Original Research Article

Association of lipid indices with markers of obesity in first year medical students

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ABSTRACT

Introduction: Dyslipidemia is one of the imperial factors in determining the risk of cardiovascular disease, which is often associated with obesity. Body mass index (BMI), the most applicable anthropometric measure, is a general adiposity predictor, whereas waist circumference (WC) and waist-to-hip ratio (WHR) were established as measures of abdominal adiposity.

Material and Methods: Total 148 medical students, age between 17-20 years were enrolled in this cross sectional study. BMI and WHR were obtained by measuring Weight, height, WC, and hip circumference (HC). Triglycerides (TG), total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), and low density lipoprotein cholesterol (LDL-C) were measured by the International Federation of Clinical Chemistry (IFCC) approved enzymatic colorimetric methods.

Results: Statistically significant positive correlations were observed between BMI and indices of different lipid parameters namely TG, TC, TC/HDL-C, and LDL-C/HDL-C. Similar statistical significances were also observed when WC and WHR were compared with lipid indices.

Conclusion: From the findings, it could be inferred that BMI is used as non-invasive alternative for lipid indices and atherogenic parameters in medical students as compare to other markers of obesity assessment.

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1. Introduction

As a result of agricultural, urban and technological developments in developing countries, and considering the influences of western culture mediated through social and electronic media, sedentary lifestyle and high fat diet have increased globally, in particular in the adolescence or young adult age group. Due to rapid changes in demography and lifestyle as a result of economic development, a dramatic increase in the prevalence of coronary artery disease has been predicted within the Indian subcontinent over the next 20 years.¹,²

As it is well known fact dietary and sedentary habits leads to a number of metabolic and hormonal disturbances, that may ultimately lead to cardiovascular and other complications. One other imperial factor in determining the risk of cardiovascular disease is dyslipidemia, which is often associated with obesity. Fat reservoirs in the body increase rapidly in obesity, that can be measured by body mass index (BMI) and waist-to-hip ratio (WHR).³ Both these parameters constitute an index of the fatness of an individual, thus serves as markers of obesity. BMI, the most applicable anthropometric measure, is a general adiposity predictor, whereas waist circumference (WC) and WHR were established as measures of abdominal adiposity. In comparison to the total amount of body fat, there is a strong correlation between central distribution of fat and metabolic abnormalities.⁴

At least 2.8 million people die each year as a result of being overweight/obese and or atherogenic lipid state (characterized by elevated triglycerides (TG), total cholesterol (TC), low density lipoprotein cholesterol (LDL-
2. Materials and Methods

This cross-sectional study was conducted at GMERS Medical College and Hospital, Himatnagar after taking prior approval from the institutional ethical committee. 148 medical students, age between 17-20 years were enrolled in the study after obtaining written informed consent. The students with acutely ill health or refusal to sign the consent form were excluded.

Obesity markers included BMI, WC, HC and WHR. Body weight was measured in kilograms by the standard digital weighing scale, with barefoot using a standardized measuring tape. BMI was computed as weight in kilograms divided by height in meters square using Quetelet’s index. The normal range of BMI is defined as 19.0–24.9 kg/m² overweight as a BMI of 25.0 to 29.9 kg/m², and obesity as BMI ≥30.0 kg/m². The participants were divided into 3 groups as underweight (BMI <19.0 kg/m²), Normal (BMI from 19.0 to 24.9 kg/m²), and overweight (BMI ≥25.0 kg/m²). WC was measured at the level of umbilicus at top of iliac crest and HC around the widest part of buttocks using non-stretchable measuring tape. WHR was obtained from WC/HC ratio.

Biochemical parameters included TG, TC, HDL-C, and LDL-C. Blood samples were collected with 12 hrs of overnight fasting and all the biochemical parameters were measured by the International Federation of clinical chemistry (IFCC) approved enzymatic colorimetric methods on fully automated analyzer TECOM T-6060 in clinical biochemistry service laboratory.

Statistical analysis was done by using the Microsoft Excel 2007. Comparisons between or among groups were made using Student’s t-tests and ANOVA as applicable. Pearson correlation was done to calculate the correlation coefficient for quantitative variables. For all analyses, p < 0.05 was taken as statistically significant.

3. Results

Total 148, 1st year medical students were included, of which 94 males and 54 females with a mean age of 18.26 years. The mean value of lipid indices, obesity markers, and anthropometric parameters are compared. According to Table 1 males had higher value of weight, WHR, triglyceride, TC:HDL-C and LDL-C:HDL-C than female while mean HDL-C is higher in females than males. p-value was <0.001 for all above parameters, which is statistically significant.

Tables 2, 3 and 4 show the correlation of BMI, WC, and WHR with lipid indices respectively. A significant positive correlation of BMI with TG, TC, LDL-C, TC/HDL-C and LDL-C/HDL-C were observed along with positive significant correlation between WC and TG, TC, LDL-C, TC/HDL-C, and LDL-C/HDL-C. There was significant positive correlation of WHR with TG, TC, LDL-C, TC/HDL-C and LDL-C/HDL-C. Correlation between HDL-C and BMI, WC, WHR was not found to be statistically significant.

Table 5 compares lipid indices, WC and WHR with three groups based on BMI. In overweight group, TG, TC, and LDL-C were found to be higher while WC, TC:HDL-C and LDL-C:HDL-C is significantly increased as compared to the normal and underweight group. Thus, BMI demonstrated significant correlation with TG, TC, and LDL-C.

4. Discussion

Dyslipidemia is a well known, important modifiable causative factor for the development and progression of coronary artery disease and related morbidity. More over for lipid indices disturbances, obesity is considered as an important hallmark. Thus, this study was done to correlate various obesity markers with lipid profile parameters and hence to signify the importance of implementing anthropometry in routine screening procedures.

The primary finding of the study reveals that mean values of weight, WHR, TG, TC:HDL-C and LDL-C:HDL-C was higher in male participants compared to the female counterparts, except in HDL-C which showed a reverse pattern (Table 1). These findings were concordant with Dholakia J et al. Observed gender differences in lipid indices is due to hormonal effects that are distributed across tissues, as well as effects mediated by genes on the X-chromosome that escape the process of X-inactivation.

In the present study, BMI, WC, and WHR correlated with TC, LDL-C levels and TG (Tables 2, 3 and 4). However, studied obesity markers did not correlate with HDL-C levels. Similar findings were observed by Reddy et al. and Chadha et al. Growing evidence exists from time to time in different scientific literature regarding the use of BMI in risk assessment as it provides a more defined and specific assessment of total body fat compared with the body weight alone. Abdominal fat is an independent and robust risk factor for various diseases as evidenced by the fact that men who have WC greater than 40 inches and women who have WC greater than 35 inches are at higher risk for developing diabetes, elevated cholesterol levels, hypertension, and cardiovascular disease. Among the obesity markers, WC

C) and decreased high density lipoprotein cholesterol (HDL-C). Risks of cardiovascular, cerebrovascular disease and diabetes increase steadily with increasing BMI and dyslipidemia. Raised BMI also increases the risk of certain cancers. Thus in this study, an attempt has been made to determine the prevalence of overweight/obesity in young adults and to find the association of lipid indices with markers of obesity, so that affected individuals can be counseled to make significant dietary and lifestyle changes.
Table 1: Mean value of lipid indices, obesity markers and anthropometric parameter

| Age (year) | Total(148) | Male(94) | Female(54) | p value |
|------------|------------|----------|------------|---------|
| 18.26±0.55 | 18.27±0.55 | 18.24±0.55 | 0.788      |
| Weight (kg) | 59.74±12.35 | 63.83±11.47 | 52.62±10.52 | <0.001   |
| BMI (kg/m²) | 21.46±3.6   | 21.79±3.55 | 20.9±3.67  | 0.149    |
| WC (cm)    | 77.73±9.42  | 78.83±9.12 | 75.81±9.71 | 0.060    |
| WHR        | 0.80±0.05   | 0.81±0.05 | 0.78±0.06  | <0.001   |

Table 2: Correlation between BMI (kg/m²) and lipid indices (mg/dl)

| Parameters | Pearson correlation | p Value |
|------------|---------------------|---------|
| BMI (kg/m²) | TG                  | 0.217   | 0.008   |
|            | TC                  | 0.294   | <0.001  |
|            | LDL-C               | 0.285   | <0.001  |
|            | HDL-C               | -0.059  | 0.473   |
|            | TC/HDL              | 0.35    | <0.001  |
|            | LDL/HDL             | 0.314   | <0.001  |

Table 3: Correlation between WC (cm) and lipid indices (mg/dl)

| Parameters | Pearson correlation | p Value |
|------------|---------------------|---------|
| WC (cm)    | TG                  | 0.179   | 0.0295  |
|            | TC                  | 0.235   | 0.004   |
|            | LDL-C               | 0.24    | 0.003   |
|            | HDL-C               | -0.056  | 0.498   |
|            | TC/HDL              | 0.298   | <0.001  |
|            | LDL/HDL             | 0.273   | <0.001  |

Table 4: Correlation between WHR and lipid indices (mg/dl)

| Parameters | Pearson correlation | p Value |
|------------|---------------------|---------|
| WHR        | TG                  | 0.185   | 0.024   |
|            | TC                  | 0.179   | 0.029   |
|            | LDL-C               | 0.176   | 0.032   |
|            | HDL-C               | -0.124  | 0.134   |
|            | TC/HDL              | 0.312   | <0.001  |
|            | LDL/HDL             | 0.263   | <0.001  |

Table 5: Comparison of lipid indices, WC and WHR within three groups of body mass index

| Parameters | Underweight(39) BMI < 19 | Normal(87) BMI 19-24.9 | Overweight(22) BMI ≥ 25 | p value |
|------------|---------------------------|-------------------------|-------------------------|---------|
| TC (mg/dL) | 141.28±16.74              | 149.45±24.51            | 156.91±23.65            | 0.030   |
| TG (mg/dL) | 78.59±19.09               | 91.05±26.17             | 93.09±28.37             | 0.022   |
| HDL-C (mg/dL) | 46.77±6.20             | 45.67±6.13              | 43.86±4.84              | 0.193   |
| LDL-C (mg/dL) | 75.79±14.82           | 84.16±18.03             | 86.71±18.47             | 0.021   |
| TC:HDLC     | 3.05±0.38                | 3.29±0.48               | 3.60±0.59               | <0.001  |
| LDL-C:HDLC  | 1.64±0.38                | 1.86±0.41               | 2.00±0.48               | 0.002   |
| WC (cm)     | 69.15±4.24               | 78.25±6.91              | 90.86±8.64              | <0.001  |
| WHR         | 0.77±0.04                | 0.80±0.05               | 0.84±0.07               | <0.001  |

measurement has its own significance, as it is particularly relevant in people who are either normal or overweight in terms of BMI classification. A high WC is often linked with an increased risk of type 2 diabetes, dyslipidemia, hypertension, and cardiovascular disease in patients with a BMI between 25 and 30 kg/m². In spite of well document correlation between BMI and lipid indices, several controversies exist among different studies, exemplified by a study conducted by Mota dos Santos C, et al.13 and Gulam Saidunnisa Begum et al.14 in which not any correlation was found between anthropometric parameters and lipid profile. However, our study was divergent from these studies, as we observed TC, LDL-C and TG levels were significantly higher in overweight individuals (Table 5). BMI dispensed robust correlation with these lipid indices in overweight individuals than normal. These results were in accordance with Vishwanath, et al.15 and Eslami, et al.16 Thus, in this study a positive correlation was observed when BMI, WC, and WHR was compared with TG, TC, LDL-C, LDL-C/HDL-C ratio, and TC/HDL ratio.
5. Conclusion

In summary, simple calculation of BMI and or WC or WHR can act as a screening indicator of the future risk of cardiovascular, cerebrovascular or other ischemic complications. Thus, it is recommended to make use of anthropometric markers like BMI, WC and WHR as a screening tool in the society for prediction of future cardiovascular complications.

6. Source of funding

None.

7. Conflict of interest

None.

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