Comparison Of Lipid Profile Between Controlled And Uncontrolled Diabetic Subjects

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Abstract

Low-density lipoprotein cholesterol is considered as an independent risk factor for CAD. The risk for CAD is higher in diabetic subjects than nondiabetic subjects. The control of glycaemic status with the reduction of CAD risk factors is unknown in our population. We aimed to compare lipid profiles with special attention to low-density lipoprotein cholesterol between uncontrolled and controlled diabetic subjects to explore the association of glycaemic status with CAD risk. Six hundred specimens obtained form confirmed diabetic subjects were analyzed. Glycosylated hemoglobin level (HbA_{1c}) was measured by HPLC based method as a marker of glycaemic status and serum total cholesterol, serum triacylglycerol and serum high-density lipoprotein cholesterol concentration were measured by standard methods. Serum low-density lipoprotein cholesterol was calculated by Friedewald's formula. Subjects were grouped in to three categories: controlled, moderately controlled and uncontrolled diabetes depending on HbA_{1c} results. Lipid profiles were compared in different diabetic, age and sex groups. Statistically significant difference was found in FPG (P<0.001), PPG (P<0.001), HbA_{1c} (P<0.001) among controlled, moderately controlled and uncontrolled diabetic subjects. No significant difference was observed in lipid profile parameters between controlled and moderately controlled diabetic subjects. Except HDLC and TG other lipid profile parameters like TC and LDLC in uncontrolled diabetic subjects were significantly higher than other diabetic groups (P< 0.01, P<0.001). Total cholesterol and HDLC values showed significant difference among male and female subjects (P<0.05, P<0.001). It is reaffirmed that uncontrolled diabetic subjects have higher risk of cardiovascular diseases than controlled diabetic subjects and males are more prone to develop CAD than females.

Key words: *Glycosylated hemoglobin, low-density lipoprotein cholesterol, type 2 diabetes.*

Non standard abbreviations: FPG, Fasting Plasma Glucose; PPG, Post-Prandial Plasma glucose;TC, Total Cholesterol; TG, Triacylglycerol; HDLC, High-Density Lipoprotein Cholesterol; LDLC, Low-Density Lipoprotein Cholesterol; HPLC, High Performance Liquid Chromatography.

Introduction

Low-density lipoprotein cholesterol is consideredas an independent risk factor for CAD[1]. The risk for CAD is higher in diabetic subjects than nondiabetic subjects[2]. Glycosylated hemoglobin (HbA_{1c}) is commonly used as a marker of glycaemic status. HbA_{1c} has been proposed as a dual marker for glycaemic control and CAD risk factor[3]. The clinical importance of glyceamic control in type 2 diabetic patients is well established in the United Kingdom Prospective Diabetes Study (UKPDS)[4]. The American. Diabetes Association (ADA) estimates that the risk of diabetes-related mortality increases 25% for each 1% increase in HbA_{1c}[5]. It has also been estimated that each percentage point increase in HbA_{1c} correspond to a 35% increase in the risk of microvascular complications and an 18% increase in the risk of myocardial infarction (fatal plus non-fatal)[5]. So the reduction or control of blood glucose level may lower the lipid risk factor for cardiovascular diseases. We aimed to compare lipid profiles with special attention to low-density lipoprotein cholesterol between uncontrolled (HbA_{1c}>9%), moderately controlled (7.0% < HbA_{1c} ≤ 9.0%) and controlled (HbA_{1c} ≤ 7.0%)[6] diabetic subjects to explore the association of glycaemic status with CHD risk factors.

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Methods

Six hundred specimens obtained form confirmed diabetic subjects during June 2009 to August 2009 were analyzed. Total study subjects were grouped in to. three categories i.e., controlled, moderately controlled and uncontrolled diabetes depending on HbA_{1c} values (described earlier). Total study subjects were also grouped in to male and female categories. According to age, subjects were grouped in to three age groups (up to 40 years, from 41 to 60 years and above 61 years). Fasting and post-prandial plasma glucose levels were measured by GOD-PAP method in Dimension RxL max auto-analyzer (Siemens Healthcare Diagnostics Ltd.). Glycosylated hemoglobin level (HbA_{1c}) was measured by HPLC based method (D-10 TM, Hemoglobin Testing System, Bio-Rad Laboratories, Inc., Hercules, CA, 94547, USA) as a marker of glycaemic status and serum total cholesterol, serum triaclyglycerol and serum high-density lipoprotein cholesterol concentration were measured by Dimension RxL max auto-analyzer (Siemens Healthcare Diagnostics Ltd., Sir William Siemens Sq., Frimley, Camberly, UK GU16 8QD.) Serum low-density lipoprotein cholesterol was calculated by Friedewald's formula[7]. Results are expressed as mean±SD and compared by unpaired t test. Statistical analysis was performed by STATISTICA 6 and GraphPad Prism 5. Lipid profiles were compared by unpaired t test in different diabetic groups. Lipid profiles were also compared between male and female groups; and also compared in three different age groups.

Results

The Mean age of the total study subjects was 49.92±11.7 years. The mean±SD of HbA_{1c} level was 9.37±2.64 %, serum total cholesterol was 186.46±42.06 mg/dL, serum high-density lipoprotein cholesterol was.36.85±8.02 mg/dL, serum triacylglycerol was 191.31±123.57 mg/dL and calculated serum low-density lipoprotein cholesterol was 112.82±35.78 mg/dL in the total study subjects. 21% of the study population were within the controlled diabetic group (HbA_{1c} ≤ 7.0 %), 30% were moderately controlled diabetic group (HbA_{1c}: 7.1 - 9.0%) and 49% were uncontrolled diabetic group (HbA_{1c} > 9.0%). Of the total study subjects 301 were male and 299 were female. 25% of the study subjects were within the age group of ≤ 40 years, 58% were in the age group of 41 - 60 years and 17% were above 61 years age group. Comparison of plasma glucose and lipid parameters in different HbA_{1c} groups is shown in table 1. It is evident from table I that fasting plasma glucose and post-prandial plasma glucose levels differ significasntly among different HbA_{1c} groups. erum total cholesterol did not differ ignificantly in the moderately controlled diabetic group compared to controlled diabetic group but the difference between moderately controlled diabetic group and uncontrolled diabetic group and also between uncontrolled and controlled diabetic groups were statistically significant (table I). Serum triacylglycerol level differs significantly between uncontrolled and controlled diabetic groups but the difference was not significant between controlled and moderately controlled diabetic groups and not between moderately controlled and uncontrolled diabetic groups (table I). There is no significant difference of serum high-density lipoprotein cholesterol level among three diabetic groups. The difference of the serum low-density lipoprotein cholesterol between moderately controlled and controlled diabetic groups is not significant but LDLC level in the uncontrolled diabetic group is significantly different from controlled and moderately controlled diabetic groups. HbA1c, fasting plasma glucose, post-prandial lasma glucose, serum TG and LDLC level did not differ significantly between male and female diabetic groups but serum total cholesterol and serum HDLC level was significantly higher in female than male diabetic groups (table II). HbA_{1c}, fasting plasma glucose, post-prandial plasma glucose, serum TC and HDLC level did not differ significantly among three different age groups but serum TG was significantly lower in the age group of >61 yrs than other two groups and serum LDLC level was significantly higher in the age group of 41 - 60 yrs than other two age groups (table III). Distribution of serum low-density lipoprotein cholesterol in to four different LDLC ranges showed that the controlled diabetic group has the maximum subjects with optimal level of LDLC (up to 100 mg/dL) and least number of subjects has LDLC level above 130 mg/dL (17%) than moderately and uncontrolled diabetic subjects (table IV). In moderately and uncontrolled percentages of diabetic patients having LDLC above 130 mg/dL are higher than controlled diabetic subjects (26% and 38% respectively) (table IV).

Table -I

Comparison of plasma glucose and lipid parameters in different HbA_{1c} groups.

	Group I	Group II	Group III
FPG (mmol/L)	5.597±1.249	7.554±1.943***	11.48±4.287***
PPG (mmol/L)	8.639±2.643	11.32±3.143***	16.53±5.467***
HbA1c (%)	6.251±0.579	7.969±0.566***	11.61±1.88***
TC (mg/dL)	174.3±33.91	182.2±42.15^{NS}	194.4±43.65**,***
TG (mg/dL)	169.3±90.94	190.7±127.8^{NS}	201.3±132.0^{NS,*}
HDLC (mg/dL)	37.12±8.33	36.85±7.65^{NS}	36.72±8.14^{NS,NS}
LDLC (mg/dL)	104.7±30.79	108.8±35.11^{NS}	118.9±37.24**,***

Group I, controlled; Group II, uncontrolled and Group III, uncontrolled diabetic subjects; NS, not significant; *, P<0.05; **, P<0.01; ***, P<0.001.

Table -II

Comparison of HbA_{1c}, plasma glucose and lipid parameters between male and female.

	Male	Female
FPG (mmol/L)	8.887±3.851	9.357±4.125^{NS}
PPG (mmol/L)	13.48±5.612	13.08±5.299^{NS}
HbA_{1c}(%)	9.351±2.698	9.387±2.583^{NS}
TC (mg/dL)	182.5±42.16	190.4±41.65*
TG (mg/dL)	199.1±141.7	183.5±101.7^{NS}
HDLC (mg/dL)	34.4±7.11	39.31±8.14***
LDLC (mg/dL)	110.5±36.44	115.2±35.00^{NS}

NS, not significant; *, P<0.05; ***, P<0.001.4).

Table-III

Comparison of plasma glucose and lipid parameters in different age groups.

Age(yrs)	Up to 40	41-60	>60
FPG (mmol/L)	8.837±3.455	9.159±3.951	9.402±4.801
PPG (mmol/L)	12.78±4.976	13.43±5.539	13.50±5.839
HbA1c (%)	9.342±2.705	9.332±2.498	9.534±3.011
TC (mg/dL)	183.3±38.85	188.8±42.85	183.1±43.66
TG (mg/dL)	206.9±152.7	193.5±121.6 ^{NS}	161.3±65.37*,**
HDLC (mg/dL)	36.60±7.623	36.71±8.045 ^{NS}	37.68±8.517^{NS,NS}
LDLC (mg/dL)	108±33.56	114.8±35.26* 1	13±40.08^{NS,NS}

NS, not significant;*, P<0.05;**, P<0.01

Table -IV

Distributions of LDLC in controlled, moderately controlled and uncontrolled diabetic subjects in different LDLC level.

LDLC range	up to100 mg/dL	101-130 mg/dL	131- 150 mg/dL	>150 mg/dL
Group I	49%	34%	9%	8%
Group II	43%	31%	14%	12%
Group III	34%	27%	17%	21%

Group I, controlled diabetic subjects; Group II, moderately controlled diabetic subjects and Group III, uncontrolled diabetic subjects.

Discussion

Except TC and HDLC; there was no significant difference of mean TG and LDLC level between male and female diabetic. Groups. Male diabetic subjects have lower level of TC and HDLC than their female counterparts. As the differences of mean HDLC was highly significant than that of total cholesterol, females are more cardiovascular disease protective than male. This finding is consistent with results of other research work carried out in our country[8] as well as in different parts of the world. The influence of age on lipid parameters was not significant except TG and LDLC, but comparison of lipid parameters showed that TG level was significantly lower in the age above 61 years than other age groups and LDLC level was significantly higher in the age group of 41 - 60 years than other age groups. So the middle age group may be less cardioprotective. The result is consistent with the finding of other work[8]. High LDLC level was also obtained in moderately controlled and uncontrolled diabetic subjects than controlled diabetic subjects. The distribution of LDLC in different LDLC range also showed the higher risk of uncontrolled and moderately controlled diabetic subjects than controlled diabetic subjects. Significant positive correlation was observed between HbA_{1c} with TC (r = 0.205, P = 0.0000004) and LDLC (r=0.193, P=0.000002) in our study but with triacylglycerol was weak (r = 0.0825, P = 0.043). LDL hyperlipoproteinemia (LDLC>100 mg/dL) was 60 % and HDL dyslipidemia (HDLC<35 mg/dL) was 46% of the total study subjects which is some what lower than that obtained in a study carried out in India[9] but the overall risk of CAD is alarming in our population. It is evident from the above findings that uncontrolled diabetic subjects have higher risk of CAD than controlled and moderately controlled diabetic subjects.

Conclusion

Uncontrolled diabetic subjects have higher risk of cardiovascular diseases than controlled diabetic subjects, so the control of hyperglycemia may lower the CAD risk.

References

1. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). JAMA 2001; 285:2486 - 97.
2. Sowers JR and Lester MA. Diabetes and cardiovascular disease. Diabetes Care 1999;22(Suppl. 3):C14-20
3. Khan HA. Clinical significance of HbA1c as a marker of circulating lipids in male and female type 2 diabetic patients. Acta Diabetol 007;44:193-200
4. UKPDS group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352:837 - 853..5. American Diabetes Association. Implications of the United Kingdom Prospective Diabetes Study. Diabetes Care 2003;26(Suppl. 1):S28 ¯S32.
6. American Diabetes Association. Standards of medical care in diabetes. Daibetes Care 2004;27(Suppl. 1):S15 S35.
7. Friedewald WT, Levy RI, and Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clinical Chemistry 1972;18(6):499-502.
8. Rahman MT, Tahmin HA, Ahmad A, Choudhury SR. Dyslipidemia in type 2 diabetes and non diabetes: A retrospective comparative biochemical study and a brief review on lipids. angladesh Medical Journal 2006;38(1):24-27
9. Udawat H, Goyal RK, Maheshwari S. Coronary risk and dyslipidemia in type 2 diabetic patients. J Assoc Physc Indi 2001;49:970-73.