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# A Study of Correlation between Lipid Profile and Waist to Hip Ratios in Patients with Diabetes Mellitus

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**ABSTRACT** The present study deals with the correlation of waist to hip ratios and four lipid profiles, viz. serum cholesterol, triglycerides, high density lipoprotein – cholesterol (HDL-C) and low density lipoprotein – cholesterol (LDL-C) in 251 confirmed cases of diabetes mellitus (113 males and 138 females) aged 31-95 years collected from Sandhu Diabetic Care Centre, Gurdaspur, Punjab, India. The results indicate that in females, statistically negatively significant correlation (r = - 0.26) was found in LDL – C in age group 41 – 50 years and in males of the same age group, positively significant correlations were noted in serum cholesterol (r = 0.48), LDL – C (r = 0.35) and in triglyceride (r = 0.35) and also in age group 61+ years positively significant correlations were found in males between waist to hip ratio and triglyceride (r = 0.60).

## INTRODUCTION

Diabetes mellitus has become a widespread disease nowadays. According to World Health Organization report (2005), around 171,000,000 people were affected with diabetes worldwide by the year 2000 and will reach around 366,000,000 by the year 2030. The prevalence of diabetes is on the rise, more alarmingly in the developing nations. In India alone 31,705,000 people were affected by the year 2000 and will reach around 79,441,000 by the year 2030. Due to the high degree of genetic predisposition and high susceptibility to environmental conditions, characterized by a low BMI, high upper body adiposity, a high body fat percentage and a high level of insulin resistance, Indian population faces higher risk for diabetes and its complications (Rosenson, 2005). The waist to hip ratio is commonly used as an indirect measure of lower and upper body fat distribution. Young adults with waist to hip ratios in excess of 0.94 for men and 0.82 for women are at high risk for adverse health consequences (Bray and Gray, 1988). Janssen et al. (2002) opined that body mass index and waist circumference independently contributed to the prediction of abdominal, subcutaneous and visceral fat.

Association of lipid profiles is reported with lifestyle (Twisk et al., 1998 and Serter et al., 2004), age (Maki et al., 1997), intraabdominal adiposity (Mannabe et al., 1999 and Mari et al., 1999), obesity (Despres et al., 1985; Denke et al., 1993; Dongsheng et al., 2000 and Pihl and Jurimae, 2001), BMI (Bertolli et al., 2003) and waist to hip ratios (Okosun et al., 2000; and Arora, 2006). In the present study, an attempt has been made to investigate the correlation of waist to hip ratios with lipid profiles in Indian context, especially in north India.

## MATERIALS AND METHODS

A total of 251 patients (113 males and 138 females) aged 31 – 95 years collected from Sandhu Diabetes Care Center, Gurdaspur, Punjab, India, were considered as samples. Comparisons of lipid profiles between patients with diabetes mellitus and controls were made by Arora (2006) and Arora et al. (2007). In the present study we considered only the diabetic samples, because it is purely a correlation study between waist to hip ratios and the lipid profiles of patients. Samples were further divided into four age groups, viz. 31 – 40 years, 41 – 50 years, 51 –60 years and 61 + years for analyses, as waist to hip ratio and lipid profile are sensitive to ages. They

were measured for waist to hip ratios and four lipid profiles, viz. serum cholesterol, triglycerides, High Density Lipoprotein – Cholesterol (HDL-C) and Low Density Lipoprotein – Cholesterol (LDL-C). The waist to hip ratio is simply calculated by dividing waist circumference by hip circumference (both measured with the help of steel tape and in centimeters). The World Health Organization (1988) recommends measuring waist circumference midway between the lower rib margin and the iliac crest, and hip circumference at the widest point over the greater trochanters. Venous blood samples were taken from all the subjects in the morning after 12 hours fasting. Total cholesterol and triglyceride concentrations were determined with a semi-automated enzymatic analyzer (RA 50, Semi-auto Chemistry Analyzer, Bayer's India Ltd, India). HDL- Cholesterol serum level was measured by using phosphotungstate precipitation method. For the analysis of data, unrelated student's t test and Pearson correlation coefficient were done.

## RESULTS AND DISCUSSION

The association between lipid profile and body fat distribution had been much discussed during the past decades (Despres et al., 1985; Denke et al., 1993; Dongsheng et al., 2000 and Pihl and Jurimae, 2001). Both lipid profile and body fat have been shown to be the important predictors for metabolic disturbances including dyslipidaemia, hypertension, diabetes, cardio-vascular diseases, hyperinsulinaemia etc. In the present study, table 1 shows the distribution of mean values and standard deviations of waist to hip ratios and four lipid components in patients with diabetes mellitus. In male patients with diabetes mellitus, individuals of age group 61+ years have the maximum mean value (0.95) and the minimum (0.92) in age group 31-40 years for waist to hip ratios. For serum cholesterol, the maximum mean value (222.97 mg/dl) was noted in age group 41 – 50 years and the minimum (189.42 mg/dl) in age group 31 – 40 years. For HDL – C, the maximum mean value (43.58 mg/dl) was found in age group 41 – 50 years and the minimum (40.06 mg/dl) in age group 61+ years. For LDL – C, almost equal distribution was recorded in all the four age groups. For triglyceride, the maximum mean value (264.19 mg/dl) was noted in age group 41 – 50 years and the minimum (235.08 mg/dl) in age group 31 – 40 years. In females, the maximum mean value (0.96) was recorded in age group 61+ years and the minimum (0.91) in age group 31 – 40 years for waist to hip ratios. For serum cholesterol, the maximum mean value (230.43 mg/dl) was found

**Table 1: Distribution of mean values and standard deviations of waist to hip ratios and four lipid components in patients with diabetes mellitus.**

| *Age group (years)* | *Waist to hip ratios* | | *Serum Chole sterol (mg/dl)* | | *HDL –C (mg/dl)* | | *LDL – C (mg/dl)* | | *Triglyceride (mg/dl)* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Mean* | *S.D.* | *Mean* | *S.D.* | *Mean* | *S.D.* | *Mean* | *S.D.* | *Mean* | *S.D.* |
| *Males* | | | | | | | | | | |
| 31-40 (n=24) | 0.92 ± 0.06 | | 189.42 ± 22.89 | | 42.50 ± 5.39 | | 110.75 ± 16.84 | | 235.08 ± 70.25 | |
| 41-50 (n=31) | 0.94 ± 0.06 | | 222.97 ± 67.09 | | 43.58 ± 4.97 | | 110.48 ± 15.76 | | 264.19 ± 121.37 | |
| 51-60 (n=41) | 0.93 ± 0.07 | | 202.22 ± 30.03 | | 42.49 ± 4.81 | | 110.93 ± 22.37 | | 254.07 ± 81.34 | |
| 61+ (n=17) | 0.95 ± 0.06 | | 201.29 ± 34.92 | | 40.06 ± 4.62 | | 110.12 ± 14.54 | | 238.47 ± 100.15 | |
| *Females* | | | | | | | | | | |
| 31-40 (n=07) | 0.91 ± 3.68 | | 230.43 ± 47.80 | | 43.43 ± 5.53 | | 105.14 ± 7.97 | | 249.00 ± 64.42 | |
| 41-50 (n=69) | 0.93 ± 0.05 | | 214.77 ± 42.75 | | 43.52 ± 5.23 | | 114.91 ± 18.33 | | 248.17 ± 70.21 | |
| 51-60 (n=39) | 0.92 ± 0.05 | | 209.03 ± 37.92 | | 42.97 ± 5.17 | | 115.08 ± 16.48 | | 258.44 ± 98.35 | |
| 61+ (n=23) | 0.96 ± 0.07 | | 199.43 ± 46.28 | | 42.30 ± 5.01 | | 108.87 ± 15.68 | | 227.48 ± 73.15 | |
| *Comparison of t – values between Males and females* | | | | | | | | | | |
| *Age group (years)* | *Waist to hip ratios* | | *Serum Chole sterol (mg/dl)* | | *HDL –C (mg/dl)* | | *LDL – C (mg/dl)* | | *Triglyceride (mg/dl)* | |
| 31-40 | 0.45. | | 3.20* | | 0.40 | | 0.85 | | 0.47 | |
| 41-50 | 1.49 | | 0.74 | | 0.05 | | 1.16 | | 0.83 | |
| 51-60 | 0.79 | | 0.89 | | 0.44 | | 0.94 | | 0.22 | |
| 61+ | 0.38 | | 0.14 | | 1.47 | | 0.26 | | 0.40 | |

*P $\leq$ 0.05

in age group 31 – 40 years and the minimum (199.43 mg/dl) in age group 61+ years. For HDL – C, the maximum mean value (43.52 mg/dl) was recorded in age group 41 – 50 years and the minimum (42.30 mg/dl) in age group 61+ years. For LDL – C, the maximum mean value (115.08 mg /dl) was found in age group 51 – 60 years and the minimum (105.14 mg/dl) in age group 31 – 40 years. For triglyceride, the maximum mean value (258.44 mg/dl) was noted in age group 51 – 60 years and the minimum (227.48 mg/dl) in age group 61+ years. When comparisons of t values were made on the distribution of waist to hip ratios and four lipid components between male and female patients, statistically significant differences ($p \leq 0.05$) were found only in serum cholesterol in age group 31 - 40 years ($t = 3.20$). The data was collected from hospital only. Therefore, it may be assumed that due to sample fluctuation and deviation from normality, the variations in standard deviation were found which is in heterogeneous range.

Table 2 shows the correlation coefficient of waist to hip ratios with four lipid components in patients with diabetes mellitus. Statistically positively significant correlation was found in males in serum cholesterol ($r = 0.48$), LDL – C ($r = 0.35$) and in triglyceride ($r = 0.35$) in age group 41 – 50 years and in the age group of 61+ years with triglyceride ($r = 0.60$); and in females, for LDL-C, negatively significant correlation ($r = -0.26$) was obtained in age group 41 – 50 years. No significant correlation was found in any other cases in both the sexes.

We may conclude from the results of the present study that, off those four lipid components, except HDL-C, all the components were positively correlated with waist to hip ratios in males and negatively correlated only with LDL-C in females between fourth and fifth decade of their lives. Okosun et al. (2000) reported in their study that waist circumference was positively correlated with fasting blood glucose. The findings of the present study was also supported by Arora (2006) and Arora et al. (2007) who were of the opinion that waist to hip circumference ratio was positively correlated with serum cholesterol, triglyceride and LDL-C in patients with diabetes mellitus.

**Table 2: Correlation coefficient (r) of waist to hip ratios with four lipid components in patients with diabetes mellitus.**

| *Parameters* | *31-40 years* | *41-50 years* | *51-60 years* | *61+ years* |
|---|---|---|---|---|
| *Males* | | | | |
| S.Cholesterol | 0.05 | 0.48* | 0.06 | 0.31 |
| HDL-C | -0.16 | 0.12 | 0.18 | 0.37 |
| LDL-C | -0.07 | 0.35* | -0.01 | 0.04 |
| Triglyceride | 0.26 | 0.35* | 0.04 | 0.60* |
| *Females* | | | | |
| S.Cholesterol | -0.62 | -0.16 | -0.06 | -0.12 |
| HDL-C | -0.11 | 0.05 | 0.02 | -0.14 |
| LDL-C | 0.07 | -0.26* | -0.06 | -0.09 |
| Triglyceride | -0.34 | -0.03 | -0.03 | 0.26 |

*$P \leq 0.05$

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