Analysis of the risk of cardiovascular diseases among people with diabetes according to triglyceride level

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ABSTRACT

The low percentage of high-density lipoprotein-cholesterol (HDL-C) is strongly accompanied with cardiovascular diseases (CVD) where female are at higher risk than male and are the most dangerous reason of a disease called type 2 diabetes mellitus (T2DM). Although the relationship between gender-specific HDL-C / LDL-C level and T2DM is difficult to understand, however, it is suspected to be linked. To determine the HDL-C and LDL-C ratios among males and females with T2DM subjects, a study was conducted in the Department of Biochemistry Laboratory of BUHS general hospital, Mirpur, Dhaka, Bangladesh from July 2018 to November 2018 among 60 T2DM patients consisting of 30 males and 30 females. Study subjects with ages ranging from 35-65 were included in this study. Serum glucose and lipid profile was analyzed by enzymatic colorimetric method. Among the glycemic profile, the fasting serum glucose levels and 2 h after breakfast (ABF) glucose levels in male and female subjects were measured. The total serum cholesterol was significantly higher in the subject of females T2DM patient compared to male T2DM subjects (p=0.043). However, HDL-C and LDL-C did not show any significant difference between male and female T2DM subjects. In conclusion, our results show hypercholesterolemia among female T2DM subjects compared to male counterparts who might have higher risk of cardiovascular diseases.

INTRODUCTION

The prevalence of diabetes mellitus is overgrowing; around 34 million people in US are living with diabetes [1]. The most prevalent form of heart diseases in individuals with diabetes is coronary heart disease [2]. The type 2 diabetes mellitus (T2DM) is a known cause in the progression of cardiovascular diseases (CVDs). It is naturally associated with some atopic disorders, including low triglyceride levels, high LDL-C, hypertriglyceridemia, and low HDL-C [3-5]. Although the risk of CVDs are relatively higher in T2DM male, it is more common in T2DM female when compared with non-diabetes women [6-9].

Several new studies have shown that female with diabetes are more likely to have CVDs than male who might have higher risk of death [10, 8]. However,

women with type-2 diabetes have estrogen scarcity compared with non-diabetic women and decline in estrogen level is one of the major causes of CVDs in the female with diabetes. Moreover, other additional factors including higher level of triglyceride cholesterol, obesity, dyslipidemia, decreased level of HDL are also associated with CVDs [11-13].

Several intensive studies have shown the beneficial impact of lowering LDL-C in the prevention of both primary and secondary CVDs with T2DM treatment [14, 9]. Triglycerides levels may undoubtedly play a role, however, it is not only responsible for CVDs in subjects with T2DM [15]. HDL helps prevent cardiovascular disorders, including atherosclerosis and low levels of HDL-C is the most prominent risk factor of CVDs [16]. Besides, low concentrations of HDL may increase the risk of evolving T2DM through

insulin resistance and lowering the function of the β cell of the pancreas [17]. Thus, increasing plasma HDL cholesterol to reduce the risk of type 2 diabetes has been suggested as a unique therapeutic option although the levels of HDL cholesterol associated with type 2 diabetes are virtually unknown [18, 19].

Recently, some works are denoting the relationship among the higher level of triglyceride levels, decreased HDL cholesterol levels, a higher proportion of smaller and denser LDL particles, with diabetics [20]. Therefore, it is becoming more important for male and female to explain the risk factors and clinical manifestations individually to develop separate drugs to get better treatment outcome [21]. So, several works are considering in this regards. The purpose of this study is to determine the level of lipidemic status among T2DM subjects and HDL-C and LDL-C levels between male T2DM and female T2DM.

MATERIALS AND METHODS

T2DM subjects

It was an observational study where a total of 60 T2DM subjects comprising 30 males and 30 females with ages ranging from 35-65 were recruited from outpatient department (OPD) of Bangladesh University of Health Sciences (BUHS) general hospital. The study was conducted in the Department of Biochemistry Laboratory of BUHS general hospital, Mirpur, Dhaka, Bangladesh from July 2018 to November 2018.

Our study was approved by the ethical review board of the Institute of Biological Sciences of the University of Rajshahi, Bangladesh under the certificate number of 255(14)/320IAMEBBC/IBSc. Informed written consents were obtained from all patients enrolled in this study.

Laboratory technique for blood examination

Glucose Oxidase (GOD-PAP) method was used to calculate serum glucose level, serum total cholesterol, and serum high density lipoprotein cholesterol (HDL-C) was measured by enzymatic colourimetric (CHOD-PAP) method using commercially available reagents (T-CHO KL for total cholesterol, Sysmex Co., Hyogo, Japan; Pureauto S TG-N and Cholestest N HDL, respectively, for Serum triglyceride and HDL-C, Sekisui Medical Co., Tokyo, Japan). Serum low density

lipoprotein cholesterol (LDL-C) was calculated by the Friedwald formula [22]. Briefly, the original plasma samples had been obtained 12 to 14 h after the last meal, mixed with EDTA (1mg/ml), and immediately stored at 4°C until analyzed. Total plasma cholesterol and tri-glycerides were measured, and data on HDL-C, and LDL-C obtained by a combination of ultracentrifugation and precipitation procedures. All tests analysis were done by using a clinical chemistry analyzer (Dimension RxLsiemens, USA).

Statistical analysis

Statistical analysis was done using MS Excel for graph representation and SPSS 17.0 for the value of mean ± SD. A P value<0.05 was considered as statistically significant.

RESULTS

Glycemic status of the total study subjects

Table 1 showed the glycemic status of the total study subjects of T2DM. Among glycemic profile, mean (±SD) fasting and postprandial serum glucose of the total study subjects were 9.55±3.88 and 13.21±4.91, respectively, indicating in diabetic patients' postprandial serum glucose level remain higher.

Table 1. Glycemic status of the total study subjects.

Parameters	T2DM subjects	Normal [32]
Fasting blood glucose (mmol/l)	9.55±3.88	5.6
2 h after breakfast (mmol/l)	13.21±4.91	7.8

Results were expressed as mean ± SD; n=60 subjects.

Lipidemic profile of the total study subjects

Table 2 showed the lipidemic status of the total study subjects of T2DM. Among the lipidemic status, mean (±SD) of HDL-C, LDL-C, total cholesterol, triglyceride, and the ratio of HDL- C and LDL-C of the total study subjects were 41.08±11.53, 126.45±38.82, 203.92±45.34, 221.15±203.06, and 0.35±0.14, respectively. Closer scrutiny of these results revealed that most such patients had very high plasma triglyceride concentrations.

Table 2. Lipidemic profile of the total study subjects.

Parameters	T2DM subjects
HDL-C (mg/dl)	41.08±11.53
LDL-C (mg/dl)	126.45±38.82
Total cholesterol (mg/dl)	203.92±45.34
Triglyceride (mg/dl)	221.15±203.06
HDL-C/LDL-C	0.35±0.14

Results were expressed as mean ± SD; n = 60 subjects.

Glycemic and lipidemic status among male and female T2DM subjects

Table 3 showed the comparison of glycemic and lipidemic status among male and female T2DM subjects. Among the glycemic profile, the fasting serum glucose levels in male and female subjects were 10.44±3.94 and 6.25±0.53, respectively. Whereas, the 2 h ABF serum glucose levels in male and female subjects were 13.61±5.43 and 11.87±2.20, respectively. The results indicating that the fasting blood glucose in males were substantially higher than in females ($p<0.001$).

Table 3. Glycemic and lipidemic status among male and female T2DM subjects.

Parameters	Male subjects	Female subjects	t/p-value
Age (years)	44.26±13.63	41.0±7.94	1.115/0.127
Fasting blood glucose (mmol/l)	10.44±3.94	6.25±0.53	7.022/<0.001
2h after breakfast (mmol/l)	13.61±5.43	11.87±2.20	-1.474/0.864

Results were expressed as mean ± S.D.; n = 30 subjects

Lipidemic status among male and female T2DM subjects

Table 4 showed the lipidemic status among female and male T2DM subjects. In female T2DM subjects, the high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, total cholesterol, triglyceride, and HDL- C/LDL-C were 40.3±11.70, 128.11±38.03, 209.93±46.13, 238.20±224.34, and 0.33±0.13, respectively. Accordingly, in male counterparts, these values were 43.50±11, 121±42.29, 184.14±37.61, 165.14±92.29, and 0.39±0.14, respectively. Among lipidemic status, serum cholesterol was significantly

higher in the subject of T2DM male compared to the T2DM female (p = 0.043). However, the HDL-C and LDL-C does not show any significant difference between male and female T2DM subjects. Therefore, HDL-c and LDL-c level according to different age group would be effective for identifying risk status of CVDs.

Table 4. Lipidemic status among male and female T2DM subjects.

Parameters	Female subjects	Male subjects	t/p-value
HDL-C (mg/dl)	40.3±11.70	43.50±11	-0.924/0.365
LDL-C (mg/dl)	128.11±38.03	121±42.29	0.553/0.553
Total cholesterol (mg/dl)	209.93±46.13	184.14±37.61	2.125/0.043
Triglyceride (mg/dl)	238.20±224.34	165.14±92.29	1.773/0.825
HDL-C/LDL-C	0.33±0.13	0.39±0.14	-1.314/0.194

Results were expressed as mean ± S.D.; n = 30 subjects

DISCUSSION

People with diabetes have lately been considered as one of the critical triggers of heart failure, ischemic heart disease and others commonly called cardio vascular diseases. The cardiovascular diseases with higher triglycerides, low HDL cholesterol, and high-density LDL particles have recently been considered as a marker to characterize type 2 diabetes [23-25]. Although type 2 diabetes and CVDs are more common in male than in female, the female often have a higher risk of severe complications and death [26, 27]. The risk of cardiovascular diseases are slightly greater in diabetes patients than in non-diabetic one. Nevertheless, growing evidence suggests that the risk of developing coronary artery diseases (CADs) varies according to gender where female faces worse situation than male [28, 29]. For comparing cardiovascular diseases among people with diabetes in males and females, our recent work can provide valuable clues to researchers and policy makers for its effective management. The outcomes of the work indicated that fasting blood glucose was significantly higher in male compared to the female T2DM subjects, (p<0.001). The HDL-C, LDL-C, total cholesterol, triglyceride, and HDL- C/LDL-C were 40.30±11.70,

128.11±38.03, 209.93±46.13, 238.20±224.34 and 0.33±0.13 in female and 43.50±11, 121±42.29, 184.14±37.61, 165.14±92.29 and 0.39±0.14 in male, respectively. The average HDL-C/LDL-C was non-significantly higher in male T2DM relative to female T2DM.

The other researchers are supporting our findings. A narrative study, which involved a mixture of 37 possible trials, found that the relative risk of severe coronary heart diseases were more significant in female than in male with diabetes [8]. LDL management in diabetic patients considering age and gender evaluated that as a high level of LDL is related to CVDs [9].

Although the symptoms of diabetes is more or less similar in males and females, females become more susceptible to CVDs than males. Further findings showed that in the absence of diabetes, young female and middle-aged female appear to develop less CADs than men, however, in the presence of diabetes, there was not significant differences for the incidence of CADs between men and women [30]. Upon consideration of hypertension, BMI, smoking, HDL, and non-HDL cholesterol, and medicine use, the CADs hazard ratio differed significantly in non-diabetic men than that of women, however, differences was less in case of diabetic patients [30]. Therefore, management of triglyceride level is essential in patients with diabetics, especially in female due to having a higher level of LDL, triglycerides, and lower level of HDL. Modern drugs should launch considering risk factors associated with people with diabetes related CVD [31].

CONCLUSION

Increased levels of triglycerides and LDL in the female with diabetes and a decrease in HDL levels indicates that females are in more vulnerable conditions due to diabetes. So, the physicians should consider the goal of personalizing their therapeutic activities to be able to influence their gender-specific conditions, especially CVDs risk in T2DM individuals.

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AUTHOR CONTRIBUTIONS

MMO, I.A.H., M.N.M.; Conceptualization. MMO, I.A.H., M.N.M.; Methodology. I.A.H., M.N.M.; Investigation. MMO, SI, M.R.C.; Writing-original draft preparation. MMO, M.R.C., SI, M.N.M.; Writing-review and editing. MMO, M.R.C., SI; Manuscript revision. I.A.H., M.N.M.; Supervision. All authors read and approve the final version of the article.

CONFLICTS OF INTEREST

There is no conflict of interest among the authors.

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