Original research article

Association between anthropometric parameters and dyslipidemia in obese and non-obese patients

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Abstract

Background: Obesity leads to dyslipidemia and predisposes to risk of atherosclerosis and premature death. Anthropometric variables when correlated with lipid profile help to screen at risk individuals who are more susceptible for developing obesity-related morbidities. **Aim and Objective:** This study aims to determine the association of dyslipidemia of obesity with anthropometric indices. **Materials and Methods:** This cross-sectional study was carried out in the Department of Physiology, Patna Medical College, Patna, Bihar, India from October 2018 to August 2019.Total 200 healthy males & females with the help of self structured questionnaire were include in this study. WC was measured, in cm, midway between the lower costal margin and iliac crest during the endexpiratory phase, with a non elastic tape. Hip circumference was measured, in cm, at the level of the greater trochanters, with the person standing and relaxed muscles. **Results**: Mean age of obese group and non obese group was 41.5 ± 9.28 years, 39.5 ± 9.37 years respectively. Mean body weight of obese group and non obese group was 94.78 ± 5.78 kg, and 92.66 ± 6.47 kg, respectively. Mean height of obese group and non obese group was 161.7± 4.78 cm, and 158.2 ± 5.15cm, respectively. Mean BMI of obese group and non obese group was 28.21 ± 2.5kg/m2, and 23.45 ± 2.7 kg/m2, respectively. Mean WHR of obese group and non obese group was 0.96 ± 0.10 cm, and 0.79 ± 0.07 cm, respectively. All the anthropometric variables were found highest in the obese group as compared to non obese group and this difference between the groups was statistically highly significant. **Conclusion**: Obesity strongly correlates with dyslipidemia and altered lipid profile status. Furthermore, from this study, we can say that WHR is the most specific parameter that can be used in the clinical setup to identify within obese subjects those who are more predisposed for developing CVD and treated appropriately.

Keywords: Obesity; Body Mass Index; Lipid Profile; Anthropometric indices

Introduction

Obesity and overweight are defined as abnormal and excessive fat accumulation in adipose tissue to the extent of impairing normal health.[1] Body mass index (BMI) provides the most useful population level measure of obesity. Its classification allows for meaningful comparison of weight status and level of adiposity within population and identifies the at risk group. With the whole world now in the risk zone of obesity, this has become a big menace of public health in our country with the increasing modernization and imbibing of a low physical activity lifestyle. Obesity is defined by (BMI) calculated as kilograms per square meters. Overweight according to the WHO is BMI ≥25.00, pre-obese: BMI is 25.00–29.99, Class I obese: BMI is 30.00–34.99, Class II obese: BMI is 35.00–39.99, and Class III obese when BMI ≥40.00.[2] The Asian cutoff value for overweight and obese is BMI ≥23.0 and ≥25.0, respectively.[3] BMI fails to differentiate weight associated with muscle or fat; so, the fat content varies with body built and proportions across different ethnic populations.[4] Obesity occurs due to complex interaction between faulty dietary habits, sedentary lifestyle, and lack of physical exercise and is aggravated by genetic predisposition in some subsets of population. The WHO states that in 2016, more than 1.9 billion adults (39%) and above were overweight and of these over 650 million (13%) were obese.[5] In India, over the past one decade, men and women who were overweight and obese (BMI ≥25.00 kg/m2)

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increased from 9.3–18.6% to 12.6–20.7%, respectively.[6] Obesity itself leads to enhanced risk of development of type 2 diabetes (44%), hypertension, 23% of ischemic heart disease, gallbladder disease, 7–41% of some cancers, and degenerative bone diseases.[7] Abdominal fat is very variable for a narrow range of BMI. High waist–hip ratio >1 in men and >0.85 in women indicates abdominal fat accumulation.[8] Recent evidences indicate that detrimental effect on cardiovascular and metabolic health is more correlated by waist circumference (WC).[9,10] Dyslipidemia is common in obesity leading to atherosclerosis. Total cholesterol (TC) to high-density lipoprotein cholesterol (HDL-C) ratio is strongly related to risk of coronary heart disease (CHD).[11] Obese is more likely to have high cholesterol levels, which increases their risk of atherosclerosis. Higher percentage of fat accumulation in truncal area and abdomen is seen in Asian Indians which makes them prone for development of insulin resistant syndrome and early atherosclerosis.[12] The National Cholesterol Education Programme Adult Treatment Panel III states that TC < 200 mg/dl is taken as normal and levels more than 240 mg/dl are considered as risk factor for CHD. Furthermore, low-density lipoprotein cholesterol (LDL-C) more than 100 mg/dl and HDL-C <60 mg/dl are considered abnormal.[13]However, due to the inferior cost effectiveness of such modalities compared to time honored anthropometric techniques, the former methods are not practical for routine clinical use. Using simple, noninvasive, anthropometric methods, diagnosing obesity as a possible predictor of dyslipidemia is expected to be helpful in efforts to prevent, diagnose early, and control both mortality and morbidity. Further, identifying the best anthropometric index in any population is essential to predict chronic disease risk factor and to facilitate enhanced screening for disease risk factors. There is lack of representative data regarding the anthropometric profile of south Indians and their association with, dyslipidemia. Hence, the present study intends to compare the ability of simple, non–invasive techniques applicable in field practices in predicting approximately the lipid levels in the body, thus, preventing the future health hazards.

Material and Methods

This cross-sectional study was carried out in the Department of Physiology, Patna Medical College, Patna, Bihar, India from October 2018 to August 2019, after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the participant.The presence of history of dyslipidemia, hypertension, diabetes mellitus, malignancy or any other major chronic illness, use of lipid lowering agents, or other drug delivery system , family history of lipid related disorders as well as critically ill patients presenting with medical emergencies like myocardial infarction, hyperglycemia, ascites or pregnancy were excluded from the study. Total 200 cardio metabolically healthy males & females with the help of self - structured questionnaire were include in this study. WC was measured, in cm, midway between the lower costal margin and iliac crest during the end expiratory phase, with a non- elastic tape. Hip circumference was measured, in cm, at the level of the greater trochanters, with the person standing and relaxed muscles. WHR was defined as the WC divided by the hip circumference. Body weight and height were measured without shoes, using an electronic measuring scale. BMI was calculated as weight in kg divided by height in m2 (Quetlet's Index).[14] 5 ml venous blood was collected from each subject after an overnight fast of 12-14 hours. Serum was separated within one hour of the blood collection and stored at -200C until analyzed for lipid profile. Serum samples were analyzed for lipid profile estimations by using standard methods.

Statistical Analysis

All statistical tests were conducted using SPSS version 20. Significance value was taken as 'p' < 0.001 or 'p' < 0.05. Sensitivities and specificities of anthropometric indices were compared.

Results

Mean age of obese group and non obese group was 41.5 ± 9.28 years, 39.5 ± 9.37 years respectively. Mean body weight of obese group and non obese group was 94.78 ± 5.78 kg, and 92.66 ± 6.47 kg, respectively. Mean height of obese group and non obese group was 161.7± 4.78 cm, and 158.2 ± 5.15cm, respectively.Mean BMI of obese group and non obese group was28.21 ± 2.5kg/m2 , and 23.45 ± 2.7 kg/m2 , respectively. Mean WHR of obese group and non obese group was0.96 ± 0.10 cm, and 0.79 ± 0.07 cm, respectively. All the anthropometric variables were found highest in the obese group as compared to non obese group and this difference between the groups was statistically highly significant table 1.In present study, based on WC 70% of study population were categorized in obese group and 30% as non obese group. On basis of WHR 60% of subjects were grouped as obese and 40% as non - obese. Further, 55% of subjects were grouped under obese category and 45% asnon-obese based on BMI values.Anthropometric indices and serum lipid profile values showed a significant (p<0.001) increase in

obese group when compared to non-obese group (Table 1). Of all the 70 obese subjects, WC has correctly identified 123 subjects as obese with abnormal serum lipid profile (table 2).Further, based on percent sensitivity and specificity of anthropometric parameters in predicting dyslipidaemia WC was more sensitive in terms of diagnostic accuracy, i.e. correctly identified the obese with dyslipidaemia, (67.5%) and WHR showed higher positive predictive value considering the diagnostic power, i.e. ability to correctly predict occurrence of dyslipidaemia (PPV % - 90%) in healthy study subjects (table 3)

Table 1: Anthropometric indices and serum lipid profile in obese and non - obese group; values expressed as Mean ±SD

Parameters	**Obese group**	**Non – Obese**
Age	41.5 ± 9.28	39.5 ± 9.37
Height	161.7± 4.78	158.2 ± 5.15
Waist circumference (cm)	93.89 ± 7.87	81.10 ± 8.01*
Waist Hip Ratio	0.96 ± 0.10	0.79 ± 0.07*
BMI (kg/ m^2)	28.21 ± 2.5	23.45 ± 2.7*
Total Cholesterol	242.78±29.07	172.75 ± 24.25*
Triglycerides	252.88 ± 30.79	107.00 ± 29.49*
HDL	32.79 ± 5.87	45.11 ± 2.88*
LDL	135.12 ± 13.02	82.11 ± 10.07*

* - p<0.001; obese versus non obese group

Table 2: Anthropometric Indices and serum Lipid Values; n - number of subjects

	Obese			**Non – obese**		
	N	Abnormal Lipidprofile	Normal Lipid profile	n	Abnormal Lipidprofile	Normal Lipid profile
WC	140	123	17	60	39	11
WHR	120	103	17	80	67	13
BMI	55	43	12	45	37	8

Table 3: Percent Sensitivity and specificity of anthropometric parameters in predicting dyslipidaemia

	WC (cm)	**WHR**	**BMI (kg/ m^2)**
Sensitivity	67.5	62.5	54
Specificity	42.5	47	39.5
Positive predictive value %	84.5	90	82.5
Negative predictive value %	14.5	15	13.5

Discussion:

Dyslipidemia is an independent and modifiable risk factor for cardiovascular diseases.[15]Prevalence of dyslipidaemia in recent years might be probably due to westernization of diet and transitions in wealth and lifestyle. Obesity poses a significant health threat to individuals and places a major burden on health care system. Obesity is associated with endothelial dysfunction, greater arterial stiffness[16] and insulin tolerance. Early detection of obesity by simple and reliable methods can help reverse or reduce these untoward effects. Anthropometric measurements are surrogate measures of body fat and are better predictors of dyslipidemia. They require no sophisticated equipment, lengthy procedures and are cost-effective. Literature survey shows that anthropometric index varies according to study design, geographic area and characteristics of the study population.[17,18]

WC, WHR and BMI are good indicators for body fatness and central fat distribution. In our study, anthropometric measures of obesity were significantly correlated with prevalence of dyslipidemia. The association of dyslipidemia with obesity observed in this study is in accordance with previous research reports.[17,18] Further, WC more accurately predicted deranged lipid profile and WHR has rightly projected obese subjects with dyslipidaemia. Studies with computed tomography sections have disclosed the fact of nearer relationship between dyslipidemia and WC.[18-

[20] An increased WC is most likely associated with elevated risk factors because of its relation with visceral fat accumulation, mechanism may involve excess exposure of the liver to fatty acids.[21]Waist circumference (WC) has been recommended as a better indicator of abnormal fat content in the body than BMI. This has also been validated by the Quebec Health Survey done by Lemeui et al.[22]The inability of BMI to correctly predict deranged lipid profile is in agreement with another broad based study done by Shamai et al.[23]BMI does not take into account proportion of weight related to increased muscle mass, bone weight or visceral organ mass. Individuals with a similar BMI can vary considerably in their abdominal fat mass by virtue of these factors. And hence, with same BMI can have varied range of serum lipid profile. Our study observed that compared with BMI, WC and WHR are good indicators for body fatness in adults at the population level and as well provide additional information about central fat distribution. This is in agreement with the studies of Xu C et al. and the fieldwork done by Feldstein *et al.* in the Chinese and Argentine populations, respectively and thus validates that WC is a better predictor of dyslipidaemia than WHR, WHtR and BMI.[24,25]. Identifying early dyslipidaemia can help in instituting corrective measures to reduce disease burden. Raised values of WC and WHR might be useful as relatively inexpensive firststage screening tools to detect dyslipidaemia. Routine health examination will enhance obesity related evaluationof cardiovascular risk factors and thus, in prevention of future health hazards. Present study concluded that WC is a more sensitive and a reliable predictor while WHR is a more specific anthropometric index in predicting dyslipidaemia among healthy individuals. Incorporating these into routine health examination will enhance obesity related evaluation of cardio vascular risk factors and thus, in prevention of future untoward health hazards.

Conclusion

In the present times when highly sophisticated instruments for accurate measurement of body fat distribution and body composition analysis are available, we can accurately pin point the at risk group. However, most of the centers do not have access to them and it is here the simple anthropometric measurements of body and lipid profile analysis can be used as an alternative. Obesity strongly correlates with dyslipidemia and altered lipid profile status. Furthermore, from this study, we can say that WHR is the most specific parameter that can be used in the clinical setup to identify within obese subjects those who are more predisposed for developing CVD and treated appropriately

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