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Anthropometric Predictors in Assessment of Metabolic Syndrome among Obese Adults

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ABSTRACT

Background: Central obesity is the important risk factor in metabolic syndrome which is in turn cardiovascular risk factor which will increase the morbidity and mortality. The study was conducted to assess the anthropometric indices in predicting metabolic syndrome among obese adults.

Methods: Cross sectional study was done among 264 adults having BMI more than 35 and visiting our hospital for a period of three months were included. A predesigned and pretested proforma was used to collect data. Anthropometric measurements, Blood pressure and diabetic profile was measured. Data was analysed using SPSS.

Results: Among 264 adults, 118 (44.69%) had metabolic syndrome; Majority belonged to 30- 39 years (40.15%); educated up to PUC (32.58%) and belonged to class II socio-economic status (38.64%). There was significant mean difference between waist circumference, diastolic blood pressure, HDL levels and FBS levels among the study participants who had and who didn't have metabolic syndrome. Area under curve (AUC) for waist: height ratio was 0.969, whereas for waist circumference and BMI it was 0.956 and 0.689 respectively.

Conclusion: Waist: height ratio can predict metabolic syndrome better than waist circumference and BMI. Central obesity should be identified at the earliest than general obesity. So that lifestyle modifications can be advised in early life to avoid further morbidity leading to further permanent disabilities and life threatening events in future.

Key words: Anthropometry, Assessment, Metabolic syndrome, Obesity, Risk factor

INTRODUCTION

The metabolic syndrome is a clustering of risk factors which may include cardiovascular and metabolic which has been shown to independently increase all-cause mortality. Identification of metabolic syndrome will attract attention to various other related conditions such as fatty liver, polycystic ovary syndrome and obstructive sleep apnea.[1-3]

With the successful conquest of most of the infectious diseases in the world, this new non-communicable disease (NCD) has become the major health hazard of modern world. Though it started in the Western world, with the spread of the western lifestyle across the globe, it has become now a truly global problem. Over a billion people in the world and one third of South Indians are now affected with metabolic syndrome which is often more in the urban population of some develop-

ing countries than in its western counterparts. Since metabolic syndrome and obesity track into adulthood, these clinical entities need to be recognized early in the life-course for effective prevention.[4] A high prevalence of metabolic syndrome and associated cardiovascular risk factors have also been observed within rural to urban migrant population belonging to lower socioeconomic population groups residing in urban slums. The two basic forces spreading this malady are the increase in consumption of high calorie-low fiber fast food and the decrease in physical activity due to mechanized transportations and sedentary form of leisure time activities. Metabolic syndrome and cardiovascular risk in Asian Indians/ South Asians are also heightened by their relative increase in body fat mass, truncal subcutaneous fat mass, intra-abdominal fat mass, and also in ectopic fat deposition. Cardiovascular risk cluster also manifests at a lower level of adiposity and abdominal obesity.[5,6] The present trend is not sustainable unless a magic cure is found (unlikely) or concerted global/governmental/societal efforts are made to change the lifestyle that is promoting it. There are certainly some elements in the causation of the metabolic syndrome that cannot be changed but many are amenable for corrections and curtailments. For example, better urban planning to encourage active lifestyle, subsidizing consumption of whole grains and possible taxing high calorie snacks, restricting media advertisement of unhealthy food, etc. Revitalizing old fashion healthier lifestyle, promoting old-fashioned foods using healthy herbs rather than oil and sugar, and educating people about choosing healthy and wholesome food over junks are among the steps that can be considered.[6]

Since the first official definition of the metabolic syndrome put forward by a working group of the World Health Organization (WHO) in 1998, a number of different definitions have been proposed.[1] First definition used Body mass index (BMI) and waist hip ratio. Later Waist circumference was used as more accurate measure of central obesity.[7] The latest definition given by International Diabetes Federation (IDF) takes into account the evidence that abdominal obesity is an important component of the metabolic syndrome and proposes gender- and race-specific cut-offs for waist circumference (WC).[1] In subsequent studies, WC was found to be superior to BMI and Waist Hip ratio as a measure of visceral adiposity, and is widely used to quantify central obesity in clinical practice as it is considered to correlate better with the risk of type 2 diabetes mellitus (T2DM) and cardiovascular diseases (CVD).[7] There are few studies which compared other anthropometric indices in predicting metabolic syndrome at early stages so that we can prevent its occurrence. This study was aimed to assess the anthropometric indices in predicting metabolic syndrome among obese adults.

METHODS

Cross sectional study was done among 264 adults visiting urban health training centre of tertiary care hospital, Dharwad for a period of three months. Adults aged between 30- 60 years with BMI of more than 25 who were willing to participate in the study were included. Persons with chronic debilitating illness were excluded. Informed written consent was taken from the study participants. A predesigned and pretested proforma was used based on WHO STEP I and II module for NCDs to collect data. It included age, occupation, literacy status, socioeconomic status. Anthropometric measurements like height, weight, waist circumference was taken. Blood pressure was measured. Diabetic profile was sent for investigation and reports were noted.

According to the new IDF definition,[8] for a person to be defined as having the metabolic syndrome they must have: Central obesity [defined as waist circumference (males >90 cm and females >80 cm)] plus any two of the following four factors: 1. Raised triglycerides ≥ 150 mg/dL(1.7mmol/L) or specific treatment for this lipid abnormality 2. Reduced HDL cholesterol < 40 mg/dL (1.03 mmol/L) in males < 50 mg/dL (1.29 mmol/L) in females or specific treatment for this lipid abnormality 3. Raised blood pressure systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg or treatment of previously diagnosed hypertension 4. Raised fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L), or previously diagnosed type 2 diabetes. Sample of 264 was taken by considering prevalence of metabolic syndrome in urban area as 32.83%[1] with allowable error of 20%. Sample was selected randomly among the obese patients who visit the OPD. Ethical clearance was obtained from IEC before starting the study.

STATISTICS: Data was entered in excel spread sheet and analysed using SPSS software version 20. Results were explained as frequencies, percentages and mean in tables and graphs. The different variables were checked for their significance using Mann-whitney U test, Kruskal wallis test and ROC curve to know the association. The area under the ROC curve (AURC) was used as a measure of discrimination of a predictor. Data were regarded as statistically significant when $p \leq 0.05$.

RESULTS

In our study 264 adults were screened for metabolic syndrome. Among them 118 (44.69%) met the

criteria of IDF. Majority of the study participants belonged to 30- 39 years (40.15%), were educated up to PUC (32.58%) and belonged to class II socio-economic status (38.64%) according to modified BG Prasad Classification.

Table 1: Socio-demographic Characteristics of Study Participants

Characteristics	Male (n=163)(%)	Female (n=101)(%)	Total (n=264)(%)
Age-group in Years			
30 - 39	62 (38.04)	44 (43.56)	106 (40.15)
40 - 49	56 (34.35)	21 (20.79)	77 (29.17)
50 - 60	45 (27.61)	36 (35.65)	81 (30.68)
Religion			
Hindu	135 (82.82)	88 (87.13)	223 (84.47)
Muslim	28 (17.18)	13 (12.87)	41 (15.53)
Education			
Illiterate	4 (2.45)	2 (1.98)	6 (2.27)
Primary	5 (3.07)	22 (21.78)	27 (10.23)
High-school	52 (31.9)	15 (14.85)	67 (25.38)
PUC	44 (26.99)	42 (41.58)	86 (32.58)
Graduate	26 (15.95)	20 (19.81)	46 (17.42)
Post-graduate	32 (19.64)	0 (0)	32 (12.12)
Socio-economic Status			
Class I	33 (20.25)	34 (33.66)	67 (25.38)
Class II	68 (41.71)	34 (33.66)	102 (38.64)
Class III	31 (19.02)	12 (11.88)	43 (16.28)
Class IV	28 (17.18)	17 (16.83)	45 (17.05)
Class V	3 (1.84)	4 (3.97)	7 (2.65)
Type of Family			
Nuclear	92 (56.44)	70 (69.31)	162 (61.36)
Joint	52 (31.9)	21 (20.79)	73 (27.65)
Three-generation	19 (11.66)	10 (9.9)	29 (10.99)

Table 2: Mean values of different Criteria of patients suffering with Metabolic Syndrome (n=118)

Criteria	Metabolic Syndrome		P value*
	Male Mean(SD)	Female Mean(SD)	
Waist Circumference	108.00(6.89)	96.90 (1.96)	0.000*
SBP	134.64(12.76)	139.68(10.29)	0.102
DBP	86.83 (6.97)	91.29 (9.21)	0.042*
Triglycerides	165.10(49.95)	172.65(51.18)	0.129
HDL	34.84 (7.04)	39.06 (3.82)	0.001*
FBS	152.01(89.59)	104.39(37.81)	0.015*

***Mann Whitney U test**

Table 3: Anthropometric Indices of Study Participants suffering from metabolic syndrome (n=264)

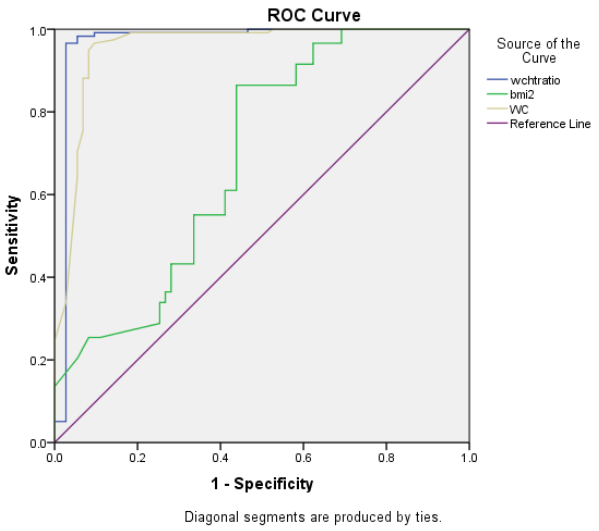
Anthropometric Indices	Metabolic Syndrome		AUC
	Yes Mean(SD)	No Mean(SD)	
Waist: Height Ratio	0.65 (0.04)	0.49 (0.05)	0.969
Waist Circumference	105.08(8.07)	81.35(9.08)	0.956
BMI	30.10(1.84)	28.62(2.22)	0.689

Most of them were Hindus (84.47%) and belonged to nuclear family (61.36%). [Table 1]

Among 118 (44.69%) participants who had metabolic syndrome, 87(73.72%) were males and 31(26.28%) were females. Out of these, 29 (24.58%) met 3 criteria, 50 (42.37%) met 4 criteria and 39 (33.05%) met 5 criteria of metabolic syndrome.

In our study, it was found that there was significant mean difference between waist circumference, diastolic blood pressure, HDL levels and FBS levels among the study participants who had and who didn't have metabolic syndrome. [Table 2]
When assessed by measuring their anthropometry, mean waist: height ratio was 0.65, mean waist circumference 105.08 cm and mean BMI of 30.10kg/m^2 among patients with metabolic syndrome. When plotted ROC curve for the same among study participants it was found that area under curve (AUC) for waist: height ratio was 0.969, whereas for waist circumference and BMI it was 0.956 and 0.689 respectively. From this we can clearly indicate that waist: height ratio can predict the metabolic syndrome better than other indices like waist circumference and BMI. [Table 3 and Figure 1]

Figure 1: ROC curve for Anthropometric Indices of Study Participants (n=264)



DISCUSSION

With the metabolic syndrome driving the twin global epidemics of type 2 diabetes and cardiovascular disease there is an overwhelming moral, medical and economic imperative to identify those individuals with metabolic syndrome early, so that lifestyle interventions and treatment may prevent the development of diabetes and/or cardiovascular disease. This study highlights about early detec-

tion of metabolic syndrome by measuring their anthropometry that are at high risk. Prevalence of metabolic syndrome was found to be 44.69% which was very high in this vulnerable age group which could increase the burden in near future. Selvaraj et al conducted a study in Tamilnadu and found out the prevalence of metabolic syndrome in their population as 30.7%.[9]

In a study conducted in Puducherry by Venugopal et al. 36.6% of study participants belong to the age group of 45–59 years, 52.8% of them were females, 73.8% were married, and 29% belong to lower SES. Most of the participants (95.6%) were Hindu by religion.[10]

A large number of studies clearly suggest that the degree of central fat distribution is more clearly related to metabolic risk than BMI. In the present study, the comparison of ROC of BMI with that of WC and waist to height ratio showed that waist: height ratio is better than BMI and waist circumference in predicting metabolic syndrome. These findings were similar to a study done in Puducherry where they compared BMI and waist circumference.[10] However, the ability of WC to be used as a universal predictor of central adiposity is limited by the use of different methods for the measurement of WC. A study done by Hoebel et al in Africa found that Waist circumference should be used as predictor of risk factor in metabolic syndrome[11] and Mastroeni et al in Brasil found that BMI is a better predictor among Brazilians for metabolic syndrome.[12] These findings again depend on the races and regions.

Demographic transition is towards population aging and if the current trend continues, there will be increase in the number of patients with metabolic syndrome leading to increased morbidity and mortality. Identifying and treating patients with metabolic syndrome is a public health challenge. Hence, while planning for new or expansion of existing health services, prevention and control strategies for non-communicable disease should be addressed specifically.

CONCLUSION

Abdominal Obesity is the important component of metabolic syndrome, which can lead to cardiovascular events and diseases. Waist: height ratio can predict metabolic syndrome better than waist circumference and BMI. Lifestyle modifications can be advised in early life to avoid further morbidity leading to further permanent disabilities and life threatening events in future. Individuals, families and communities need education regarding healthy lifestyle in their younger age to contribute positively to making their adulthood safer.

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