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Relationship of anthropometric variables with lipid profile in moderate and sedentary workers

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Abstract

Introduction: Sedentary lifestyle is associated with increased body mass index, increased waist circumference and type-2 diabetes, leading to metabolic syndrome. Various anthropometric variables are strong and consistent predictors for non communicable diseases. There is positive relationship between anthropometric measures and adiposity. Dyslipidemia is a marker for development of cardiovascular disease.

Objective: To assess relationship of anthropometric variables with lipid profile in moderate and sedentary workers in Jammu region.

Materials and Methods: The present one year cross-sectional study was carried out on healthy moderate workers (Group-I) and healthy sedentary workers (Group-II) in the age group of 20 to 60 years. Baseline data of anthropometric variables, including body mass index, waist-hip ratio, waist-height ratio, abdominal volume index was recorded as per WHO standards. Lipid profile values were assessed according to the National Cholesterol Education Programme of USA. Mean and standard deviation reported for quantitative variables were calculated and noted. Mean values were compared with the help of unpaired 't' test and statistical result was obtained. For unilateral comparison, linear regression was used. A p-value of < 0.05 was considered as statistically significant. All p-values reported were two-tailed.

Results: The mean values of age and anthropometric variables in moderate workers (Group-I) were significantly less as compared to those of sedentary workers (Group-II). Serum HDL-C and serum VLDL-C of the moderate workers showed significant relationship with waist circumference. Mean total cholesterol and serum LDL-C showed significant relationship with waist circumference in sedentary workers. Serum total cholesterol showed significant relationship with WHR in moderate workers.

Conclusion: Anthropometric variables, total cholesterol and low density lipoprotein cholesterol had significant effect in sedentary workers. High density lipoprotein cholesterol has significant effect in moderate workers showing that HDL-C increases with level of activity.

Keywords: Anthropometric variables, Lipid profile, Moderate workers, Sedentary workers.

Introduction

Despite the health-promoting effects associated with regular physical exercise, physical inactivity not only continues to be a common problem, but is becoming increasingly widespread.[1] Physical activity refers to both leisure time and occupational exertion. Sedentary lifestyle is characterized by energy expenditure $\leq$1.5 metabolic equivalents with sitting or reclining posture.[2] It is positively associated with increased risk of metabolic syndrome.[3] Moreover, it is associated with increasing body mass index and waist circumference,[4] and an increased risk of type 2 diabetes.[5]

Many epidemiological studies have demonstrated that different anthropometric measures for abdominal obesity such as BMI, waist circumference (WC), and waist-hip ratio (WHR) are strong and consistent predictors for noncommunicable diseases, such as type 2 diabetes mellitus and cardiovascular disease.[6]

A study by Mamtani and Kulkarni has shown that waist circumference has the highest overall predictive accuracy that is gender-sensitive, a comparable information content as that of abdominal volume index and is a better predictor of the risk of type 2 diabetes than all the remaining anthropometric indexes. Waist circumference also correlates strongly with the biochemical markers of diabetes like blood sugar and lipid profile.[7]

In each sex-by-race group, all anthropometric measures are highly correlated with percentage of fat, fat mass and subcutaneous adipose tissue and moderately correlated with visceral adipose tissue, with the exception of the waist-hip ratio. This analysis provides evidence of the linkage between simple anthropometric measurements and the proposed pathways between adiposity and health.[8]

Clustering of features, such as high plasma glucose, obesity, dyslipidemia (high triglyceride and total cholesterol levels, low high density lipoprotein cholesterol levels, low high density lipoprotein cholesterol levels) and hypertension, referred to as insulin resistance or the metabolic syndrome, is a marker of increased risk for the development of type-2 diabetes as well as for CVD.[9] Insulin resistance is part of cascade of disorders that is often called the metabolic syndrome.[10]

Adipose tissue is found in specific locations, which are referred to as adipose depots. Adipose tissue contains several cell types, with the highest percentage of cells being adipocytes, which contain fat droplets. In diabetes, as a result of insulin resistance, lipolysis and free fatty acid flux from adipocytes are increased, leading to increased lipid synthesis in hepatocytes. Thus lipid storage or steatosis in the liver may lead to non alcoholic fatty liver disease (NALD) and abnormal liver function tests. This is also responsible for the dyslipidemia found in type 2 diabetes mellitus, which is characterized by low HDL, high LDL and high plasma triglyceride concentration.[11]

Previous studies have reported that BMI identified individuals at increased risk of CVD as effectively as WC.[12] It has also been suggested that BMI is a better predictor of CVD than WC.[13] Conversely, some studies reported that WC is a better indicator of CVD risk than BMI and WHR, in ethnically diverse groups.[14] WC and WHR have also been identified as independent predictors of CVD risk but not BMI, accounting for conventional risk factors in the Framingham risk score model.[15]

Waist circumference, WHR and waist-to-stature ratio have larger effects on increased CVD risk compared with body mass index (BMI). Central obesity measures also record better correlations with CVD risk as compared with general obesity measures. WC and WHR were found to be significant and independent predictors of CVD risk (> 0.76), after controlling for BMI in the simplified general CVD risk score model.[16]

The present study was carried out to assess relationship of anthropometric variables with lipid profile in moderate and sedentary workers in Jammu region with respect to distribution of fat and amount of adipose tissue, so as to evaluate the effects of overweight on overall health.

Materials and Methods

The present one year cross-sectional study was carried out on healthy moderate workers (Group-I) and healthy sedentary workers (Group-II) in the age group of 20 to 60 years in the Postgraduate Department of Physiology, Government Medical College, Jammu. Administrative and paramedical staff members of the college willing to participate were enrolled in this study. An informed consent was obtained from the participants after approval from the Institutional Ethical Committee. All those subjects with history of diabetes mellitus, hypertension, any other illness known to effect lipid profile, subjects on lipid lowering drugs and pregnant women were excluded from the study. A total of 300 subjects, 150 each from both the groups consisting of 75 males and 75 females were selected for this study.

Record of body weight, height, waist circumference and hip circumference was made as per WHO standards. The body mass index and waist hip ratio were calculated. The BMI interpretation used was: BMI < 25 kg/m^2 (normal), 25-30 $kg.m^2$ (overweight) and > 30 kg/m^2 (obese).[17] Abdominal obesity was assessed by measuring waist hip ratio.WHR interpretation used was: > 0.9 for men and > 0.85 for women.

For biochemical parameters, subjects were asked to fast for 14 hours before the day of test. This was to avoid the influence of diet on blood sugar. 5 ml of venous blood was drawn from anticubital vein under all aseptic precautions for the estimation of biochemical parameters. The sample from disposable syringe was transferred immediately to plain vacutainers [which were pre-marked and placed in a rack] and allowed to clot at room temperature for more than 30 minutes. These samples were centrifuged in Remilab centrifuge at 3000 rpm for 15 minutes. Serums were separated and transferred to other dry test tubes which were then capped with cotton plugs and taken to the Department of Biochemistry for analysis.

Lipid profile values were assessed according to the National Cholesterol Education Programme of USA, which classifies total cholesterol as desirable (< 200 mg/dL), borderline high risk (200-239 mg/dL) and high risk (≥ 240 mg/dL); triglycerides as desirable (< 200 mg/dL), borderline (200-400 mg/dL), high (400 to 1000 mg/dL) and extremely high (> 1000 mg/dL) and HDL cholesterol as low (< 35 mg/dL), normal (35-59 mg/dL) and high (> 60 mg/dL).[18]

The data was analyzed using computer software Microsoft Excel and IBM SPSS version 22.0 for Windows. Mean and standard deviation (SD) was calculated and reported for quantitative variables. The statistical difference in mean value was tested using unpaired 't' test. Linear regression was used for unilateral comparison. A p-value of <0.05 was considered as statistically significant. All p-values reported are two-tailed.

Results

The mean age of Group-I subjects (39.49 years) was significantly less as compared to that of Group-II subjects (43.33 years, p < 0.001). Comparison of mean values of anthropometric variables between the two groups is given in Table 1. The mean weight of Group-I subjects was significantly less as compared to that of Group-II subjects (63.35 vs 71.98 kg, p<0.0001). The mean height in Group-I subjects was found to be comparable with that of Group-II subjects (1.62 vs 1.61 m, p = 0.336). The mean BMI of Group-I subjects (24.35 kg/m^2) was significantly less than that of Group-II subjects (24.35 vs 27.78 kg/m^2, p < 0.0001). The mean waist circumference of Group-I subjects (75.96 cm) was significantly less than that of Group-II subjects (75.96 vs 90.2 cm, p<0.0001). In Group-I, no male subject had waist circumference ≥102 cm and no female subject had waist circumference ≥88 cm. However, in Group-II, 50 female subjects had waist circumference ≥88 cm. The mean hip circumference of Group-I subjects (81.47 cm) was significantly less than that of Group-II subjects (81.47 vs 94.88 cm, p<0.0001). In Group-I, abdominal obesity (WHR >0.9) was present in 61 (81.33%) male subjects, while in Group-II, abdominal obesity was present in 74 (98.67%) male subjects. The mean WHR of Group-I male subjects (0.93) was significantly less than that of Group-II male subjects (0.93 vs 0.95, p<0.0001). In Group-I, abdominal obesity (WHR > 0.85) was present in 70 (93.33%) female subjects, while in Group-II, abdominal obesity was present in 72 (96%) female subjects. The mean WHR of Group-I female subjects was comparable with that of Group-II female subjects (0.92 vs 0.93, p=0.085). The mean WHtR (0.46) of Group-I subjects was significantly less than that of Group-II subjects (0.46 vs 0.56, p<0.0001). The mean AVI (11.62) of Group-I subjects was significantly less than that of Group-II subjects (11.62 vs 16.44, p < 0.0001).

Table 1: Comparison of anthropometric variables of Group-I and Group-II subjects

Parameter		Group-I (n=150) Mean ± SD (Range)	Group-II (n=150) Mean ± SD (Range)	p-value (Unpaired 't' test)
Weight (in kg)		63.35 ± 9.71 (40-86)	71.98 ± 10.13 (45-107.5)	t=7.53; p<0.0001*
Height (in m)		1.62 ± 0.09 (1.44-1.88)	1.61 ± 0.09 (1.42-1.86)	t=0.96; p=0.336**
BMI (in kg/m²)		24.35 ± 3.91 (15.85-35.5)	27.78 ± 4.10 (17.9-40.91)	t=7.41; p<0.0001*
WC (in cm)		75.96 ± 5.90 (60-85)	90.2 ± 5.97 (61-109)	t=20.77; p<0.0001*
HC (in cm)		81.47 ± 7.06 (64-100)	94.88 ± 6.77 (63-120)	t=16.79; p<0.0001*
WHR	Males	0.93 ± 0.03 (0.82-1.03)	0.95 ± 0.02 (0.89-1.11)	t=4.80; p<0.0001*
	Females	0.92 ± 0.03 (0.8-0.98)	0.93 ± 0.04 (0.85-1.06)	t=1.73; p=0.085**
WHtR		0.46 ± 0.05 (0.34-0.64)	0.56 ± 0.11 (0.38-1.75)	t=0.13; p<0.0001*
AVI		11.62 ± 1.75 (7.21-14.45)	16.44 ± 1.91 (14.12-23.78)	t=22.78; p<0.0001*

*Significant; **Not significant

Comparison of mean values of lipid profile between the two groups is given in Table 2. Respective values of mean serum total cholesterol, mean serum HDL-C, mean LDL-C, mean VLDL-C and mean triglycerides in both the groups were comparable. Mean values of lipid profile in both the groups was found to be within desirable range.

Table 2: Comparison of lipid profile of Group-I and Group-II subjects

Parameter	Group-I (n=150) Mean ± SD (Range)	Group-II (n=150) Mean ± SD (Range)	p-value (Unpaired 't' test)
Serum total cholesterol (mg%)	175.07 ± 40.20 (90-316)	173.08 ± 43.60 (103-381)	t=0.41; p=0.681**
Serum HDL-C (mg%)	43.62 ± 7.26 (27-63)	42.47 ± 6.23 (27-61)	t=1.47; p=0.142**
Serum LDL-C (mg%)	100.78 ± 33.51 (35.2-203)	96.96 ± 35.29 (11.8-246)	t=0.96; p=0.337**
Serum VLDL-C (mg%)	33.34 ± 23.39 (12.4-186)	33.14 ± 19.77 (5.6-135.2)	t=0.08; p=0.936**
Serum TG (mg%)	161.12 ± 98.91 (62-581)	159.27 ± 81.64 (64-615)	t=0.17; p=0.859**

**Not significant

Using linear regression for unilateral comparison, the present study observed that in Group-I (moderate workers) and in Group-II (sedentary workers), relationship of body mass index with lipid profile was not significant (p>0.05). In Group-I, relationship of waist circumference with serum HDL-C and serum VLDL-C was significant (p = 0.007 and p = 0.024 respectively), while with serum total cholesterol, serum LDL-C and serum triglycerides it was not significant (p > 0.05). In Group-II, relationship of waist circumference with serum total cholesterol, serum LDL-C was significant (p = 0.037 and p = 0.030 respectively), while with other variables it was not significant (p > 0.05).

In Group-I, relationship of waist-hip ratio with serum total cholesterol was significant (p = 0.003), while with other variables it was not significant (p > 0.05). In Group-II, relationship of waist-hip ratio with lipid profile was also not significant (p > 0.05).

In Group-I and Group-II, relationship of waist-height ratio with lipid profile was not significant (p > 0.05). Similarly, in Group-I and Group-II, relationship of abdominal volume index with lipid profile was not significant (p > 0.05).

Discussion

Prevalence of raised blood sugar and deranged lipid profile in a population and its association with anthropometric variables such as weight, height, body mass index, waist circumference, hip circumference, waist-hip ratio, waist-to-height ratio and abdominal volume index is important to design preventive programmes. Nevertheless, the high burden of non-communicable diseases indicates an impending epidemic in sedentary workers.

In the present study, mean values of weight, body mass index waist circumference, waist-hip ratio, waist-height ratio and abdominal volume index of moderate workers (63.35 kg) were significantly less as compared to those of sedentary workers. These results are in agreement with studies conducted by Ahluwalia,[19] Jayalakshmi *et al.*,[20] Ahmad *et al.*,[21] Li *et al.*,[22] and Patil *et al.*[23]

In the present study, mean lipid profile of moderate workers was comparable with that of sedentary workers. These results are in disagreement with the study of Ikekpeazu Ebele *et al.*, who found that the mean values showed a statistically significant increase in total cholesterol, triglycerides, LDL-C and VLDL of sedentary group when compared with non-sedentary group.[24] Fatema *et al.*[25] and Crichton and Alkerwi[26] also observed that spending less time in sedentary behaviour and engaging in medium levels of intense physical activity may be associated with a more favourable blood lipid profile.

Our results being in contrast to other studies could be due to a small sample size of the present study and also due to the fact that we did not take lifestyle, behaviour, dietary habits and socioeconomic status of the subjects enrolled.

In the present study, serum HDL-C and serum VLDL-C of the moderate workers showed significant relationship with waist circumference. Mean total cholesterol and serum LDL-C showed significant relationship with waist circumference in sedentary workers. Serum total cholesterol showed significant relationship with WHR in moderate workers. Similar results were found in the study of Ashwell and Gibson.[27]

There were certain limitations in the study. It is speculated that lifestyle, behaviour, eating habits may be one of the causes of high prevalence of raised BMI, central obesity and deranged biochemical parameters, besides the job profile followed in the office and hence the observations can be biased and the sample size of the present study was probably small for studying the behaviour pattern of a group.

Conclusion

The present study was conducted to assess the relationship of anthropometric variables with lipid profile in moderate and sedentary workers. The present study found that along with anthropometric variables, total cholesterol and low density lipoprotein cholesterol were significantly altered only in sedentary workers. High density lipoprotein cholesterol was significantly altered in moderate workers, showing that HDL-C increases with level of activity.

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