Original Research Article

Prevalence and significance of generalised and central body obesity among medical students

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Abstract

Background: Obesity is a major modifiable cardiovascular risk factor as studied by American Heart Association. Aim of present study was to determine the prevalence of generalised and central body obesity among Medical Students and association of obesity measured by body mass index (BMI) and waist circumference (WC) with health risk factors.

Material and methods: The present study was conducted on 200 medical students including 102 males and 98 females in the age group of 18-23 years in the Department of Physiology, Govt. Medical College, Amritsar. For generalised obesity (BMI> 25 kg/m^2 and abdominal or central obesity (WC 94>cm in males and 80 >cm in females) were used.

Results: The prevalence of generalised obesity in males and females was 75.51% (males 50.0%, females 25.51%) and abdominal or central obesity 82% (males 14% and females 68%). Isolated generalised obesity (BMI increased and WC normal) in males and female was 62.96% and 37.04% and isolated abdominal obesity (WC increased and BMI normal) in males and females 17.28% and 82.72%. Combined obesity (BMI and WC both increased) in males and females 40.12% and 59.88%.

Conclusion: Prevalence of combined obesity was found high among both sexes. While isolated generalised obesity was more common in males and isolated abdominal obesity more common in females. However, these prevalence rates vary markedly depending on cut points used. WC is a better marker of obesity related risk than BMI.

Key words

Generalised obesity, Central obesity, Body mass index (BMI), Waist circumference (WC), Cardiovascular risk factors and Asian Indians.

Introduction

Industrialization and urbanisation are associated with decreased physical activity, increased consumption of calorie-dense food and psychosocial stress. These factors lead to increase in weight and confer either generalised or central obesity [1]. The consequent of these alterations are the major coronary risk factors, hypertension, high low density lipoprotein cholesterol (LDL), low high density lipoprotein cholestrerol (HDL) and Diabetes develop [2]. Obesity is a major modifiable cardiovascular risk factor as studied by American Heart Association [3]. Obesity has multiple pathophysiological effects on cardiovascular system. The weight gain during childhood may be one of the most important determinants of cardiovascular risk. The escalating levels of major coronary major risk factors have contributed to coronary heart disease epidemic [4].

Body mass index (BMI) calculator is a measurement that helps in categorising an individual into a certain weight group. It is however not a test for identifying health or fatness of any individual. According to BMI the individuals are categorised into different weight groups like underweight, overweight and obese. So BMI calculator is one way of determining if an individual falls under any of these categories. BMI quantifies the muscle, fat and bone mass of an individual. It takes into account the height and weight of a person and result is the number that determines the weight category. Body mass index is calculated by formula= weight in kg/ height in m^2. Generally, the range of a healthy BMI is 18.5 to 24.9. Therefore, if you fall under this range, you are in a safe weight zone. If you are below 18.5, you are categorized underweight and BMI more than 25 but less than 29.9 overweight and with BMI more than 30 obese. The BMI of 25 is considered to be healthy internationally. The individuals with healthy BMI are at a lower risk of acquiring diseases like diabetes. However, for Indians, it is found that even people with lower BMI than 25 are vulnerable to diabetes risks. Two factors that

differ the health risks depending on BMI values between Asians and non–Asians are that fat content is found to be higher in Asian people and second the distribution of accumulated fat in body is different in Asians and in western people.

The studies have shown that for Indians the waist circumference (WC) plays a vital role in measuring obesity. The waist circumference (WC) in males <94 cm and <80 cm has low health risk. Therefore both BMI and WC are important for measuring obesity in Indians. The diseases of excess weight are diabetes, heart diseases, hypertension, osteoarthritis, liver diseases, gall bladder diseases and cancers. The study conducted in United States found that people who had a BMI of 25-29.9 Kg/m^2 had a 50% increased risk of diabetes compared to people with BMI between 18-24.9 Kg/m^2.

Epidemiological surveys use body mass index (BMI) as an indicator of generalised obesity and wait circumference (WC) or waist hip ratio (WHR) as a measure of central or abdominal obesity [5, 6]. Both generalised and abdominal obesity have been associated with number of metabolic abnormalities.

The present study reveals the prevalence and significance of generalised and abdominal obesity among Medical Students.

Materials and methods

The study was conducted on 200 medical students comprising of 102 male and 98 female students in the age of 18-23 years, in Physiology Department, Govt. Medical College, Amitsar, Punjab. For calculation of body mass index (BMI) height and weight was measured.

Measurement of height
Height was measured with the measuring tape to nearest centimetre. The Students were requested to stand upright without shoes with their back against the wall, heels together and eyes directed forward.

Measurement of Weight

Weight was measured with spring balance that was kept on a level horizontal surface. The Students wore light clothes, stood up right without shoes and weight was recorded to the nearest 0.5kg. The scale was calibrated every day with standard weights.

The body mass index (BMI) was calculated by formula= weight in kilogram/height in (metres)^2 in both sexes.

Measurement of waist circumference (WC)

Waist circumference was measured using a non-stretchable measuring tape. Subjects were asked to stand erect in a relaxed position with both feet together on a flat surface with minimal layer of clothing. Waist circumference was measured as the smallest horizontal girth between costal margins and iliac crests.

Results

The study was conducted in the Department of Physiology, Govt. Medical College, Amritsar.

Table – 1 shows prevalence of generalised obesity based on Body mass index (BMI) using World Health Organisation (WHO) guidelines. The BMI (18.5-24.9 Kg/m^2) of Males and females was 44.12% and 62.24% while BMI (25.0-29.9Kg/m^2) of males and females was 24.51% and 20.41%. The BMI (>30 kg/m^2) of males and females was 25.49% and 5.10%. The generalised obesity was present in 75.51% students (males 50% and females 25.51% using BMI >25 Kg/m^2).

Table - 1: Prevalence of generalized obesity based on BMI.

Sex	Under weight (<18.5)	Normal (18.5-24.9)	Overweight (25.0-29.9)	Obese (>30)	Total
Male (n=102)	6 (5.88%)	45 (44.12%)	25 (24.51%)	26 (25.49%)	102 (100%)
Female (n=98)	12 (12.24%)	61 (62.24%)	20 (20.41%)	5 (5.10%)	98 (100%)

Table – 2: Prevalence of abdominal obesity based on waist circumference (WC).

WC of Girls (n=98)			WC of Boys (n=102)			
Range (cm)	No.	%	Range (cm)	No.	%	P-value
<80	31	31.63	<94	88	86.28	0.00
80-88	48	48.98	94-102	10	9.80	0.00
>88	19	19.39	>102	4	3.92	0.00
Total	98	100.00	Total	102	100.00	0.01

Table - 2 shows prevalence of abdominal obesity by waist circumference (WC) measurement in males and females was 10% and 49% (WC: females 80-88cm, males 94-102cm) and 4% and 19% (WC: females >88cm and males >102cm). The abdominal obesity was present in 82% students (males 14% and females 68%).

Table - 3 shows isolated abdominal obesity (WC increased and BMI normal): The Isolated abdominal obesity in males and females was 17.28% and 82.72%. **Table - 4** shows the isolated generalised obesity (BMI increased and WC normal) in males and females was 62.96% and 37.04%.

Table - 3: Isolated abdominal obesity (WC increased and BMI normal).

| Sex (waist circumference)	Waist circumference	
	No.	%
Male (>94.0 cm)	14	17.28
Female (>80.0 cm)	67	82.72
Total	81	100.0

Table – 4: Isolated generalized obesity (BMI increased and WC normal) (n=119).

Sex	Waist circumference	No.	BMI (Kg/m^2)	No.	Total
Male	<94.0 cm	88 (73.94%)	>25	51 (62.96%)	139 (69.5%)
Female	<80.0 cm	31 (26.06%)	>25	30 (37.04%)	61 (30.5%)
Total		119 (100%)		81 (100%)	200 (100%)

Table – 5: Combined obesity (BMI and WC both increased).

Sex	Waist circumference		Body mass index (>25 kg/m^2)		Total	
	No.	%	No.	%	No.	%
Male	14	17.28	51	62.96	65	40.12
Female	67	82.72	30	37.04	97	59.88
Total	81	100	81	100.00	162	100.0

Graph – 1: Combined obesity (BMI and WC both are increased, BMI >25 kg/m^2 and WC males >94 cm and females >80 cm).
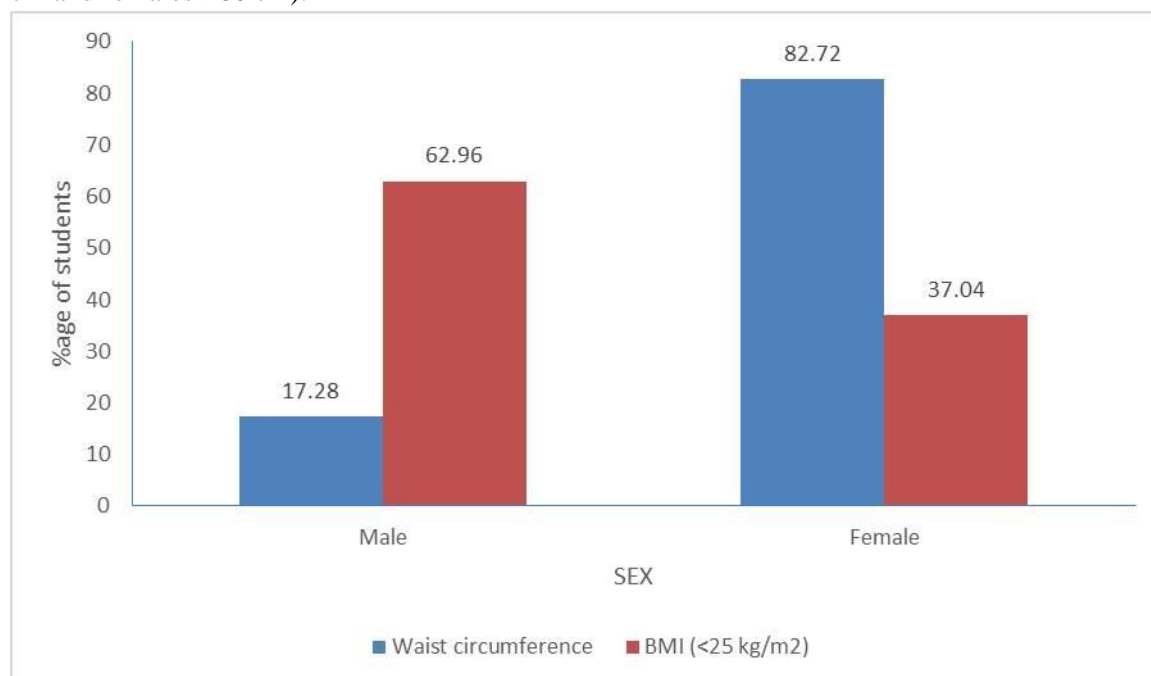
Table - 5 shows combined obesity (BMI and WC both increased). The combined males and females was 40.12% and 59.88%.

Graph – 1 shows combined obesity of both sexes (BMI and WC both were increased).

The isolated abdominal obesity in females was 82.72% and generalized obesity in females was 37.04%. The isolated abdominal obesity in males was 17.28% and generalised obesity 62.96%. Combined obesity in males and females was 40.12% and 59.88% respectively.

Discussion

The present study was conducted on medical students to find generalised and central or abdominal or visceral obesity by measuring their body mass index (BMI) and waist circumference (WC). It was found that combined obesity in males was 40.12% and females 59.88%. While isolated abdominal obesity was higher in females 82.72% and isolated generalised obesity was higher in males 62.96%. The result shows that combined and abdominal obesity is more in females while general obesity in more in males. The abdominal obesity has greater correlation

with cardio metabolic abnormalities than generalised obesity.

Deepa M, et al. studied the generalised and central or abdominal obesity in urban Asian Indians and found generalised obesity 45.3% (females 47.4% and males 43.2%) and abdominal obesity 46.6% (females 56.2% and males 35.1%). While isolated generalised obesity (increased BMI and normal WC) was present in 6.1% females 12.7% males and isolated abdominal obesity (increased WC and normal BMI) was present in14%females and 4.7%males.The combined obesity was present in 43.6% females and 32.6% males. While in our study generalised obesity was 75.1% (males 50.0%, females 25.51%) and abdominal obesity was 82% (males 14% and female 68%) the generalised obesity in males and abdominal obesity in females was significantly higher in our study. The isolated generalised obesity in males was 62.96% while isolated abdominal obesity in females was 82.72% which is significantly higher in our study. Similarly the combined obesity in males 40.12% and females 59.88% is higher than the study conducted by Deepa M, et al. [7].

The prevalence of overweight, obesity and extreme obesity among adults from 2007-2008 of National Health and Nutrition Examination Survey (NHANES) [8], using measured heights and weights, indicate that an estimated 34.2% of U.S adults age 20 years and over are overweight, 33.8% are obese, and 5.7% are extremely obese. The study showed that total of 73.7% of young population is having BMI $>25kg/m^2$. While the results of our study (75.51%) are near to this survey.

The studies conducted in Asians countries show different results. The Chinese national Nutrition survey showed that prevalence of obesity BMI >25 was 17.25 in Shanghai, 26.5% in Tianjin and 32.8% in Beijing (Ge L, et al.) [9]. The prevalence of obesity BMI $\geq$30 among Honkong Chinese population was 2.2% in men and 4.8% in women, While using a cut point of BMI $\geq$27 in

men and $\geq$25 in women the prevalence was 10% in men and 27.9% in women (Ko GT, et al.) [10]. In Malaysia the prevalence of obesity using BMI 25-30 was 24% in men and 18.1% in women, while using BMI >30 was 4.7% in men in 7.7% in women (Ismail MN, et al.) [11]. In Thailand the prevalence obesity was 16.7% using cut point of BMI 25-30 and 4% with BMI>30 (Chuprapavarn J) [12].

The prevalence rates of abdominal obesity WC: men $\geq$102 cm and women $\geq$88 cm were reported to be 27.1, 20.2 and 21.4% for white, black, Hispanic men and corresponding figures were 43.2, 56 and 55.4% for white, black, Hispanic women respectively in united states (Okosun, et al.) [13]. Hong Kong Chinese women had much higher prevalence of abdominal obesity 22.5% (WC: men $\geq$94cm and women $\geq$ 80 cm) compared to men 4.5%. The cut off points are similar to our study but our results show higher figures [14]. Case control study in Nagpur, Maharashtra in India Showed that abdominal obesity using WC is a better predictor of risk of diabetes mellitus compared to waist hip ratio (Mamtani MR, et al.) [15].

The Heart Outcomes Prevention Evaluation (HOP) study reported that abdominal obesity worsens the prognosis of patients with cardiovascular disease (Degenais GR, et al.) [16].

Our study showed that generalised obesity is higher in males than females and abdominal obesity is higher in females than males. It is emphasizing that prevalence of generalised or isolated obesity varies in the same population depending on cut points. WHO classification of BMI and Asia Pacific guidelines are different. While for abdominal obesity few studies have taken WC $\geq$94cm males and $\geq$80 cm in females and others $\geq$ 102 in males and $\geq$88 cm in males [6, 17, 18]. In our present study we have used WC $\geq$94 cm in males and $\geq$80 cm in females for abdominal obesity, while BMI $>25kg/m^2$ for generalised obesity. It is therefore clear that defining obesity either by BMI or WC is purely arbitrary and figures can vary widely based on

cut points used. So data from different ethnic group using different cut points vary.

In this study we found that WC yields higher obesity result compared with BMI in identifying the metabolic risk factors. However, there is need for prospective studies to confirm these finding. The risk of developing diabetes starts even at normal BMI and WC in our population. Indeed four of five countries with most cases of Diabetes are in Asia and risk of diabetes has been shown to start at much lower BMI (Nakagami T, et al. and Yajnik CS) [19-21] and WC (Vikram NK, et al.) [22].

BMI, WHR, WC and waist to stature ratio complement one another and proved to be best anthropometric indices for screening cardiovascular disease risk factors among Singaporean women (Pua and Ong). A metaanalysis of prospective studies emphasized the importance of incorporating WHR or WC into cardiovascular disease risk assessment (De koning, et al.). The obesity and lower BMI cause metabolic and vascular risk in developing countries compared with developed countries (Deuranberg).

The females have increased abdominal obesity so they are prone to diabetes mellitus, hypertension, cardiovascular and overweight related diseases. The findings in our study suggest that in Asian Indians measuring the WC is a better method of estimating obesity related cardiovascular risk than BMI. These findings further support for the inclusion of WC as a component of Indian diabetes risk score (IDRS) which has been shown to be very effective tool for predicting the undiagnosed diabetes.

The following important findings emerge from present study
- The prevalence of generalised obesity is higher in males and abdominal obesity in females
- The prevalence of isolated abdominal obesity is higher in females
- Combined obesity (generalised plus abdominal obesity) is higher in females

The findings in present study suggest that in Asian Indians Measuring WC is a better method of estimating obesity related cardiovascular disease risk than BMI.

Conclusion

The present study shows that regular physical activity of any type is inversely related to all measures of obesity viz; BMI (body mass circumference), WC (waist circumference) and WHR (waist hip ratio). The other major determinant of obesity is diet. So life style modification, daily use of seasonal, fresh, cheap vegetables and fruits with regular exercise can keep a person physically, mentally healthy and free from obesity related diseases.

References

1. Yusuf S, Reddy KS, Ounpuu S, Anand S. Global burden of cardiovascular diseases: general considerations, the epidemiologic transition, risk factors and impact of urbanisation. Circulation, 2001; 104: 2746-53.
2. Rashid MN, Fuentes F, Touchon RC, Wehrer PS. Obesity and the risk of cardiovascular disease. Prev Med., 2003; 6: 42-47.
3. Eckel RH, Krauss RM. For the American Heart Association Nutrition Committee. Obesity as a major risk factor for coronary heart disease. Circulation, 1998; 97: 2099-2100.
4. Gupta R, Rastogi S, Panwar RB, Soangra MR, Gupta VP, Gupta KD. Major coronary risk factors and coronary heart disease epidemic in India. South Asian J Prev Cardiol., 2003; 7: 11-40.
5. Gupta R, Gupta VP, Sarna M, Prakash H, Rastogi S, Gupta KD. Serial epidemiological surveys in an urban Indian population demonstrate increasing coronary risk factor among the lower

socioeconomic strata. J Assoc Physicians Ind., 2003; 55: 470-77.

6. WHO Expert Committee. Physical Status: the use and interpretation of anthropometry. WHO Technical Report Series, 1995; 854: 424-38.

7. Deepa M, Farooq S, Deepa R, Manjula D, Mohan V. Prevalence and significance of generalized and central body obesity in an urban Asian Indian population in Chennai, India (CURES: 47). European journal of clinical nutrition, 2009 Feb 1; 63(2): 259-67.

8. Ogden CL, Carroll MD. Prevalence of overweight, obesity, and extreme obesity among adults: United States, trends 1960–1962 through 2007–2008. National Center for Health Statistics, 2010 Jun; 6(1): 1-6.

9. Ge L. Body mass index in young Chinese adults. Asia Pac J Clin Nutr., 1997; 6: 175–179.

10. Ko GT, Chan JC, Woo J, Lau E, Yeung VT, Chow CC, et al. (1997). Simple anthropometric indexes and cardiovascular risk factors in Chinese. Int J Obes., 1997; 21: 995–1001.

11. Ismail MN, Zawiah H, Chee SS, Ng KK. Prevalence of obesity and chronic energy deficiency (CED) in adult Malaysians. Malays J Nutr., 1995; 1: 1–9.

12. Chuprapavarn J. First report on survey of health status in Thai populations by questionnaires and physical examination, 1991–1992. Institute of Public Health: Bangkok, 1996.

13. Okosun IS, Prewitt TE, Cooper RS. Abdominal obesity in United States: prevalence and attributable risk of hypertension. J Hum Hypertens., 1999; 13: 425.

14. Moon OR, Kim NS, Jang SM, Yoon TH, Kim SO. The relationship between body mass index and the prevalence of obesity-related diseases based on 1995 National Health Interview Survey in Korea. Obes Rev., 2002; 3: 191–196.

15. Mamtani MR, Kulkarni HR. Predictive performance of anthropometric indexes of central obesity for the risk of type 2 diabetes. Arch Med Res., 2005; 36: 581–589.

16. Dagenais GR, Yi Q, Mann JFE, Bosch J, Pogue J, Yusuf S. On behalf of the Heart Outcomes Prevention Evaluation (HOPE) study investigators. Prognostic impact of body weight and abdominal obesity in women and men with cardiovascular disease. Am Heart J., 2005; 149: 54–60.

17. National Cholesterol Education Program. Third report of the National Cholesterol Education Program Expert Panelon detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel-III). Circulation, 2002; 106: 3143-3421.

18. National Cholesterol Education Program. Second report of the expert panel on detection, evaluation and treatment of high blood cholesterol in adults (Adult treatment Panel-II).Circulation, 1994; 89: 1333-1445.

19. Nakagami T, Qiao Q, CarstensenB,Nhr-Hansen C, Hu G, Tuomilehto J, et al. The DECODE-DECODA Study Group. Age, bodymass index and type 2 diabetes-associations modified by ethnicity. Diabetologia, 2003; 46: 1063–1070.

20. Yajnik CS. Symposium on 'Adipose tissue development andthe programming of adult obesity'. Obesity epidemic in India: intrauterine origins? Proc Nutr Soc., 2004; 63: 387–396.

21. Yajnik CS. Waist–hip ratio: a thrifty phenotype? Natl Med J India, 2006; 19: 200–201.

22. Vikram NK, Pandey RM, Misra A, Sharma R, Rama Devi J, Khanna N. 'Non-obese' (BMI 25 kg/m^2) Asian Indians with 'normal' waist circumference have high cardiovascular risk. Nutrition, 2003; 19: 503–509.