Research Article

Correlation of body fat distribution and lipid profile in males of the Northwest region of Punjab

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ABSTRACT

Background: The prevalence of obesity has substantially increased over the past few decades. Central obesity, in particular, has a major role in the development of various metabolic disturbances including deranged lipid profile which leads to increased risk of cardiovascular diseases. Timely assessment of any changes in lipid profile can help the prevention of cardiovascular diseases in obese men. **Objectives:** The objective of this study was to evaluate the association of abnormal waist-hip ratio (WHR) with the lipid profile in healthy men. **Materials and Methods:** The study was conducted in the tertiary care center of Amritsar. Two groups of 50 men each of the age group of 20–40 years were enrolled in the study. Group I included men with normal WHR while Group II included men with increased WHR. Lipid profile including cholesterol, triglycerides (TGs), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL) was measured by standard methods. Statistical analysis was done by Student's *t*-test and correlation was established using correlation coefficient. **Results:** Evaluation of lipid profile showed that serum cholesterol, TGs, LDL, and VLDL were higher in Group II than in Group I while HDL was lower in Group II than in Group I. Central obesity (WHR) has direct association with deranged lipid profile. **Conclusion:** It can be concluded that visceral or central obesity has direct correlation with the fasting lipid profile in men of the Northwest region of Punjab and WHR is a more reliable predictor of risk.

KEY WORDS: Obesity; Lipid Profile; Waist-hip Ratio; Cardiovascular Diseases

INTRODUCTION

Cardiovascular diseases are one of the leading causes of mortality and morbidity and account for around 16.7 million deaths per year worldwide.[1] There are many risk factors which predispose the patients to the cardiovascular diseases that cannot be modified, namely age, gender, family history, and genetics. Certain risk factors, especially those related to the lifestyle (smoking, sedentary lifestyle, unbalanced diet, obesity, and dyslipidemia), can be modified to decrease the risk.[2] The rate of the prevalence of overweight and obesity has substantially increased in developing countries. More than 1.4 billion adults older than age 20 years and 40 million children who are younger than 5 years of age are overweight all over the world.[3] Excessive deposition of visceral fat, especially abdominal fat, leads to certain physiological alterations resulting in disturbed lipid profile.[4] Obesity, especially central, plays a major role in the etiology and progression of the metabolic syndrome.[5] Many studies have shown that central obesity is associated mainly with high cardiovascular morbidity and mortality.[5,6] Dyslipidemia as a result of obesity includes increased levels of triglycerides (TGs), FFA, and low-density lipoprotein (LDL) while decreased levels of high-density lipoprotein cholesterol

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(HDL-C).[5] All these lipid abnormalities reflect the typical features of the metabolic syndrome. This abnormal lipid profile is linked to a pro-inflammatory gradient originating in the adipose tissue itself which has direct impact on the endothelium. The development of insulin resistance in peripheral tissues can be attributed to the obesity, abnormal lipid profile, and development of metabolic syndrome. This causes accelerated hepatic flux of fatty acids from dietary sources and intravascular lipolysis. The adipose tissue develops resistance to the antilipolytic effects of insulin.[7]

Many methods have been developed to measure the amount and the distribution of body fat and its association with the cardiovascular diseases. The anthropometric indices such as body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR) are more simple to use and reproducible.[1] BMI is widely used as a marker of adiposity, but it is not useful in cases of extremes of stature and advancing age. The correlation between BMI and body fat percentage can vary with different races and populations.[8] Many studies have shown that WHR has direct association with abnormal lipid profile and incidence of cardiovascular diseases.[9,10] Punjab is one of the richest states of India. In the past few decades, sedentary lifestyle coupled with unhealthy dietary changes has led to increased cardiovascular morbidity and mortality. Hence, we planned to evaluate the association of body fat distribution (WHR) with lipid profile in healthy men of Amritsar.

MATERIALS AND METHODS

The present study was conducted at a tertiary health care facility in Amritsar. Prior approval from the institutional ethics committee was taken. The study was conducted on two groups of 50 men each.

Group I: It included 50 males in the age group of 20–40 years with normal WHR.

Group II: It included 50 males in the age group of 20–40 years with increased WHR.

For the above purpose, the subjects were selected at random from general population of Amritsar. Informed consent was obtained from all the volunteers after full explanation of the procedure. The subjects participated in the medical examination in the morning after fasting overnight. After taking a brief medical history, a detailed physical examination was conducted for all the subjects.

Waist and hip circumference were measured using a flexible and inelastic measuring tape while the subject was standing relaxed and their ratio was calculated. WC was measured at naval level (the narrowest part of the torso). The hip circumference was measured in a horizontal plane at the maximum circumference of the buttocks posteriorly and the symphysis pubis anteriorly.[10,11] BMI was calculated by dividing the body weight (in kilograms) by the square of height (in meters).

Investigations

About 5 ml of venous blood was taken after overnight fasting under aseptic conditions for biochemical analysis of lipid profile. A lipid profile included total cholesterol, direct HDL-C, LDL cholesterol, and TG. All tests were performed using fully automated clinical chemistry analyzers and all quality control aspects were adhered to while performing the tests.[11] Very low-density lipoprotein (VLDL) cholesterol was calculated using the Friedewald formula.[12]

Statistical analysis

Statistical analysis was carried out using unpaired *t*-test using Microsoft Excel. Correlation coefficient was used to find the degree of association between WHR and various parameters of lipid profile. $P < 0.05$ was taken as statistically significant.

RESULTS

The present study was conducted with the objective to assess the association of WHR with the lipid profile of the 100 normal healthy males divided into two groups on the basis of WHR. The results were expressed as mean ± SD. The average age in both the groups was comparable [Table 1].

Depending on the type of physical activity, the subjects were divided into three groups, namely sedentary lifestyle, moderate physical activity, and heavy physical activity. Majority of subjects in Group I had moderate physical activity (46%) followed by sedentary lifestyle (44%) and 10% of males with heavy physical activity. Similarly, in Group II, most of the males (49%) were in moderate physical activity group followed by sedentary lifestyle group comprising 40% of the subjects and only 11% had heavy physical activity. Thus, both the groups were similar in their physical activity [Table 2].

The difference of mean WHR and BMI in Groups I and II was highly significant ($P < 0.001$) [Table 3].

Comparison of lipid profile in both the groups showed that the mean serum cholesterol levels, serum triglyceride levels,

Table 1: Comparison of age in years (Mean±SD) in Groups I and II

Groups	*n*	Age (Mean±SD)
Group I	50	31.8±5.71
Group II	50	32.6±6.23

and LDL were significantly higher in Group II as compared to Group I ($P < 0.05$). The mean HDL-C level was higher in Group I than in Group II and the difference was statistically significant ($P < 0.05$) [Table 4].

In the present study, VLDL cholesterol of both the groups was determined by calculation method. The mean VLDL cholesterol in Group II was lower as compared to Group I and the difference was found to be statistically significant ($P < 0.05$) [Table 4].

Correlation coefficient showed positive correlation of WHR with serum cholesterol, TGs, LDL, and VLDL while HDL-C had an inverse relation with WHR [Table 5].

DISCUSSION

The present study showed that there is a positive correlation of WHR with serum cholesterol, TGs, LDL, and VLDL and negative association of WHR with HDL-C.

Table 2: Comparison of the level of physical activity (%) in Groups I and II

Type of work	Group I	Group II
Sedentary	44	40
Moderate	46	49
Heavy	10	11

Table 3: Comparison of waist-hip ratio and BMI (Mean±SD) in Groups I and II

Parameters	Group I	Group II
Waist-hip ratio	0.94±0.04	1.06±0.04**
BMI	23.4±3.62	27.63±2.87**

**$P<0.001$ versus corresponding values in Group I. BMI: Body mass index.

Table 4: Comparison of lipid profile (Mean±SD) in Groups I and II

Lipid profile	Group I	Group II
Serum cholesterol	243.89±41.2	255.74±68.05*
Serum TG	146.69±58.57	213.89±15.3*
HDL cholesterol	40.62±7.78	42.28±8.0*
VLDL cholesterol	33.38±12.20	42.30±30.32*
LDL cholesterol	145.58±44.10	175.54±58.92*

**$P<0.05$ versus corresponding values in Group-I.
HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein

The average age in both the groups was comparable so any effect of age on lipid profile is minimized. Both the groups had similar level of physical activity. Regular physical exercise has positive effect on improving lipid metabolism and its profile.[13] The statistical analysis showed that subjects in Group I with normal WHR had optimum BMI while in Group 2 increased WHR resulted in higher BMI.[14] The mean serum cholesterol levels in Group I were statistically lower than in Group II. Our findings match with the study conducted on 38-year-old men which showed that serum cholesterol was higher in men with higher WHR.[15] On analyzing the serum triglyceride levels in both the groups, it was found that there were serum triglyceride concentrations increased significantly with increase in WHR. Our study is similar to another study which shows strong correlation of obesity with triglyceride levels.[11,14] Another study conducted on 103 healthy men observed that increasing android-to-gynoid ratio was independently associated with elevated serum TGs.[16] HDL-C levels in the Group II were lower as compared to their levels in Group I indicating that with increase in WHR, the levels of serum HDL-C decrease. Our results are in accordance with another study conducted on 634 men showing that WHR was the principal predictor of HDL-C.[17] The mean LDL and VLDL cholesterol in Group II with increase in WHR was statistically higher than in Group I. The results are supported by a study conducted on 60 men showing positive correlation of LDL and VLDL cholesterol with central obesity.[11,18] The levels of serum cholesterol, serum TGs, VLDL cholesterol, and LDL cholesterol are increased in direct proportion to the WHR so positive correlation with WHR while serum HDL-C has negative correlation with WHR. Our results are in agreement with an earlier study comparing same parameters.[11]

Clinically, the waist-to-hip circumference ratio is a good indicator of deranged lipid profile which increases the risk of atherosclerosis and coronary artery diseases. Thus, proper weight management programs should be undertaken to reduce WHR. This will, in turn, lead to a reduction in incidence of various metabolic disorders.

Strength and Limitations

Northwest region of Punjab has experienced phenomenal rise in cardiovascular morbidity and studies evaluating risk factors are few. Moreover, BMI as a risk assessment parameter is flawed. In our study, we did not take into account hormonal milieu which could have influenced the fat deposition and lipid profile.

Table 5: Correlation of various parameters of lipid profile with WHR in Groups I and II

WHR	Serum cholesterol	Serum TGs	HDL	LDL	VLDL
	+0.382	+0.173	−0.019	+0.1676	+0.3916

WHR: Waist-hip ratio, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein, TGs: Triglycerides

CONCLUSION

It can be concluded that visceral or central obesity has direct correlation with the fasting lipid profile in men of the Northwest region of Punjab and WHR is a more reliable predictor of risk.

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