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Body Fat Muscle Ratio: A Better Assessment Of Dyslipidemia Than The Conventional Anthropometric Measurements.

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ABSTRACT

Dyslipidemia is defined as an increase in Triglycerides and total cholesterol or decrease in high density lipoprotein levels that contributes to the pathogenesis of cardiovascular diseases like atherosclerosis. Cardiovascular diseases have been the leading cause of morbidity and mortality in India. Anthropometric measures of abdominal obesity are directly associated with the progression of atherosclerosis and acute coronary events. Studies report that anthropometric measurements such as BMI may provide false information regarding body fat due to its inability to differentiate between adipose tissue and lean body mass. This study aims in establishing Body fat to muscle ratio as an efficient marker over the other conventional Anthropometric measures in detecting dyslipidemia. This Cross sectional study was conducted on 180 apparently healthy individuals within the ages of 18 to 45 years. Bivariate Correlation between Body fat to muscle ratio and Cholesterol, TGL , HDL showed significance of P at 0.01 level and a correlation of r=0.635, 0.661, -0.544 respectively. The results of the study shows that the Body-fat to muscle ratio is a good predictor of dyslipidemia and is comparable to the other anthropometric measures such as BMI, waist to hip ratio, Body fat percentage and Body roundness index.
Keywords: Dyslipidemia , anthropometry, Body fat to muscle ratio, Lipid profile.

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INTRODUCTION

Dyslipidemia leads to atherosclerosis and atherosclerosis causes cardiovascular and cerebrovascular diseases. Cardiovascular diseases have been the leading cause of morbidity and mortality in India [1]. An Indian study carried out in the year 2019, shows that 25-30% of the urban population show the presence of dyslipidemia [1]. Recent trends indicate that younger age groups also have started to get affected from dyslipidemia. To screen for dyslipidemia, all adults aged ≥ 21 years and individuals who are younger with risk factors such as obesity, diabetes mellitus, family history of Cardiovascular diseases and stroke must undergo a fasting lipid test periodically to evaluate total cholesterol, triglyceride, HDL-C, Low density lipoprotein cholesterol (LDL-C) and non-HDL-C levels [2,3]. Anthropometric measures of abdominal obesity, such as waist-to-hip ratio and waist circumference, are associated directly with the progression of atherosclerosis and are directly associated with the risk for various acute coronary events [4]. Various studies have evaluated association between anthropometric measures such as BMI, Bodyroundness index (BRI) and Body fat percentage and dyslipidemia [5]. Body roundness index (BRI) was developed by Thomas et al. in 2013 and combines height and waist circumference and predicts the percentage of body fat This method estimates the shape ofthe body as an ellipse or oval [6]. Most of the former research done measured the association of dyslipidemia with waist circumference (WC) and body mass index (BMI) [7-9]. Some studies report that BMI may provide false information regarding body fat due to its inability to differentiate between adipose tissue and lean body mass [10,11]. Therefore t,his study aimed to identify the role of body fat to muscle ratio (BFMR) in assessing dyslipidemia over the conventional anthropometric measurements.

MATERIALS AND METHODS

This Cross sectional study was carried out in the Department of General Medicine and Biochemistry in a tertiary care center after obtaining institutional ethical committee approval and informed consent from the participants.

Sample size was calculated as below

Calculation of sample size (n) = $Z^2 \times p(1-p)/d^2$ Z=1.96

p (prevalence of dyslipidemia) = 35% d (prediction or absolute error) = 7%

The calculated sample size is 180.

Study Population

Inclusion Criteria

Apparently healthy individuals attending master health check-up within the ages of 18 to 45 years.

Exclusion Criteria

Known case of dyslipidemia or taking drugs for it, chronic diseases like Chronic Kidney disease, Coronary artery disease, Diabetes Mellitus, COPD, pregnancy, the use of alcohol or drugs, and, in general, the presence of any disease not directly associated with nutrition.

Investigations

Blood Investigations

5ml of fasting venous blood sample was obtained from the study participants using red topped vacutainer tubes. Blood sample was centrifuged ,serum separated and lipid profile was analysed using fully automated clinical chemistry random access analyser roche c311

Anthropometric Measurements

Body Fat

Fat is measured using skin fold calipers as described by PJ Dyke et al [12. Measurement of skin thickness was done using Harpenden skin fold caliper whose resolution is 0.2 mm and measuring range 0-80 mm. A minimum skin fold is lifted on the mid anterior aspect of the forearm and thigh and readings aretaken thrice. Mean of the readings gives the mean of twice the thickness of skin (subcutaneous fat).

Muscle Girth

The equations used is as follows, where: H = height, FG = forearm girth, CG = calf girth, CCG = corrected calf girth, TG = mid-thigh girth, CTG = corrected mid-thigh girth, ϖ = Pi.

Measuring muscle mass,

$$CTG = TG - \varpi(\text{mid-thigh skinfold}/10) CCG = CG - \varpi(\text{calf skinfold}/10)$$

$$\text{Muscle mass (g)} = H \times (0.0553CTG^2 + 0.0987FG^2 + 0.0331CCG^2) - 2445 \qquad [12]$$

$$\text{BODY FAT-MUSCLE RATIO} = \text{Body fat (mm)}/\text{Muscle mass (g)}$$

$$BMI = \text{Weight measured in Kilograms}/(\text{Height in metres})^2$$

Waist Circumference

Waist circumference was measured midway between the iliaccrest and lowermost margin of the ribs using an inch tape to an accuracy of 0.1cm. Waist Circumference is measured three times to determine the mean.

Hip Circumference

Hip circumference is measured around the widest portion of the buttocks, with tape parallel to the floor using an inch tape to an accuracy of 0.1cm. Hip circumference is measured three times to determine the mean.

Waist To Hip Ratio (WHR) = Waist Circumference (cm)/Hip Circumference(cm)

Body Fat Percentage (BF %) = (1.2 × BMI) + (0.23 × age) - 5.4 [7]

Body Roundness Index (BRI) [8]

$$BRI = 364.2 - 365.5 \times \sqrt{1 - \left(\frac{(WC/(2\pi))^2}{(0.5\,\text{height})^2}\right)}$$

Statistical analysis was done with SPSS software. The correlation between body fat to muscle ratio, BMI, waist to hip ratio, with dyslipidemia was obtained using Pearson’s correlation coefficient.

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OBSERVATIONS AND RESULTS

Table 1

	Mean	Std. Deviation (±)	Minimum	Maximum
Glucose	260.44	44.94	180	383
Serum Osmolality	288.9	8.27	257.51	303.79
Corrected serum Sodium	133.1	3.95	118.05	138.53
eGFR	101.37	38.17	35.22	249.98
Potassium	5.17	0.3	4	5.9

Table 2: Pearson Spearman Correlation With Serum Glucose

Analytes	r value	P value
Serum osmolality	**0.365**	**0.000***
Corrected sodium	**0.219**	**0.016***
eGFR	-0.101	0.274
Potassium	**0.596**	**0.000***

*Significance < 0.05

Table 3: Correlation Of Serum Glucose And Serum Osmolality

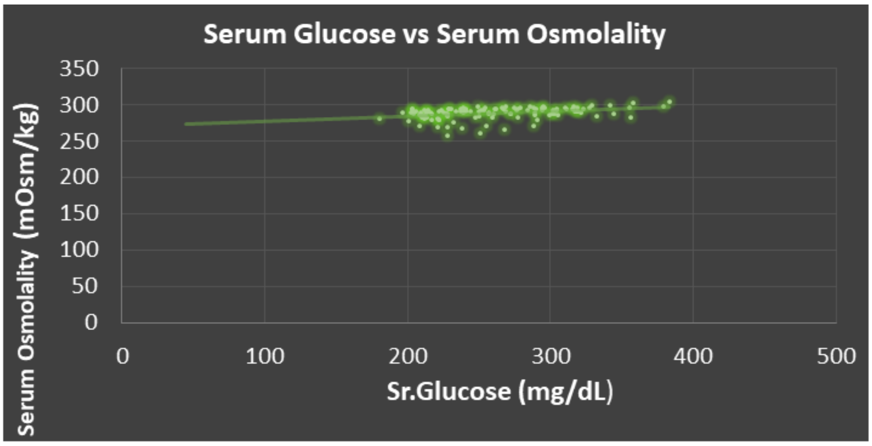


Table 4: Correlation Of Serum Glucose And e GFR

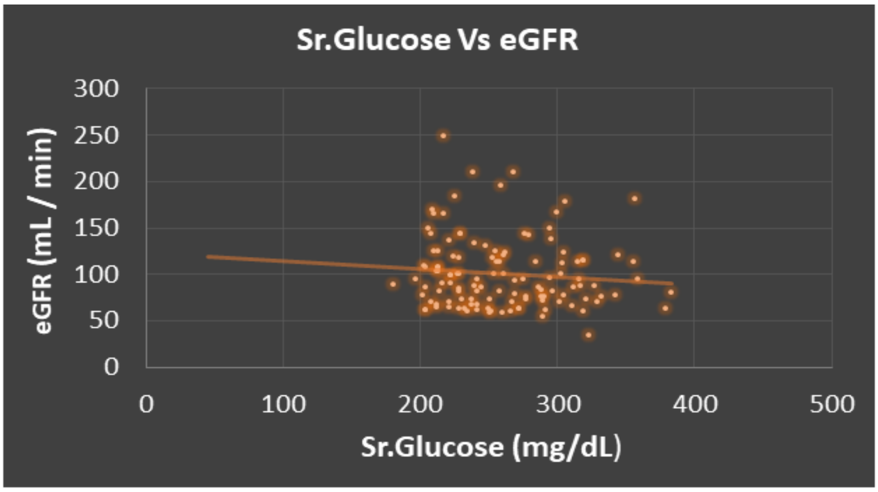


Table 5: Correlation Of Serum Glucose And Corrected Serum Sodium

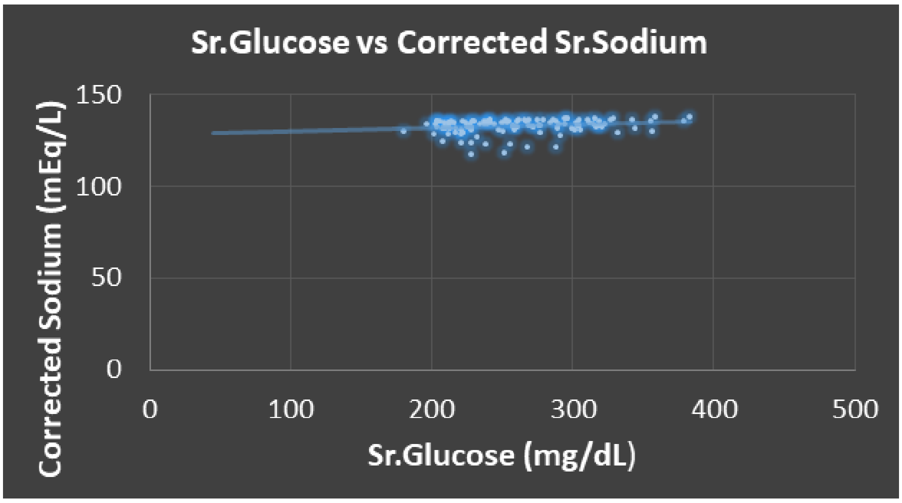
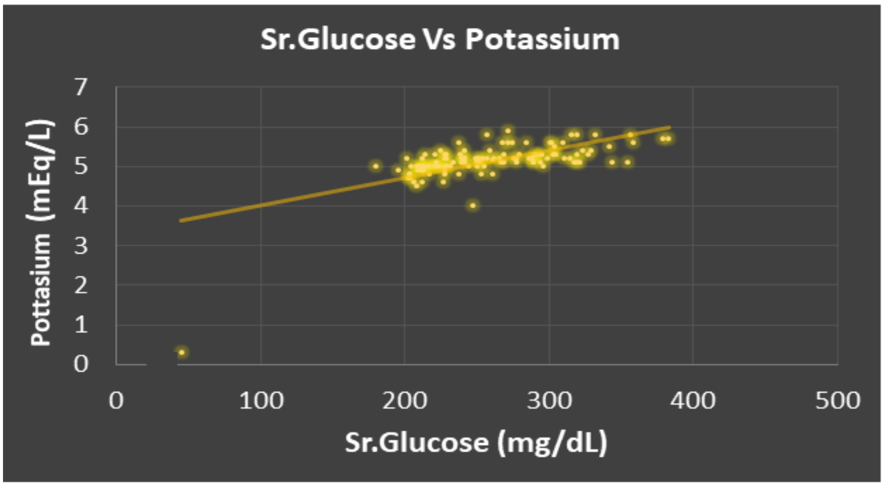


Table 6: Correlation Of Serum Glucose And Potassium



DISCUSSION

The purpose of the study was to establish a relationship between body fat muscle ratio and dyslipidemia and compare it to the other anthropometric measures such as BMI, Waist to hip ratio, Body fat percentage and Body roundness index. To our knowledge, this is the first study to have compared Body-fat to muscle ratio in relation todyslipidemia.

In agreement with previous studies, in our study various body indices including the established indicators of obesity - BMI and waist to hip ratio showed a statistically significant positive correlation with serum cholesterol, LDL and TG levels, and a negative correlation with serum HDL levels.

The graphs show: Bivariate Correlation between Body fat to muscle ratio and Cholesterol which shows significance of P at 0.01 level and a positive correlation of r=0.635.

Bivariate Correlation between Body fat to muscle ratio and TGL which shows significance of Pat 0.01 level and a positive correlation of r=0.661.

Bivariate Correlation between Body fat to muscle ratio and HDL which shows significance of Pat 0.01 level and a correlation of r=-0.544

The results of the study are in accordance with our hypothesis that the Body-fat to muscle ratio may be a good predictor of dyslipidemia and is comparable to the preexisting measures such as BMI, waist to hip ratio, Body fat percentage and Body roundness index.

Further research into the relationship between Body-fat muscle ratio and dyslipidemia is warranted as clues of association are apparent. If a strong association is further proved, it can serve as an important screening tool for the assessment of dyslipidemia.

CONCLUSION

The relationship between dyslipidemia and Body fat to muscle ratio was found comparable to the other preexisting anthropometric measures of dyslipidemia such as BMI, Waist to hip ratio, Body- fat % and Body roundness index. Therefore Body fat to muscle ratio can be used as a screening tool for the assessment of dyslipidemia.

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