PRINT: ISSN 0970-9274 ONLINE: 2456-6608
J. Hum. Ecol., 24(3): 227-229 (2008)
DOI: 10.31901/24566608.2008/24.03.09

# A Study of Correlation between Lipid Profile and Body Mass Index (BMI) in Patients with Diabetes Mellitus

**Hardev Singh Sandhu[1], Shyamal Koley[2] and Karanjit Singh Sandhu[1]**

*1. Sandhu Diabetic Care Centre, Cinema Road, Batala 143 505, District Gurdaspur, Punjab, India*
*2. Department of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar, 143 005, Punjab, India*

**KEYWORDS** Lipid Profiles. Body Mass Index. Diabetes Mellitus

**ABSTRACT** The present study deals with the correlation of body mass index and four lipid profiles, viz. serum cholesterol, triglycerides, HDL-C and LDL-C in 251 randomly selected confirmed cases of diabetes mellitus (113 males and 138 females) aged 31-91 years of Gurdaspur, Punjab. 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, statistically negatively significant correlation (r = - 0.33) in age group 41 – 50 years in HDL-C and positive correlations in triglyceride in age group 31 – 40 years (r = 0.41) and in age group 61 + years (r = 0.23).

## INTRODUCTION

As per the report of International Diabetes Federation, South East Asian countries have the highest prevalence of diabetes in the world. 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 BMI is commonly used to classify individuals as underweight ( less than 18.5 $Kg/m^2$), normal weight (18.5 – 24.9 $Kg/m^2$), overweight (25.0 – 29.9 $Kg/m^2$), obesity class I (30.0 – 34.9 $Kg/m^2$), class II (35.0 – 39.9 $Kg/m^2$ ) and class III (more than 40 $Kg/m^2$) (World Health Organization, 1998). It has been established that BMI is a significant predictor of cardiovascular disease and type 2 diabetes mellitus (Janssen et al., 2002).

Association of lipid profiles is reported with lifestyle (Serter et al., 2004 and Twisk et al., 1998), age (Maki et al., 1997), intra-abdominal 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) and BMI (Bertolli et al., 2003). In the present study, an attempt has been made to investigate the correlation of BMI with lipid profiles in Indian context, especially in north India.

## MATERIALS AND METHODS

A total of 251 randomly collected patients (113 males and 138 females) aged 31 – 95 years from Gurdaspur, Punjab, India, were considered as samples. Comparisons of lipid profiles between patients with diabetes mellitus and controls were made in our earlier study (Arora et al., 2007). In the present study we considered only the diabetic samples, because it is purely a correlation – study between BMI 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. They were measured for body mass index and four lipid profiles, viz. serum cholesterol, triglycerides, HDL-C and LDL-C. Measurements of the weight to the nearest 0.1 kg by a weighing machine and height to the nearest of 0.1 cm by an anthropometer rod were done. BMI was calculated as weight (in kgs) divided by height (in meters) squared as indicated by the World Health Organization (WHO, 1998).

Venous blood samples were taken from all the subjects in the morning after fasting overnight. 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. Standard Statistical calculations were also made.

## 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 age wise distribution of mean values and standard deviations of BMI and four lipid components in patients with diabetes mellitus. In male patients with diabetes mellitus, individuals of age group 41 – 50 years have the maximum mean value (32.07 Kg/m$^2$) and the minimum (25.85 Kg/m$^2$) in age group 61+ years for BMI. 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 (30.07 Kg/m$^2$) was recorded in age group 31 – 40 years and the minimum (26.31 Kg/m$^2$) in age group 51 – 60 years for BMI. For serum cholesterol, the maximum mean value (230.43 mg/dl) was found 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 was made on the distribution of BMI and four lipid components between males and females, statistically significant differences ($p < 0.01$) 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 BMI with four lipid components in patients with diabetes mellitus. Statistically positively significant correlation ($r = 0.41$) was found in males and negatively significant correlation ($r = - 0.76$) in females for triglyceride in age group 31 – 40 years. For HDL – C statistically negatively significant correlation ($r = -0.33$) was obtained only in males 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

**Table 1: Age group wise distribution of mean values and standard deviations of BMI and four lipid components in patients with diabetes mellitus.**

| *Age group (years)* | *BMI (kg/m$^2$)* | | *Serum Cholesterol (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) | 26.74 | ±5.25 | 189.42 | ±22.89 | 42.50 | ±5.39 | 110.75 | ±16.84 | 235.08 | ±70.25 |
| 41-50(n=31) | 32.07 | ±7.79 | 222.97 | ±67.09 | 43.58 | ±4.97 | 110.48 | ±15.76 | 264.19 | ±121.37 |
| 51-60(n=41) | 30.57 | ±5.52 | 202.22 | ±30.03 | 42.49 | ±4.81 | 110.93 | ±22.37 | 254.07 | ±81.34 |
| 61+(n=17) | 25.85 | ±3.13 | 201.29 | ±34.92 | 40.06 | ±4.62 | 110.12 | ±14.54 | 238.47 | ±100.15 |
| *Females* | | | | | | | | | | |
| 31-40(n=7) | 30.07 | ±3.68 | 230.43 | ±47.80 | 43.43 | ±5.53 | 105.14 | ±7.97 | 249.00 | ±64.42 |
| 41-50(n=69) | 27.03 | ±4.58 | 214.77 | ±42.75 | 43.52 | ±5.23 | 114.91 | ±18.33 | 248.17 | ±70.21 |
| 51-60(n=39) | 26.31 | ±4.76 | 209.03 | ±37.92 | 42.97 | ±5.17 | 115.08 | ±16.48 | 258.44 | ±98.35 |
| 61+(n=23) | 27.95 | ±7.80 | 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 (yrs)* | *BMI (kg/m$^2$)* | *S.Cholesterol (mg/dl)* | *HDL-C (mg/dl)* | *LDL – C (mg/dl)* | *Triglyceride (mg/dl)* |
|---|---|---|---|---|---|
| 31-40 | 1.56 | 3.20* | 0.40 | 0.85 | 0.47 |
| 41-50 | 1.10 | 0.74 | 0.05 | 1.16 | 0.83 |
| 51-60 | 0.74 | 0.89 | 0.44 | 0.94 | 0.22 |
| 61+ | 1.05 | 0.14 | 1.47 | 0.26 | 0.40 |

*P < 0.01

**Table 2: Correlation coefficient (r) of BMI with four lipid components in patients with diabetes mellitus.**

| *Parameters* | *31-40 years* | *41-50 years* | *51-60 years* | *61+ years* |
|---|---|---|---|---|
| *Males* | | | | |
| S.Cholesterol | 0.35 | -0.11 | 0.04 | 0.18 |
| HDL-C | 0.16 | -0.33* | 0.29 | -0.18 |
| LDL-C | 0.21 | -0.13 | -0.03 | 0.14 |
| Triglyceride | 0.41* | -0.16 | 0.01 | 0.23 |
| *Females* | | | | |
| S.Cholesterol | -0.09 | -0.21 | -0.26 | -0.12 |
| HDL-C | -0.19 | 0.14 | -0.22 | 0.31 |
| LDL-C | 0.02 | 0.01 | -0.13 | -0.26 |
| Triglyceride | -0.76* | 0.05 | -0.24 | -0.11 |

* $P < 0.05$

present study that, off those four lipid components, only triglyceride is adversely correlated with BMI both in males and females. Maki et al. (1997) explained in this direction that, BMI increased due to increase in adiposity characterized by decreased HDL-C and increased triglycerides. In some other studies, a significant relationship was found between cardio respiratory fitness, BMI and LDL-C (Bertoli et al., 2003). Data demonstrated that aerobic fitness is related to metabolic parameters and to body fat distribution in the patients. Janssen et al. (2002) opined that BMI and waist circumference independently contributed to the prediction of subcutaneous and visceral fat.

## REFERENCES


Arora, M., Koley, S. Gupta, S. and Sandhu, J.S.: A study on lipid profile and body fat in patients with diabetes mellitus. *Anthropologists*, **9(4)**: 295-298 (2007).

Bertolli, A., Di-Daniele, N., Ceccobelli, M., Ficara, A., Girasoli, C. and Lorenzoa, D.: Lipid profile, BMI, body fat distribution and aerobic fitness in men with metabolic syndrome. *Acta Diabetol.*, **40 Suppl.:** S130-S133 (2003).

Denke, M.A., Sempos, C.T., and Grundy, S.M.: Excess body weight: An under- recognised contributor to high blood cholesterol in White American men. *Arch. Int. Med.*, **153:** 1093-1103 (1993).

Despres, J.P., Allard, C., Tremblay, A., Talbot, J. and Bouchard, C.: Evidence for a regional component of body fatness in association with serum lipids in men and women. *Metabolism*, **34:** 967-973 (1985).

Dongsheng, H., Judy H., Stuart, R., Gray, K., Jablonski, A., Jeffrey, A., Henderson, D.C. R., Lee, E.T., Wilty, T.K. and Howard, B.V.: Effects of obesity and body fat distribution on lipids and lipoproteins in nondiabetic American Indians: The Strong Heart Study, *Obesity Research* , **8:** 411-421(2000).

Janssen, I., Heymsfield, S.B., Allison, D.B., Kotler, D.P. and Ross, R.: Body mass index and waist circumference independently contribute to the prediction of non abdominal, abdominal subcutaneous and visceral fat. *Amm. J. Clin. Nutr.*, 7**5:** 683-688 (2002).

Mari, O., Furuya, R., Ohkawa, S., Yoneyama, T., Nisikino, M., Hishida, A. and Kumagai, H.: Altered abdominal fat distribution and its association with serum lipid profile in non diabetic haemo-dialysis patients. *Nephrol. Dial. Transplant*, **14:** 2427-2432 (1999).

Maki, K.C., Kritsch, K., Foley, S., Soneru, I. and Davidson, M.H.: Age dependence of the relationship between adiposity and serum LDL-C in men. *J. Am. Clin. Nutr.*, **16:** 578-583 (1997).

Mannabe, E., Aoyagi, K., Tachibana, H. and Takemoto, T.: Relationship of intra-abdominal adiposity and peripheral fat distribution to lipid metabolism in an island population in western Japan: gender differences and effect of menopause. *Tohoku J Exp. Med.*, **188:** 189-202 (1999).

Pihl, E. and Jurimae, T.: Relationship between body weight change and cardiovascular risk factors in male former athletes. *Int. J. Obes. Relat. Metab. Disord.*, **25**: 1057-1062 (2001).

Rosenson, R.S.: HDL-C and the diabetic patients: target for therapeutic intervention. *Diabetes Res. Clin. Pract.*, **68:** 36-42 (2005).

Serter, R., Demirbas, B., Korukluoslu, B., Culha, C., Cakal, E. and Aral, Y.: The effect of L-thyroxine replacement therapy on lipid based cardiovascular risk in subclinical hypothyroidism . *J. Endocrinol. Invest.*, **27:** 897-903 (2004).

Twisk, J.W., Kemper, H.C., Van Mechelen, W., Post, G.B. and Van Lenthe, F.J.: Body fatness: longitudinal relationship of BMI and the sum of skinfolds with other risk factors for CHD. *Int. J. Obes. Relat. Metab. Disord.*, **22:** 915-922 (1998).

WHO. *Obesity*: *Preventing and Managing the Global Epidemic*. Report of a WHO Consultation on Obesity, Geneva (1998).