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ORIGINAL ARTICLE

To examine the relationship between obesity-related dyslipidemia and anthropometric indicators

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ABSTRACT:

Aim: The purpose of this research is to examine the relationship between obesity-related dyslipidemia and anthropometric indicators. **Methods:** This cross-sectional research was conducted at the Department of Physiology. A total of 100 healthy males and females participated in this study using a self-structured questionnaire. With a non elastic tape, WC was measured in cm halfway between the lower costal border and the iliac crest at the end expiratory phase. With the subject upright and muscles relaxed, the hip circumference was measured in centimetres at the level of the greater trochanters. **Results**: Based on WC, the current research 70% of the study population was classified as obese, whereas 30% were classified as non-obesity. Based on WHR, 66.67% of participants were classified as obese, whereas 33.33% were classified as non-obese. Furthermore, based on BMI values, 65.71% of participants were classified as obese and 34.29% as non-obese. When compared to the non-obese group, anthropometric indices and serum lipid profile values increased significantly (p<0.001). WC accurately detected 24 obese participants with abnormal blood lipid profiles out of 27 obese subjects. Furthermore, the % sensitivity and specificity of anthropometric measures in predicting dyslipidaemia were calculated. In terms of diagnostic accuracy, WC was more sensitive (71.58%), correctly identifying the obese with dyslipidaemia, and WHR showed higher positive predictive value in terms of diagnostic power, i.e. ability to correctly predict the occurrence of dyslipidaemia (PPV% - 91.39%) in healthy study subjects. **Conclusion**: Changes in lipid profile and dyslipidemia are significantly linked to obesity. This research also shows that WHR is the most specific measure that may be utilised in a clinical setting to identify those obese patients who are at a higher risk for developing CVD so that they can be given the proper treatment.

Key words: Obesity; Body Mass Index; Lipid Profile; Anthropometric indices

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INTRODUCTION

Obesity has previously been linked to higher incidence of dyslipidemia and other cardiovascular risk factors. [1] The most effective population-level measure of obesity is the body mass index (BMI). Its categorization enables for meaningful comparisons of weight status and adiposity levels throughout the population and identifies the at-risk group. With the whole globe now in the danger zone of obesity, it has become a major public health threat in our nation, especially with the rising modernity and imbibing of a low physical activity lifestyle. Obesity is characterised by a body mass index (BMI) of more than 30 kilogrammes per square metre. According to the WHO, overweight is defined as BMI 25.00, pre-obese as BMI 25.00-29.99, Class I obesity as BMI 30.00-34.99, Class II obese as BMI 35.00-39.99, and Class III obese as BMI 40.00. [2] BMI 23.0 and 25.0 are the Asian threshold values for overweight and obese. [3] Because BMI does not distinguish between weight associated with muscle and fat, fat content varies with body type and proportions between ethnic groups. [4] Obesity develops as a result of a complicated interplay between poor food habits, a sedentary lifestyle, and a lack of physical activity, and is exacerbated in certain subsets of the population by genetic susceptibility. According to the WHO, more over 1.9 billion individuals (39%) and above were overweight in 2016, with over 650 million (13%) obese. [5] Over the last decade, the proportion of men and women in India who were overweight or obese (BMI 25.00 kg/m2) went from 9.3-18.6% to 12.6-20.7%, respectively. [6] Obesity increases the likelihood of developing type 2 diabetes (44%), hypertension, ischemic heart disease (23%), gallbladder disease (7-41%), and degenerative bone disorders. [7] For a limited range of BMI, abdominal fat is very variable. A waist-hip ratio more than one in males and greater than 0.85 in women implies abdominal fat buildup. [8] Recent data suggests that waist size has a greater negative impact on cardiovascular and metabolic health (WC). [9, 10] Obesity is associated with dyslipidemia, which can lead to atherosclerosis. The ratio of total cholesterol (TC) to high-density lipoprotein cholesterol (HDL-C) is strongly associated with the risk of coronary heart disease (CHD). [11] Obese people are more likely to have high cholesterol levels, which puts them at risk of atherosclerosis. Asian Indians have a higher percentage of fat accumulation in the truncal area and abdomen, making them predisposed to the development of insulin resistance syndrome and early atherosclerosis. [12] According to the National

Cholesterol Education Programme Adult Treatment Panel III, TC 200 mg/dl is considered normal, and levels greater than 240 mg/dl are considered a risk factor for CHD. Furthermore, LDL-C levels greater than 100 mg/dl and HDL-C levels less than 60 mg/dl are considered abnormal. [13] However, due to their lower cost effectiveness when compared to time-tested anthropometric techniques, such modalities are not practical for routine clinical use. Diagnosing obesity as a potential predictor of dyslipidemia using simple, noninvasive anthropometric measures is likely to aid efforts to avoid, detect early, and reduce both mortality and morbidity. Furthermore, determining the optimal anthropometric index in every community is critical for predicting chronic disease risk factors and facilitating increased disease risk factor screening. As a result, the current research aims to examine the capacity of basic, non-invasive procedures used in field operations to forecast roughly lipid levels in the body, therefore averting future health concerns.

METHOD AND MATERIAL

After receiving clearance from the protocol review committee and the institutional ethics committee, this cross-sectional research was carried out at the Department of Physiology. Following informed permission, the Participant provided a full history. The study excluded patients with a history of dyslipidemia, hypertension, diabetes mellitus, malignancy, or any other major chronic illness, use of lipid lowering agents or other drug delivery systems, a family history of lipid related disorders, and critically ill patients presenting with medical emergencies such as myocardial infarction, hyperglycemia, ascites, or pregnancy. This research included 100 cardio-metabolically healthy men and females who completed a self-structured questionnaire. WC was measured using a non-elastic tape halfway between the lower costal border and the iliac crest during the endexpiratory phase. With the subject upright and muscles relaxed, the hip circumference was measured in centimetres at the level of the greater trochanters. WHR was calculated by dividing the WC by the hip circumference. An electronic measuring scale was used to determine body weight and height without the need of shoes. BMI was computed by dividing weight in kg by height in m2 (Quetlet's Index). After an overnight fast of 12-14 hours, 5 ml of venous blood was obtained from each volunteer.[14] Serum was separated within one hour of blood collection and refrigerated at -200C until the lipid profile was determined. Standard techniques were used to estimate the lipid profiles of serum samples.

STATISTICAL EVALUATION

SPSS version 25.0 was used for all statistical tests. The significance level was set at 'p' 0.001 or 'p' 0.05. Anthropometric indexes' sensitivities and specificities were compared.

RESULTS

The mean age of the obese and non obese groups was 39.85 ±6.85 years and 39.11± 6.47 years, respectively. The mean body weight of the obese group was 93.78 ±4.78 kg and 91.66 ±5.47 kg, respectively. The mean heights of the obese and nonobese groups were 160.8± 2.96 cm and 159.2± 3.87 cm, respectively. The mean BMI of the obese and nonobese groups was 29.54± 3.91 kg/m2 and 23.11± 3.51 kg/m2, respectively. The mean WHR of the obese and nonobese groups was 0.96±0.11 cm and 0.79± 0.05 cm, respectively. All anthropometric characteristics were found to be higher in the obese group than in the non-obesity group, and the difference between the groups was statistically significant (table 1). Based on WC, the current research 70% of the study population was classified as obese, whereas 30% were classified as non-obesity. Based on WHR, 66.67% of participants were classified as obese, whereas 33.33% were classified as non-obese. Furthermore, based on BMI values, 65.71% of participants were classified as obese and 34.29% as non-obese. When compared to the non-obese group, anthropometric indices and serum lipid profile values increased significantly ($p<0.001$) (Table 1). WC accurately detected 24 obese participants with abnormal blood lipid profiles out of 27 obese subjects (table 2). Furthermore, the % sensitivity and specificity of anthropometric measures in predicting dyslipidaemia were calculated. In terms of diagnostic accuracy, WC was more sensitive (71.58%), correctly identifying the obese with dyslipidaemia, and WHR showed higher positive predictive value in terms of diagnostic power, i.e. ability to correctly predict the occurrence of dyslipidaemia (PPV% - 91.39%) in healthy study subjects (table 3)

Table 1: Anthropometric indices and serum lipid profile in obese and non - obese group

Parameters	Obese group	Non – Obese
Age	39.85 ± 6.85	39.11 ± 6.47
Height	160.8± 2.96	159.2 ± 3.87
Waist circumference (cm)	92.92 ± 4.85	81.11± 5.12
Waist Hip Ratio	0.96 ± 0.11	0.79 ± 0.05
BMI (kg/ m^2)	29.54 ± 3.91	23.11 ± 3.51
Total Cholesterol	239.97±19.78	169.98 ± 19.89
Triglycerides	252.99 ± 18.88	105.96 ± 15.85
HDL	30.81 ± 5.59	45.24 ± 3.59

LDL	135.52 ± 8.84	81.84 ± 6.89

* - 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 Lipid profile	Normal Lipid profile	n	Abnormal Lipid profile	Normal Lipid profile
WC	27	24	3	8	6	2
WHR	20	15	5	10	7	3
BMI	23	17	6	12	8	4

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

	WC (cm)	WHR	BMI (kg/ m ^{2})
Sensitivity	71.58	63.59	55.89
Specificity	45.96	49.87	41.81
Positive predictive value %	84.96	91.39	85.11
Negative predictive value %	15.58	13.55	15.21

DISCUSSION

Dyslipidemia is a risk factor for cardiovascular disease that is both independent and controllable. [15] The rise in the prevalence of dyslipidaemia in recent years is most likely attributable to the westernisation of cuisine and changes in affluence and lifestyle. Obesity is a substantial health risk for people and a big cost on the health-care system. Obesity is linked to endothelial damage, increased arterial stiffness[16], and impaired insulin tolerance. Obesity may be detected early using simple and accurate procedures, which can help reverse or lessen these negative consequences. Anthropometric parameters are stronger predictors of dyslipidemia than body fat measurements. They do not need specialised equipment or extensive processes, and they are inexpensive. According to a review of the literature, the anthropometric index varies depending on the research design, geographic location, and features of the study population. [17,18]

Body fatness and central fat distribution are well-indicated by WC, WHR, and BMI. Anthropometric indices of obesity were shown to be substantially linked with the incidence of dyslipidemia in our research. The link between dyslipidemia and obesity reported in this study is consistent with prior research findings. [17,18] Furthermore, WC indicated a disordered lipid profile more well than WHR, while WHR correctly identified obese people with dyslipidaemia. Studies using computed tomography sections have shown a closer link between dyslipidemia and WC. [18-20] Because of its relationship with visceral fat buildup, an increased WC is most likely connected with raised risk factors; the process may include excessive exposure of the liver to fatty acids. [21] Waist circumference (WC) is thought to be a stronger predictor of abnormal fat content in the body than BMI. The Quebec Health Survey conducted by Lemeui et al. has also verified this. [22] The inadequacy of BMI to accurately predict a disordered lipid profile is consistent with another large-scale investigation conducted by Shamai et al. [23] BMI does not account for weight gain due to increased muscle mass, bone mass, or visceral organ mass. Individuals with comparable BMIs might have a wide range of abdominal fat mass due to these variables. As a result, people with the same BMI might have a wide variety of blood lipid profiles. In comparison to BMI, our research found that WC and WHR are excellent predictors of body fatness in adults at the population level, as well as providing extra information on central fat distribution. This is consistent with the findings of Xu C et al. and Feldstein et al. in Chinese and Argentine populations, respectively, and confirms that WC is a stronger predictor of dyslipidaemia than WHR, WHtR, and BMI. [24,25] Detecting early dyslipidaemia may aid in the implementation of remedial interventions to minimise disease burden. Raised WC and WHR levels might be effective as low-cost first-stage screening techniques for dyslipidaemia. Routine health examinations will improve obesity-related assessment of cardiovascular risk factors, resulting in future health risks prevention. The current research revealed that WC is a more sensitive and accurate predictor of dyslipidaemia in healthy adults, while WHR is a more precise anthropometric indicator. Incorporating them into regular health examinations will improve obesity-related assessment of cardio vascular risk factors, resulting in the avoidance of future unfavourable health consequences.

CONCLUSION

Today, we can precisely identify the population at risk because we have access to extremely advanced technologies for measuring body fat distribution and doing body composition analyses. Even though they are ideal, most clinics lack them, thus anthropometric measures and lipid profile analyses must suffice. Changes in lipid profile and dyslipidemia are significantly linked to obesity. This research also shows that WHR is the most specific measure that may be utilised in a clinical setting to identify those obese patients who are at a higher risk for developing CVD and provide them with the necessary treatment.

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