in both developed and developing countries.^{1,2} The prevalence of obesity and overweight among adults across the world in 2014 was nearly 13% and 39%, respectively. It was higher in women compared to men. Obesity has doubled between 1980 and 2014.²

Once considered a high-income country problem, overweight and obesity are now on the rise in low- and middle-income countries, particularly in urban settings. In developing countries the rate of increase of overweight and obesity is higher than that of developed countries.³ India is currently facing a swift rise in the prevalence of obesity, especially among the adult population.⁴ In India, more than 25% of urban adults are overweight, 5% are obese, and 15% of urban children are overweight.⁵

The fundamental cause of obesity and overweight is an energy imbalance.⁶ Globally, there is increased intake of energy dense foods accompanied

with a decrease in physical activity due to the increasingly sedentary nature of work and increasing rates of urbanization.⁷ The common health consequences of overweight and obesity are cardiovascular diseases, diabetes, musculoskeletal disorders, and some cancers.^{8,9,10}

Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2).¹¹ The WHO definition is a BMI is greater than or equal to 25 is overweight and a BMI greater than or equal to 30 is considered obese.² The WHO expert stated Asians generally have a higher percentage of body fat than white people of the same age, sex, and BMI. Therefore, the proportion of Asian people with risk factors for diabetes and cardiovascular disease is more substantial even below the existing WHO BMI cut-off point of $25 \text{ kg}/\text{m}^2$.¹²

There is a need to scrutinize actual obesity so that effective and adequate measures can be taken to combat the burden of obesity. This study was conducted to assess the prevalence of general and abdominal obesity among adult outdoor patient in Urban and Rural Health Training Centre, Department of Community Medicine, Veer Chandra Singh Garhwali Government Medical Sciences and Research Institute, Srinagar, Uttarakhand.

MATERIALS AND METHODS

This study was conducted in the outpatient department of the Urban Health Training Centre, Srinagar and Rural Health Training Centre, Kritinagar under Department of Community, Medicine, Veer Chandra Singh Garhwali Government Medical Sciences, and Research Institute, Uttarakhand. This is a hospital - based cross sectional study. The study was conducted in September 2015- December 2015.

All patients' aged ≥ 20 years, attending the outpatient department constituted the eligible study population. The sample size was determined following the WHO guidelines for medicine.¹³ With alpha error of 20%, the sample size came to be 150. Taking non-response rate of 20%, the final minimum sample size was 180. A total of 200 patients were randomly studied as a subcomponent of a primary study conducted on patient's satisfaction in these health centres. An ethical approval was obtained from the Institutional Ethical Committee. Written consent was taken from the patients in the participant's consent form. The participant's information sheet was prepared. This information sheet was explained and given to the participants. A simplified questionnaire was used for interview-

ing participant and anthropometric measurements were done. The digital weighing scale was used. Zero error was checked. The study participants were asked to remove their shoes and outer clothing. The participants were asked to stand in the middle of the scale, with their feet slightly apart, and to remain until the weight appeared on the display. This weight was recorded.

Stadiometer was used for height. Shoes, socks, and hair ornaments were removed, as well. The participants stood on the baseboard with their feet slightly apart. The participants' heads were positioned so that a horizontal line from the ear canal to the lower border of the eye socket ran parallel to the baseboard. Keeping the head in position, the headboard was pushed down to rest firmly on the top of the head and compressed the hair. Their height was measured and recorded.

Body Mass Index (BMI): Calculated as weight in kilograms (kg) divided by height in meters squared (m^2), rounded to one decimal place. Using the Indian Council of Medical Research released updated guidelines (in 2012) based on the World Health Organization Asia Pacific Guidelines; Normal BMI: $18.0\text{-}22.9 \text{ kg}/\text{m}^2$, Overweight: $23.0\text{-}24.9 \text{ kg}/\text{m}^2$, Obesity: $\geq 25 \text{ kg}/\text{m}^2$; abdominal obesity: Waist circumference $\text{WC} \geq 90 \text{ cm}$ for men, $\text{WC} \geq 80 \text{ cm}$ for women.¹⁴ Using World Health Organization criteria for Europids (Overweight: $25 \text{ kg}/\text{m}^2 \leq \text{BMI} < 30 \text{ kg}/\text{m}^2$; Obesity: $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$; abdominal obesity: $\text{WC} \geq 102 \text{ cm}$ for men, $\text{WC} \geq 88 \text{ cm}$ for women).¹¹ Abdominal obesity was also defined as Waist Hip Ratio WHR > 0.95 in men, > 0.80 for women.¹¹

All the data was entered using Epi Info version 3.3.2. Data was then transferred to Microsoft Excel 2010. Analysis was done using SPSS17 compatible for Windows. The prevalence of general and abdominal obesity was calculated. The results were presented in proportions and percentages. The P value < 0.05 was considered to be significant.

RESULTS

Distributions of the characteristics of 200 patients are shown in [Table 1]. Participants aged from 20-74 years and their average age were 37.9 ± 16.2 for women and 43.5 ± 22.6 years for men, respectively. 43.5% of the participants were males. Women have higher mean BMI values $22.4 \pm 4.6 \text{ kg}/\text{m}^2$ compared to men. Men had higher mean WC $82.4(13.8) \text{ cm}$ and WH ratio 0.92 (0.06) than women. The difference in WH ratio between men and women was statistically significant with $p < 0.001$.

The overall prevalence of general obesity and overweight were 26.5% (19.5% for men and 31.9% for women, $p < 0.01$) and 12.5% (12.6% for men and 12.4% for women) respectively using World Health Organization Asia Pacific Guidelines. According to the World Health Organization's obesity criteria for euroids, the overall prevalence of general obesity and overweight were 7.5% and 19.0% respectively. The overall prevalence of abdominal obesity was 38.5% (24.1% for men and 49.6% for women, $p < 0.05$) using World Health Organization Asia Pacific Guidelines. By World Health Organization obesity criteria for euroids, the prevalence of abdominal obesity was 19.5% (11.5% for men and 25.7% for women, $p < 0.05$). The prevalence of general and abdominal obesity differed within age distributions for men and women. The prevalence of

abdominal obesity by the WH ratio was 48.0 % (35.6% for men and 57.5% for women, $p < 0.05$). [Table 2]

On multiple logistic regression analysis on general obesity and abdominal obesity by the World Health Organization Asia Pacific Guidelines, women had a higher risk of general obesity and abdominal obesity than men with $p < 0.05$. Those less than 60 years and with an annual family income more than 10,000 INR showed an increased risk of general obesity but was not significant statistically. Participants, who had less than a primary school education, were at lower risk of general obesity but higher risk of abdominal obesity than others do. Not working patients were at higher risk of both general obesity and abdominal obesity $p < 0.05$. [Table 3]

Table 1: Distributions of demographics and lifestyle factors by gender (n=200)

Variables	Total (n=200) (%)	Men (n=87) (%)	Women (n=113) (%)	p values
Age (years) ^a	40.3 (19.4)	43.5 (22.6)	37.9 (16.2)	0.042
BMI (kg/m ²) ^a	22.1 (4.8)	21.6 (5.1)	22.4 (4.6)	0.242
WC (cm) ^a	80.8 (13.3)	82.4 (13.8)	79.6 (12.9)	0.142
WH ratio ^a	0.89 (0.07)	0.92 (0.06)	0.87 (0.07)	<0.001
Educational level				
Less than primary school	78 (39.0)	29 (33.3)	49 (43.4)	0.266
Primary school to intermediate	86 (43.0)	39 (44.8)	47 (41.6)	
Graduation and above	36 (18.0)	19 (21.8)	17 (15.0)	
Occupation				
Not working	133 (66.5)	39 (44.8)	94 (83.2)	<0.001
Working	67 (33.5)	48 (55.2)	19 (16.8)	
Annual Family income				
<10,000 INR	117 (58.5)	48 (55.2)	69 (61.1)	0.490
10,000-30,000 INR	67 (33.5)	33 (37.9)	34 (30.1)	
>30,000	16 (8.0)	6 (6.9)	10 (8.0)	

a = Mean±S.D

Table 2: Prevalence of Overweight and Obesity Classified by BMI, WC and WHR by Age and Gender

Age (in yrs)	n	ICMR Criteria		WHO Euroids		WC (cm)		WHR
		Overweight ^a	Obesity ^a	Overweight ^b	Obesity ^b	Abdominal obesity ^a	Abdominal obesity ^b	Abdominal ^c obesity
Men								
<60	59	10.2	23.7	15.3	8.5	20.3	11.9	40.7
≥60	28	17.9	10.7	7.1	3.6	32.1	10.7	25.0
Total	87	12.6	19.5	12.6	6.9	24.1	11.5	35.6
Women								
<60	99	13.1	31.3	24.2	7.1	49.5	26.3	56.6
≥60	14	7.1	35.7	21.4	14.3	50.0	21.4	64.3
Total	113	12.4	31.9	23.9	8.0	49.6	25.7	57.5
All subjects								
<60	158	12.0	28.5	20.9	7.6	38.6	20.9	50.6
≥60	42	14.3	19.0	11.9	7.1	38.1	14.3	38.1
Total	200	12.5	26.5	19.0	7.5	38.5	19.5	48.0

BMI, Body mass index; WC, Waist circumference. WHR, Waist Hip ratio

^a Using the Indian Council of Medical Research released updated guidelines (in 2012) ; Normal BMI: 18.0-22.9 kg/m², Overweight: 23.0-24.9 kg/m², Obesity: >25 kg/m²; abdominal obesity: WC≥90 cm for men, WC≥80 cm for women). ^b Using WHO criteria for Euroids (Overweight: 25 kg/m²≤BMI<30 kg/m²; Obesity: BMI≥30 kg/m²; abdominal obesity: WC≥102 cm for men, WC≥88 cm for women). ^c WHR >0.95 in men, >0.80 for women

Table 3: Risk Factors Associated with the Prevalence of general and abdominal obesity from Multi-variate Logistic Regression

Variables	BMI General obesity ^a n(%)	OR (95% CI)	WC Abdominal obesity ^a n(%)	OR (95% CI) ^a	WHR ^c Abdominal obesity ^a n(%)	OR (95% CI)
Gender						
Male	17(8.5)	0.2(0.1-0.6)*	21(10.5)	0.2(0.1-0.4)**	31(15.5)	0.2(0.1-0.6)**
Female	36(18.0)	1	56(28.0)	1	65(32.5)	1
Age (years)						
<60	45(22.5)	1.4(0.5-3.8)	61(30.5)	0.7(0.3-1.7)	80(40.0)	1.7(0.7-4.0)
≥60	8(4.0)	1	16(8.0)	1	16(8.0)	1
Educational status						
Less than primary school	21(10.5)	0.7(0.2-2.0)	35(17.5)	1.1(0.4-3.0)	44(22.0)	1.4(0.5-3.6)
Primary school to intermediate	20(10.0)	0.4(0.1-1.3)	28(14.0)	0.7(0.3-1.7)	34(17.0)	0.6(0.2-1.4)
Graduation and above	12(6.0)	1	14(7.0)	1	18(9.0)	1
Occupation						
Not working	29(14.5)	0.2(0.1-0.6)*	51(25.5)	0.5(0.2-1.0)	60(30.0)	0.3(0.1-0.7)*
Working	24(12.0)	1	26(13.0)		36(18.0)	1
Annual Family income						
<10,000 INR	30(15.0)	0.8(0.2-3.3)	43(21.5)	0.9(0.2-3.3)	56(28.0)	1.1(0.3-3.9)
10,000-30,000 INR	18(9.0)	1.0(0.2-4.1)	28(14.0)	1.5(0.4-5.2)	33(16.5)	1.5(0.4-5.2)
>30,000 INR	5(2.5)	1	6(3.0)	1	7(3.5)	1

^a Logistic regression models were used to adjust for all other variables in the table. CI, confidence interval; OR, odds ratio. ^b Using WHO criteria for Asian (general obesity: BMI≥25 kg/m²; abdominal obesity: WC≥90 cm for men, WC≥80 cm for women). ^c WHR >0.95 in men, >0.80 for women.*p value<0.05, ** p value <0.001

DISCUSSION

Obesity is a global nutritional concern. Overall, 26.5 percent of our study population was obese and the prevalence of overweight was 12.5 percent in the study population using WHO Asia Pacific Guidelines. The prevalence obesity was nearly 3.5 times that of WHO europids guidelines. The results were similar to the ICMR INDIAB study, which reported the prevalence of general obesity was 24.6, and 31.3 per cent among residents of Tamil Nadu, and Chandigarh, while the prevalence of abdominal obesity was 36.1 per cent among residents of Chandigarh, respectively.¹⁴This is because both the studies used the same criteria to define obesity. In addition, both studies included urban and rural study participants.

A cross-sectional survey among Chinese adults also found the prevalence of central obesity was 16.1% in men and 37.6% in women.¹⁵A survey found, in England, currently 25.6% of adults (aged 16 years and over) were obese.¹⁶ The prevalence of obesity was 24.1% in Canada as per Canadian Health Measures Survey in 2007.¹⁷Obesity results as complex interaction between the environment, hereditary predisposition, and behaviour. The primary reason for similar findings in present study and other studies from China, England and Canada could be the environmental factors. Studies had reported that there is excess energy intake in form of energy dense food in both developed and developing countries.¹⁸

Nevertheless, the prevalence of obesity in the present study was higher than the study done in Karbi Anglong District of Assam, which showed the prevalence of obesity were 10.7% (males: 9.9%; females: 11.6%), respectively.¹⁹ It was also higher to a cross-sectional study of Dharan municipality which found the prevalence of obesity in the population was 7.2%.²⁰The primary reason is the difference in BMI criteria used to define obesity. A population-based cross-sectional study in the north of Iran measured overall prevalence rates of obesity was 18.8% respectively.²¹

The prevalence of obesity in present study was lower in contrast to a cross-sectional survey were conducted in Moradabad, Trivandrum, Kolkata, Nagpur, and Mumbai among women aged 25-64 years. The overall prevalence of central obesity among the total number of women was 55.0%.²² The main reason for this difference could be that this study included only females. Moreover, they excluded elderly from the study. In addition, the majority of study participants are from hilly regions. Therefore, they might have higher physical activity due to the terrain. A study conducted in urban areas of New Delhi, reported the prevalence of generalized obesity and abdominal obesity was 50.1 percent and 68.9 percent, respectively.²³A study in Chennai city in Tamil Nadu also revealed the prevalence of generalized obesity and abdominal obesity was 45.9 percent and 46.6 percent, respectively.²⁴The lower prevalence noted in the present study compared to others could be because New Delhi, Chennai, and Mumbai are metropoli-

tan cities, whereas the present study was in primary care centers of small towns.

The prevalence of General obesity, and Abdominal Obesity were significantly higher among women compared to men in the present study. The prevalence of obesity among males and females was 8.5 percent and 18.0 percent respectively. The National Family Health Survey 3 (NFHS3) also reported that in India, obesity (BMI \geq 25 kg/m²) was more prevalent in women.²⁵ The results were alike a cross-sectional epidemiological descriptive study, where obesity was more prevalent in females (15.6%) than in males (13.3%); on body mass index.²⁶ Similarly, in another epidemiological study of Kashmir Valley the prevalence of obesity in males was 7.0% and in females was 23.7%.²⁷ The higher prevalence of obesity among females compared to males was also found in studies conducted in Mumbai²⁸, Karbi Anglong District of Assam¹⁹ and Bahraini subjects.²¹ A study also reported that BMI in females was comparatively more than that in males ($p < 0.001$).²⁷

The prevalence of general obesity and abdominal obesity were significantly higher among nonworking participants. The prevalence of general obesity and abdominal obesity were higher among study population with annual family income more than 10000 INR. The NFHS 3 revealed obesity was more prevalent in higher socioeconomic groups.²⁵ The ICMR INDIAB study showed that female gender, and higher socioeconomic were significantly associated with general obesity, and abdominal obesity.¹⁴ The study also had a few limitations. It is a hospital based cross-sectional study design hence lack generalization to population.

CONCLUSION AND RECOMMENDATIONS:

The prevalence of overweight and obesity was high in adults. Abdominal obesity was more prevalent than general obesity. Women were more obese compared to men. Factors associated with obesity need closer examination and prevention of obesity should be targeted toward the high-risk groups at the same time. Suitable healthcare strategies are needed for combating such prevalence in India's population.

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