

Study of glycemic status and lipid profile in type 2 diabetic patients attending the Community Based Medical College Hospital

Rahman MM¹, Hassan Z², Sen B³, Shahidullah ASM⁴, Paul AR⁵, Saha KR⁶

Abstract

A cross sectional study of 129 type 2 diabetic patients attending out patient department of Community Based Medical College Hospital was done with an aim to evaluate their metabolic control. Of the total cases, 88 (68.2%) were male and 41 (31.8%) were female. Blood glucose and lipid levels were measured by following the standard laboratory methods. The study subjects had relatively poor glycemic control. Fasting serum glucose was 7.45 ± 2.71 (mmol/l, mean $\pm$ SD); Male- 7.04 ± 2.36 and Female 8.33 ± 3.20 , $p = ns$. Mean ($\pm$ SD) of total cholesterol and triglyceride of the female subjects were significantly higher compared to the male counterpart ($p = 0.01$ for both). About 71% and 78.0% female subjects had triglyceride and HDLc abnormality compared to 63.3% and 61.4% respectively in their male counterpart. Fasting glucose level showed significant positive correlation with triglyceride among total and male study subjects ($p = 0.003$ for both). In case of total cholesterol significant positive association was among total and female subjects ($p = 0.005$ and 0.007 respectively).

The data concluded that (i) relatively large number of diabetic patients were having dyslipidemia of either component or in combination; and (ii) attention needs to be paid to address this issue of dyslipidemia and to avoid or at least delay the coronary artery and atherosclerotic complications of these subjects.

CBMJ 2014 January: Vol. 03 No. 01 P: 20-24

Key words: Type 2 diabetes mellitus, Glycemic control, Dyslipidemia

Introduction

The world is passing through an epidemic of diabetes mellitus. It is not only affecting the people of developed but also the developing countries. It is estimated that about one-fifth of all diabetics in the world live in the South-East Asia Region. Estimated prevalence of diabetes by 2012 in the world is 8.3%, in South East Asia 8.7% and in Bangladesh 7.11%¹. It is understood that diabetes mellitus put on additional three fold risk for cardiovascular mortality than the general population². The increase in risk is particularly evident in younger-age groups, and in women. Atherosclerotic cardiovascular, peripheral vascular and cardio- and cerebrovascular diseases found to be accounting for 80% of total diabetic mortality³. The vascular change is attributed to the dyslipidemia commonly found in these patients. The most commonly recognized lipid abnormality found to be hypertriglyceridemia⁴. The characteristic features of diabetic dyslipidemia are a high plasma triglyceride concentration, low HDL cholesterol concentration and increased concentration of small dense LDL-cholesterol particles⁵. Increased lipolysis in diabetes mellitus understood to be stimulated by activity of hormone-sensitive lipase, resulting

1. *Prof Dr Md Muzibar Rahman
Professor (CC) and Head
Department of Biochemistry, Community Based
Medical College Bangladesh, Winnerpar, Mymensingh.
2. Dr Zahid Hassan
Associate Professor
Department of Physiology & Molecular Biology,
BIRDEM,
122 Kazi Nazrul Islam Avenue, Dhaka-1000
3. Dr Bina Sen
Associate Professor
Department of Biochemistry,
Community Based Medical College Bangladesh,
Winnerpar, Mymensingh
4. ASM Shahidullah
Associate Professor
Department of Biochemistry
Community Based Medical College Bangladesh
Winnerpar, Mymensingh
5. Arup Ratan Paul
Assistant Professor
Department of Biochemistry
Community Based Medical College Bangladesh
Winnerpar, Mymensingh
6. Kamana Rani Saha
Assistant Professor
Department of Biochemistry
Community Based Medical College Bangladesh
Winnerpar, Mymensingh

* Address of Correspondence:

E-mail: muzibdr@yahoo.com

Mobile: 01711046607

in excessive free fatty acid (FFA) in the blood. The excess delivery of FFA to the liver, together with hepatic insulin resistance, produces and exports an increased amount of triglyceride (TG)-rich/apoB-rich very low-density lipoproteins (VLDL). These particles, together with chylomicron absorbed from the gut, saturate the activity of lipoprotein lipase (LPL), producing prolonged postprandial lipemia. LPL activity found to be also blunted, which accounts, in part, for the elevated plasma VLDL-TG and the diminished HDL as well as the relatively low LDL. A second factor contributing to these circulating abnormalities is the circulating plasma enzyme cholesterol ester transfer protein (CETP). When plasma VLDL-TG is elevated, CETP causes TG to move to HDL and LDL, and, conversely, causes cholesterol ester to move from HDL and LDL to VLDL-TG. Hence, diabetics with high plasma VLDL concomitantly have low measured plasma HDL because the cholesterol ester is being transferred out of the HDL fraction, as well as a diminution in the size of the LDL particle because LDL becomes TG enriched, and this is converted by hepatic lipase to small, dense LDL⁶.

It is understood that management of dyslipidemia is of great challenge during treating diabetes mellitus cases. It has been mentioned that diabetes, in particular type 2 variety, affecting Bangladeshi people in an alarming rate. It is well understood that Bangladesh Diabetic Association (BADAS) is involved in delivering diabetes care through its central institute in and around Dhaka city. BADAS has taken up policies to train physicians for diabetes management at the same time patients are encouraged to seek medical advices from their nearest available facilities.

Community Based Medical College Hospital is situated on the outskirts of Mymensingh and serving reasonably huge number of population in the area. In the last year the hospital served a total number of 72452 patients in the out-patient department. The hospital runs an out-patient diabetes clinic. About 12 diabetes patients daily visit the diabetes OPD.

Since optimum management of diabetes is the prime to achieve lipid levels within the target of the diabetic patients to arrest or at least delay related complications the present study was undertaken to evaluate its status among the patients receiving diabetes care in the CBMC Hospital out-patient department.

Methods

A cross-sectional study was conducted among one hundred and twenty nine type 2 diabetic patients, age range 37-65 years who were purposively selected from the Out-patient department, Community Based Medical College Hospital from 05.06.12 to 31.12.12.

Nature and purpose of the study was briefed and written consent obtained from the voluntarily consenting patients. Overnight (8-10 hours) fasting blood samples were collected in the Biochemistry Laboratory, Community Based Medical College between 8.30 - 9.30 am. Samples were allowed to clot and serum prepared by centrifugation at 3000 rpm for 10 minutes. Biochemical analyses were performed using Analyzer Evolution 3000 on the same day.

Glucose was measured by glucose-oxidase (GOD-PAP) method. Total cholesterol, triglyceride and HDL-cholesterol were measured by CHOD-PAP, GPO-PAP and precipitation methods respectively. LDL-cholesterol was calculated by Friedewald formula.

The data were managed using Statistical Package for Social Science (SPSS) for Windows version 10. All the values were expressed as mean $\pm$ SD. Correlation of lipid levels with fasting glucose was calculated. P value <0.05 was considered as level of significance.

Results

Out of 129 T2DM cases, 88 (68.2%) were male and 41 (31.8%) were female. Mean ($\pm$ SD) age of the patients were 51.9 $\pm$ 15.1 years. Male and female patients were of comparable age (51.9 $\pm$ 15.9 vs 50.8 $\pm$ 14.2, p=ns). Mean ($\pm$ SD) fasting blood glucose (FBG) of all subjects was 7.45 $\pm$ 2.71 mmol/l. In case of male the value was 7.04 $\pm$ 2.36 and female 8.33 $\pm$ 3.20 (p=ns) (Table 1).

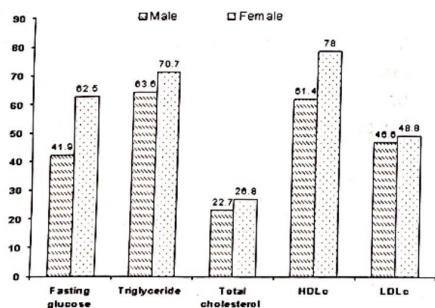
Table 1: Age and biochemical characteristics of the study subjects

Variables	Total (n=129)	Male (n=88)	Female (n=41)
Age (yrs)	51.9±15.1	51.9±15.9	50.8±14.2
Fasting glucose (mmol/l)	7.45±2.71	7.04±2.36	8.33±3.20
Total cholesterol (mg/dl)	173±45	170±44	180±46*
Triglyceride (mg/dl)	182±94	168±71	213±125*
HDL-c (mg/dl)	39.6±14.4	38.8±13.7	41.2±15.4
LDL-c (mg/dl)	96.3±42.8	97.5±40.9	92.4±46.3

Data were expressed as mean±SD. Unpaired Student's-'t' test was performed to calculate statistical significant difference between groups. $P<0.05$ was taken as level of significance.

Mean (±SD) of total cholesterol and triglyceride of the total study subjects were 173±45 mg/dl and 182±94 mg/dl respectively. These two variables in the female subjects were significantly higher compared to the male counterpart (Table 1). Mean (±SD) of HDL-c and LDL-c for the total patients were 39.6±14.4 and 96.3±42.8 respectively. Between male and female patients HDL-c and LDL-c did not show significant difference.

About 71% and 78.0% female subjects had triglyceride and HDL-cholesterol abnormality which, however, did not show significant difference with 63.3% and 61.4% respectively among their male counterpart (Figure 1).

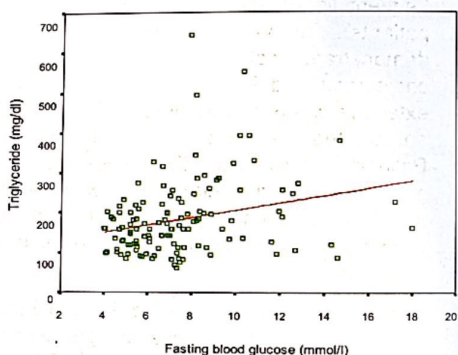
**Figure 1: Proportion of male and female subjects with abnormal lipid levels.**

Fasting glucose level showed significant positive correlation with triglyceride among total and male study subjects ($p=0.003$ for

both) (Table 2). Regression between fasting glucose and triglyceride is shown in figure 2. In case of total cholesterol significant positive association was among total and female subjects ($p=0.005$ and 0.007 respectively) (Table 2). HDL and LDL cholesterol did not show statistical significant association in any of the situation.

Table 2: Correlation analysis of fasting glucose with lipid levels in the study subjects

Variables	Total <i>r/p value</i>	Male <i>r/p value</i>	Female <i>r/p value</i>
Triglyceride	0.260/0.003	0.316/0.003	0.143/0.379
Total cholesterol	0.240/0.007	0.089/0.413	0.439/0.005
HDL-c	-0.089/0.322	-0.096/0.381	-0.137/0.400
LDL-c	0.110/0.219	0.021/0.850	0.283/0.077

**Figure 2: Regression analysis between fasting glucose and triglyceride of the study subjects**

Discussion

Despite advances made in the prevention and management of cardiovascular disease, people with diabetes mellitus continue to have alarmingly high morbidity and mortality secondary to cardiovascular disease⁵. Relatively poor glycemic control as revealed by fasting glucose level (7.45±2.71 mmol/l) and dyslipidemia in proportion among all the study subjects both in male and female.

Hypertriglyceridemia in diabetes mellitus causes coronary artery disease (CAD). A meta-analysis involving 17 population-based prospective studies showed plasma TG levels is associated with increased risk for CAD both in men and women, after adjustment for HDL cholesterol and other risk factors⁷.

Copenhagen City Heart Study demonstrated association between non fasting TG levels with myocardial infarction, ischemic heart disease, and death after adjustment for age, total cholesterol, BMI, hypertension, diabetes, smoking, alcohol consumption, physical inactivity, lipid-lowering therapy, postmenopausal status, and hormone therapy in women. The effect of postprandial hypertriglyceridemia is independent of and cumulative to the effect of hyperglycemia on endothelial function⁸.

The association between reduced HDLc levels and increased risk of heart disease is well established, independently of TG levels. In fact, the low HDL cholesterol is the most frequent lipoprotein abnormality in coronary patients⁹. Intravascular ultrasound studies demonstrate that patients with low HDL cholesterol and high TG levels have more extensive coronary atheromas than those with an isolated elevation of LDL cholesterol¹⁰. Patients with reduced HDL cholesterol levels show intima-media thickness¹¹, while a high level of HDL cholesterol reduced plaque growth in subjects with preexisting atherosclerosis¹².

The UK Prospective Diabetes Study (UKPDS) established the importance of tight glycemic control in patients with diabetes¹³. Efforts to reduce cardiovascular morbidity and mortality in people with diabetes have therefore focused on overall or global risk factor management, including weight loss and increased physical activity, tight control of blood pressure and blood glucose, and intensive management of diabetic dyslipidemia. The typical lipid disorder in patients with diabetes, diabetic dyslipidemia, is characterized by elevated triglycerides, low levels of HDL cholesterol, and increased numbers of small, dense LDL particles^{14,15}.

In the Framingham Heart Study, 13% of men and 24% of women with diabetes mellitus had increased total plasma cholesterol levels, compared with 14% of men and 21% of women without diabetes mellitus. The prevalence of high LDL cholesterol levels in men and women with diabetes mellitus (9%

and 15%, respectively) did not differ significantly from the rates in nondiabetic men and women (11% and 16%, respectively). The prevalence of low HDL cholesterol level in those with diabetes mellitus was almost twice as high as the prevalence in nondiabetic individuals (21% versus 12% in men and 25% versus 10% in women respectively). Thus, both men and women with diabetes had an increased prevalence of hypertriglyceridemia and low HDL cholesterol levels, but their total cholesterol and LDL cholesterol levels did not differ from those in non-diabetic counterparts¹⁶. A similar pattern of altered plasma lipid profiles was observed in the UKPDS¹⁷. In the present study nearly 70% of the study subjects had fasting hypertriglyceridemia, 25% hypercholesterolemia which appeared to be relatively higher compared to the reported studies^{16,17}. It is interesting to note that about 75% of them had lower HDL-c and 50% high LDL-c. One of the notable weaknesses of the study is failure to collect data about duration of diabetes and any episodes of cardiac events in the past. The dyslipidemia of the diabetic cases was not compared with any healthy control group. It would be interesting to follow up these patients and look into the relationship of dyslipidemia with plausible complications.

Conclusions

The data of the present study concluded that (i) relatively large number of diabetic patients are having dyslipidemia of either component or in combination; and (ii) attention needs to be paid to address this issue of dyslipidemia and circumvent the plausible risk for coronary artery and atherosclerotic disease of these subjects.

Acknowledgement

The authors respectfully acknowledge the voluntary participation of the diabetic patients. Without their participation the study would have not been possible.

References

1. IDF Diabetes Atlas. 5th Edition 2012 Update. International Diabetes Federation 2012.
2. Kannel, William B, McGee DL. Diabetes and cardiovascular disease: A Framingham study. *JAMA* 1979; 241: 2035-2038.
3. Ginsberg HN, Tuck C. Diabetes and dyslipidemia. *Heart Fail Monit* 2001; 2: 14-20.
4. Yoshino G, Hirano T, Kazumi T. Dyslipidemia in diabetes mellitus. *Diabetes Res Clin Pract* 1996; 33:1-14.
5. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. *Nature Clin Pract Endocrinol Metab* 2009; 5: 150-159.
6. Goldberg IJ. Diabetic Dyslipidemia: Causes and Consequences. *J Clin Endocrinol Metab* 2001; 86: 965-971.
7. Hokanson JE, Austin MA.: Plasma triglyceride level is a risk factor for cardiovascular disease independent of high-density lipoprotein cholesterol level: a meta-analysis of population-based prospective studies. *J Cardiovasc Risk* 1996; 3: 213-219.
8. Nordestgaard BG, Benn M, Schnohr P, Tybjaerg-Hansen A.: Nonfasting triglycerides and risk of myocardial infarction, ischemic heart disease, and death in men and women. *JAMA* 2007; 98: 299-308.
9. Genest JJ, McNamara JR, Salem DN, Schaefer EJ.: Prevalence of risk factors in men with premature coronary artery disease. *Am J Cardiol* 1991; 67: 1185-1199.
10. Hausmann D, Johnson JA, Sudhir K, Mullen WL, Friedrich G, Fitzgerald PJ et al. Angiographically silent atherosclerosis detected by intravascular ultrasound in patients with familial hypercholesterolemia and familial combined hyperlipidemia: correlation with high density lipoproteins. *J Am Coll Cardiol* 1996; 27: 1562- 1570.
11. Baldassarre D, Amato M, Pustina L, Tremoli E, Sirtori CR, Calabresi L, Franceschini G.: Increased carotid artery intima-media thickness in subjects with primary hypoalphalipoproteinemia. *Arterioscler Thromb Vasc Biol* 2002; 22: 317-322.
12. Johnsen SH, Mathiesen EB, Fosse E, Joakimsen O, Stensland-Bugge E, Njølstad I, Arnesen E.: Elevated high-density lipoprotein cholesterol levels are protective against plaque progression: a follow-up study of 1952 persons with carotid atherosclerosis: the Tromsø Study. *Circulation* 2005; 112: 498-504.
13. Turner RC, Millns H, Neil HAW, Stratton IM, Manley SE, Matthews DR, Holman RR, for the U.K. Prospective Diabetes Study Group: Risk factors for coronary artery disease in non-insulin dependent diabetes mellitus (UKPDS: 23). *BMJ* 1998; 316:823 -828.
14. American Diabetes Association: Standards of medical care in diabetes. *Diabetes Care* 2007; 30 (Suppl 1): S4 -S41,
15. The Expert Panel: 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): final report. *Circulation* 2002; 106: 3143-3421.
16. Kannel WB. Lipids, diabetes, and coronary heart disease: insights from the Framingham Study. *Am Heart J* 1985; 110: 1100-1107.
17. UK Prospective Diabetes Study 27. Plasma lipids and lipoproteins at diagnosis of NIDDM by age and sex. *Diabetes Care* 1997; 20: 1683-1687.