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Study on Serum Cholesterol in Female Type 2 Diabetes Mellitus Patients

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Abstract

The relationship between diabetes and cardiovascular risk is closely linked to dyslipidaemia, a condition where there is an abnormal amount of lipids (cholesterol, triglycerides, etc.) in blood. In female diabetic patients, understanding the lipid profile is essential due to the unique physiological and hormonal differences compared to males. A cross-sectional, descriptive study was carried out in the Department of Physiology, Mymensingh Medical College, Bangladesh, between July 2016 and June 2017, to see the cholesterol levels in type 2 diabetes mellitus female patients and compare with that of normal subjects. A total of 210 subjects were selected. They were grouped as control group (group-I) consisting of 70 healthy females of reproductive age, (21-45 years) and study group (group-II), which was again subdivided to group-IIA (70 diabetic females of reproductive age, 21-45 years) and group-IIB (70 diabetic females of post-menopausal age, 45-70 years). Estimation of serum cholesterol was done by enzymatic colorimetric method. The mean serum total cholesterol in group I, group IIA and group IIB were found 171.05±12.07 mg/dl, 217.75±36.87 mg/dl 239.28±48.01 mg/dl respectively. The difference between group I and group IIA was found statistically highly significant ($p<0.0001$). Similarly, the difference between group IIA and group IIB was also statistically significant ($p<0.05$). Our data suggests that serum total cholesterol observed in control group of normal healthy females was within normal physiological range. However, in type 2 diabetic females, both in reproductive age group and postmenopausal group, serum total cholesterol levels were found elevated.

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Introduction

Diabetes mellitus (DM) is one of the most common metabolic disorders of great impact worldwide.[1] It is one of the major global health problems, affecting 382 million people & accounting for 5.3 million deaths in 2013.[2] By 2035 the number of affected people is expected to increase to 592 million globally.[3] In the South Asian region, Bangladesh has the second largest number of adults with diabetes (5.1 million adults, 6.31%).[4] Dyslipidemia, hypertension and visceral adiposity are associated with diabetes mellitus, and these are the comorbid risk factors for developing chronic disease and cardiovascular disease.[5] Dyslipidemia has been known to be the most important risk factor for atherosclerosis and CVD irrespective of the presence of DM.[6] Insulin has substantial effects on vital steps regarding synthesis and metabolism of lipids and lipoproteins whereas lipids and lipoproteins are known to be deranged among individuals having DM which could be the reason why these individuals are at high risk of progressing into dyslipidemia.[7] Dyslipidemia is a crucial contributing entity to cardiovascular complications among patients of DM. Lipid abnormalities in DM might be depicted in the form of hypertriglyceridemia and decreased levels of high-density lipoprotein cholesterol (HDL-C).[8] Evidence showed that cholesterol was higher in type 2 diabetes mellitus, which may be the cause for increased incidence of coronary artery complications in type 2 diabetes.[9] Cholesterol

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is important to overall health, but when levels are too high, cholesterol can be harmful by contributing to narrowed and blocked arteries. Unfortunately, people with diabetes are more prone to having unhealthy high cholesterol levels, which contributes to cardiovascular disease.[9] Insulin has substantial effects on vital steps regarding synthesis and metabolism of lipids and lipoproteins whereas lipids and lipoproteins are known to be deranged among individuals having DM which could be the reason why these individuals are at high risk of progressing into dyslipidaemia.[10] Diabetes tends to lower good cholesterol level and raise triglyceride and bad cholesterol levels, which increase the risk of heart disease and stroke. This common condition is called diabetic dyslipidaemia.[11] Females with diabetes have a higher prevalence of abdominal obesity (women have greater subcutaneous fat storage capacity), increasing the risk of hypertension, a worse lipid profile and a more marked endothelial dysfunction than males.[12] The lipid profile in female diabetic patients is of particular interest because women with diabetes are at a higher risk of cardiovascular diseases than non-diabetic women.[13] Postmenopausal women tend to deteriorate lipid profile that becomes more atherogenic than their premenopausal counterpart.[14,15] After menopause, total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-c) usually increase, and these changes are accompanied by a decrease in high-density lipoprotein cholesterol (HDL-c) and an increase in triglycerides (TG) in blood.[16,17] Additionally, postmenopausal women experience changes in their lipid profile due to decreased oestrogen levels, which further elevates their cardiovascular risk. The interplay between diabetes and dyslipidaemia in females can be influenced by several factors, including hormonal fluctuations, obesity, physical activity levels, and the duration of diabetes. Looking at the importance, we proposed this study to see the cholesterol levels among type 2 diabetes mellitus female patients and compare with that of non-diabetic subjects.

Methods

This cross-sectional, descriptive study was carried out in the Department of Physiology, Mymensingh Medical College, Bangladesh, from July 2016 to June 2017. A total of 210 subjects participated in this study. Group-I (control group) consists of 70 apparently healthy women of reproductive age of 21-45 years of age. Group-II (study group) consists of 140 diabetic women – this group was again subdivided into two groups: Group IIA consists of 70 diabetic females of reproductive age group (21-45 years) and Group IIB consists of 70 diabetic females of post-menopausal age group (45-70 years). Patients <25 years and >70 years, underwent hysterectomy or receiving hormone replacement therapy, pregnant women, diagnosed case of hypothyroidism, Cushing's syndrome, polycystic ovary, or receiving antipsychotic drug or steroid, smokers and alcohol users, known case of cardiac disease, or systemic illness like tuberculosis, hepatitis, cancer, thalassemia, hemophilia, gastrointestinal bleeding and acute infectious conditions were excluded from the study. After selection the subjects were requested to attend the concerned center in the morning on a particular day. Under strict aseptic precaution about 3ml of venous blood was collected from antecubital vein by disposable syringe with a gentle pull and the blood was taken in a test tube labeled with name of subject,

with date and time of blood collection. Estimation of serum cholesterol was done by enzymatic colorimetric method. A comparison in serum cholesterol was done in between Group I and Group IIA and also in between Group IIA and Group IIB using unpaired Student's-t tests. A p-value <0.05 was considered as statistically significant. Data analyses were done by using Statistical Package for the Social Science (SPSS) software version 13.0 for Windows. This study obtained ethical clearance from the Ethical Review Committee of Mymensingh Medical College, Mymensingh, Bangladesh.

Results

The mean (±SD) of serum total cholesterol in group I, group IIA and group IIB were 171.05±12.07 mg/dl, 217.75±36.87 mg/dl 239.28±48.01 mg/dl respectively. According to the above results, serum total cholesterol observed in control group of normal healthy females was within normal physiological range. However, in type 2 diabetic females, both in reproductive age group and postmenopausal group, serum total cholesterol levels were found elevated (Table-I). The difference between group I and group IIA was found statistically highly significant (p<0.0001). Similarly, the difference between group IIA and group IIB was also statistically significant (p<0.05) (Table-II).

Table-I: Comparison of serum cholesterol between control and study groups

Biochemical parameters	Group-I (n=70) Mean ±SD	Group-IIA (n=70) Mean±SD	Group-IIB (n=70) Mean±SD
Serum cholesterol (mg/dl)	171.05± 12.07	217.75± 36.87	239.28± 48.01

Table-II: Statistical difference between the control group and study groups in serum total cholesterol levels

Groups	Mean difference	t value	Level of significance
Group I vs. Group IIA	46.7	-10.069***	p<0.0001
Group IIA vs. Group IIB	21.53	-2.946**	p<0.05

P value reached from unpaired Student's t-test; ***=highly significant, **=significant

Discussion

In our study, we investigated the changes in serum concentrations of total cholesterol, in type 2 diabetic persons compared with normal healthy persons. We found a significant change of serum total cholesterol concentration in study group than control group. Serum total cholesterol was found significantly increased in study group than in control group. Simonen *et al.* argued that serum total cholesterol showed stronger correlations in type 2 diabetes mellitus person than in normal healthy person.[18] Our results are consistent with their findings. Pasquali *et al.* found that serum cholesterol was significantly higher in post-menopausal women then reproductive women.[19] Our results are in congruence with their study findings. They also argued that the increased cholesterol level is linked to lack of oestrogen.[19] Evidence stated that premenopausal women tend to protect against coronary heart disease (CHD); however, this protection is gradually lost once they become postmenopausal.[20] Menopause appears to be associated with adverse changes in blood lipid profile. These changes may enhance the process of atherosclerosis and especially CHD[21], which is one of the major causes of disability and death in postmenopausal women.[22] A study done by

Shibata *et al.* suggested a strong association between female hormones and serum lipid metabolism.[23] Among female hormones, oestrogen has known beneficial effects on lipid metabolism; therefore, it must be taken into account.[24] However, Gliani *et al.* argued that gender does not play a significant role in diabetic dyslipidemia, as they found that serum total cholesterol increased in type 2 diabetes patients irrespective of gender.[25] Data from the United Kingdom Prospective Diabetes Study (UKPDS) also showed that type 2 DM patients had higher triglycerides and lower HDL-cholesterol as compared with nondiabetic individuals.[26]

Conclusion

To conclude, serum cholesterol is significantly increased in female type 2 diabetic patients in comparison to normal healthy individuals. The unique physiological aspects of women, particularly those related to hormonal changes, necessitate a targeted approach to treatment. Regular screening and timely intervention, coupled with lifestyle modifications, can significantly reduce the incidence of cardiovascular events in this population. As research continues to evolve, it is essential to integrate these findings into clinical practice to improve outcomes for female diabetic patients.

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