PATTERN OF LIPID PROFILE AMONG TYPE 2 DIABETIC PATIENTS

Nazia Elham[1] and Meerjady Sabrina Flora[2]

[1]Department of Community Medicine, Ibrahim Medical College, Dhaka;
[2]Department of Epidemiology, National Institute of Preventive and Social Medicine, Dhaka

Abstract

Diabetes mellitus is recognized as a serious global health problem and frequently associated with disabling and lifethreatening complications related to some modifiable risk factors. One of the modifiable factors is dyslipidemia. This study addressed the dyslipidemic status of 124 subjects with type 2 diabetes mellitus (T2DM) attending the outpatient department, Ibrahim General Hospital and Diabetic Care and Education Center Dhanmondi, Dhaka during the period from January to June 2010. The diagnosed diabetic subjects were interviewed and the biochemical investigation data were collected from record review. Three fourth of the respondents were female and majority (24.2%) of them were 46 to 50 years of age. Most of the respondents were graduates having neuclear families. The mean total cholesterol and triglyceride were found 181.7 ± 43.0 mg/dl and 161.0 ± 112.5 mg/dl respectively. According to NCEP ATP III (2001), 59.7% of the participants had high level of low density lipoproteins (LDL) and only 18% had desired level of high density lipoproteins (HDL). The mean ($\pm$SD) of LDL and HDL were 109.8 ± 37.0 mg/dl and 41.0 ± 7.9 mg/dl respectively. Men had elevated level of mean TG with wide variation (185.98 ± 179.56 mg/dl) than women (151.63 ± 72.16 mg/dl). The mean ($\pm$SD) of HDL was found lower in men than women (35.8 ± 6.3 vs. 42.9 ± 7.5 mg/dl, $p < 0.05$) though not significant. The study revealed that dyslipidemia (high TC, TG, LDL and low HDL) was prevalent among the T2DM subjects, which needs attention of equal importance to maintain within normal limit as with the control of hyperglycemia and hypertension.

Introduction

Diabetes mellitus (DM) is considered as a compound of complex metabolic syndrome and can lead to both micro and macrovascular complications.[1]

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The urban population in developing countries is projected to be double between 2000 and 2030 and the global prevalence of type 2 diabetes is expected to rise to double in 2025.[2] The prevalence of type 2 diabetes observed in Bangladesh in 1994-95 was 5.2% (rural 4.3%, urban 6.9%) and which increases to 11.2%(urban) and 6.8% (rural) in 2003-4.[3]

The long–term effects of diabetes mellitus include progressive development of the specific complications of retinopathy, nephropathy, and or neuropathy with risk of foot ulcers, amputation, and features of autonomic dysfunction. People with diabetes are also at increased risk of cardiovascular, peripheral vascular and cerebrovascular disease.[4]

In addition to poor glycemic control these complications are associated with some other risk factors, e.g., BMI more than 30 kg/m², smoking, untreated hypertension and dyslipidemia. Elevated level of LDL was shown as a relevant risk factor for

Address for Correspondence:
Dr. Nazia Elham, Lecturer, Department of Community Medicine, Ibrahim Medical College , 122 Kazi Nazrul Islam Avenue, Shahbagh, Dhaka, E-mail: naziaelham@yahoo.com

patients who have proliferative diabetic retinopathy.[5,6] The combination of blood pressure values in the high-normal range with moderately elevated levels of total cholesterol and hemoglobin A1c defines a high-risk group for the progression to diabetic nephropathy and for clinical events related to arteriosclerotic cardiovascular disease.[7]

Diabetic subjects have significantly higher cholesterol, triglycerides, LDL and significantly lower HDL cholesterol as compared to non diabetic subjects.[8] The plasma triglyceride levels are the metabolic markers most closely related to poor glycemic control and high levels of VLDL and LDL and with a low level of HDL are associated with poor glycemic control also.[2] High proportion of upper-body fat or abdominal fat, independent of overall obesity, is recognized as an important component in the insulin resistance linked to obesity and type 2 diabetes mellitus. [9]

Many studies regarding diabetes mellitus and its prevalence and risk factors have been done in Bangladesh, but studies explaining the distribution of lipid fractions among the diabetic patients, so far revealed, are very limited. The aim of the study was to provide information about the extent of dyslipidemia in the T2DM patients.

Materials and Methods

This cross sectional study was carried out on 124 already diagnosed adult type 2 diabetic patients attending the outpatient department of Ibrahim General Hospital and Diabetic care and education Center, Dhanmondi, Dhaka during the period from January to June 2010. Patients of both sexes aged 20-60 years and having lipid profile done within 3 months of the interview were purposively selected in the study.

Consent was taken from the respondents before data collection. Socio-demographic data including sex, age, residence, marital status, level of education, main occupation, average monthly income and family size were collected by face to face interview through pretested questionnaire. Data related to lipid profiles of the patients were taken from their diabetic book.

Desired and abnormal category of lipid profiles of the respondents was done by following cut off values according to the National Cholesterol Education Program guideline.

Total cholesterol, triglyceride and LDL were considered desirable or normal up to 200 mg/dl, 150 mg/dl and 100 mg/dl respectively. HDL $\leq$ 40 mg/dl for male and $\leq$ 50 mg/dl for female was considered low or abnormal.[10, 11]

The study was approved by the Ethical Committee of the National Institute of Preventive and Social Medicine.

Statistical analyses: Collected data were cleaned, edited and analyzed with the help of SPSS Windows version 11.5. Statistical comparisons between different groups were made using t-test, ANOVA for quantitative variables and Chi-square tests for qualitative variables. Correlation co-efficient was calculated to determine the association between quantitative variables. All the tests were 2 tailed and $p < 0.05$ was considered to be statistically significant.

Results

Socio-demographic characteristics of the respondents

Of the 124 participants, 27.4% were male 72.6% were female. The youngest respondent was 22 years old and the oldest one 60 years. The mean $\pm$ SD and median age of the respondents were 46.65 $\pm$ 8.62 years and 48 years, respectively. The age group of 46 to 50 years constituted the highest portion (24.2%) of the respondents, which was followed by the age group of 56 years and more (17.1%). Most of the respondents were Muslims (95.2%), resided in the urban area (95.2%). Rest of them lived in rural or semi-urban area. Regarding education, 41.1% were graduates and 7.2% were illiterate (table 1). About half the participants (49%) had an average monthly income ranging from BDT 31000 to Tk 50000.

Lipid profile of the respondent

Lipid profile data included total cholesterol (TC), triglyceride, LDL and HDL. About one-third of the diabetics were with high TG and less than one-third (27%) and more than half (59.7%) were with high total cholesterol (TC) and high LDL respectively. HDL was abnormal in more than 80% patients.

The association between socio-demographic characteristics and lipid profile were tested and presented in table 1. No gender influence on lipid profile was observed. Although, mean TC

Table 1: *Sociodemographic characteristics and mean lipid Profile*

Characteristics	N	Total Cholesterol Mean±SD	Triglyceride Mean±SD	LDL Mean±SD	HDL Mean±SD
Sex					
Male	34	175.86±45.12	185.98±179.56	107.45±37.66	35.83±6.27
Female	90	183.97±42.25	151.63±72.16	110.69±37.07	42.93±7.53
Age					
≤ 35	12	177.14±56.10	190.59±251.93	99.83±30.81	39.98±12.03
36 – 45	40	188.79±40.26	161.41±82.73	113.55±38.19	41.83±6.76
46 – 55	50	184.47±43.45	163.54±101.39	113.82±37.46	41.40±7.37
≥ 56	22	165.27±36.98	138.62±55.97	99.27±36.69	39.04±8.24
Education					
Illiterate	9	173.28±45.33	147.72±50.47	105.62±42.65	39.83±10.47
Secondary	31	181.82±41.40	151.44±55.95	116.52±42.11	40.35±5.97
Higher Secondary	33	184.18±44.59	144.63±89.39	113.36±35.79	41.35±8.63
Graduate	51	181.62±43.67	179.87±151.99	104.13±33.76	41.39±8.03
Occupation					
Service	13	165.25±38.57	142.14±137.93	94.95±30.08	37.68±7.01*
Business	20	183.76±46.93	187.81±157.07	105.95±38.14	38.60±7.79
Housewife	72	185.18±38.57	179.87±72.20	104.95±38.14	42.94±7.59
Income					
<11000	10	165.14±28.25	135.71±61.09	113.52±43.66	40.39±9.27*
11000-30000	33	170.70±44.94	168.63±90.64	100.03±41.44	37.64±6.01
30000-50000	61	190.10±39.93	155.52±118.57	115.89±31.77	42.38±8.53
>50000	20	182.79±50.85	178.07±145.18	105.49±40.21	42.56±6.29

*Significant ($p < 0.05$)
[Student's t test and ANOVA was done to see the statistical significance]

(183.97 ± 42.25 mg/dl), LDL (110.69 ± 37.07 mg/dl) and HDL (42.93 ± 7.53 mg/dl) was higher in females, only mean TG (185.98 ± 179.56 mg/dl) was higher in males. Mean TG was 151.63 ± 72.16 mg/dl in females and TC, LDL and HDL was 175.86 ± 45.12 mg/dl, 107.45 ± 37.66 mg/dl and 35.83 ± 6.27 mg/dl, respectively in males. But the difference was not statistically significant. [Table 1]

ANOVA was done to see the difference in lipid profile between different age groups but found insignificant. The Pearson's correlation coefficient between age and lipid profile also didn't show any significant relation.

On average, TC and LDL was higher in secondary and higher secondary passed respondents. Graduate respondents had highest mean TG (179.87 ± 151.99 mg/dl). But the difference was not statistically significant.

ANOVA was done to see the difference of lipid profile in different occupation. Mean TC and TG was highest among the businessmen. Housewives had highest mean HDL (42.82 ± 7.59 mg/dl). The differences in TC, TG and LDL was not statistically significant but the difference in HDL was statistically significant between housewives and respondents of other occupation ($F = 5.87$, $p < 0.05$).

None of the component of lipid profile was correlated with monthly income. Mean TC increased with income and mean HDL (42.56 ± 6.29 mg/dl) was highest in income group of Tk >50000. TC, TG and LDL was not significantly different but the difference in HDL was significant between income group of Tk 11000-30000 and Tk >50000 ($F = 3.067$, $p < 0.05$) [Table 2]. ANOVA was done to see the difference of lipid profile in different income group.

According to standard cut-off value the lipid profile data were categorized into normal and abnormal and the influence of socio-demographic status was tested.

Table 2: *Sociodemographic characteristics and percentage of dyslipidemia*

Characteristics	N	High Total Cholesterol n(%)	High Triglyceride n(%)	High LDL n(%)	Low HDL n(%)
Sex					
Male	34	9(26.5)	12(35.3)	19(55.9)	24(70.6)
Female	90	25(27.8)	32(35.6)	55(61.1)	77(85.6)
Age					
≤ 35	12	4(33.3)	3(25.0)	5(41.7)	8(66.7)
36 – 45	40	14(35.0)	16(40.0)	26(65.0)	33(82.5)
46 – 55	50	13(26.0)	20(40.0)	33(66.0)	42(84.0)
≥ 56	22	3(13.6)	5(22.7)	10 (45.5)	18(81.8)
Educational status					
Illiterate	9	2(22.2)	2(22.2)	3(33.3)	6(66.7)
Secondary passed	3	7(22.6)	14(45.2)	20(64.5)	29(93.5)
Higher Secondary passed	33	11(33.3)	11(33.3)	22 (66.7)	26(78.8)
Graduate	51	14(27.5)	17(33.3)	29 (56.9)	40 (78.4)
Main occupation					
Service	32	5(15.6)	8(25.0)	4(7.8)	40(78.4)
Business	20	8(40.0)	9(45.0)	4(21.5)	11(84.6)
Housewife	72	21(29.2)	27(37.5)	1(5.0)	14(70.0)
Income					
<11000	10	1(10.0)	3(30.0)	4(40.0)	7(70.0)
11000-30000	33	5(15.2)	14(42.4)	15(45.5)	29(87.9)
30000-50000	61	23(37.7)	21(34.4)	44(72.1)	49(80.3)
>50000	20	5(25.0)	6(30.0)	11(55.0)	16(80.0)

Chi-square test was done to see the influence of sociodemographic characteristics on the lipid profile of the respondents. TC and TG were within normal limit in most of males and females. LDL was high in higher percentage of females than males. Only a few of the respondents had desired HDL level, but double the proportion of males (29.4%) had desired HDL level than females (14.4%).

Respondents in the middle age group had more commonly high TC, TG and LDL level than other groups. Aged persons (>55 years) had lowest percentage of high cholesterol (13.6%) and high TG (22.7%). LDL were high in 41.7% of the youngest age group of <36 years and 45.5% of the oldest age group. Desired HDL level was observed in 33.3% of respondents of <36 years age. Other age groups included a few with desired HDL level. Chi-square test did not show any influence of age on lipid profile.

Among the all education group, higher secondary passed respondents had highest proportion (33.3%) of high cholesterol level. TG level was highest in secondary passed (45.2%) group among the all. More than half of the secondary passed, higher secondary passed and graduates had high LDL. Desired HDL level was in lowest proportion (6.5%) in secondary passed respondents.

Businessmen had highest percentage of high cholesterol (40%) and TG (45%) than the other groups. Service holders had highest percentage (57%) and housewives had lowest percentage (5%) of high LDL. Desired HDL level was observed highest in housewives (30.0%). Occupation had no significant influence on lipid profile. [Table 2]

Respondents having income less than Tk 11000 were with highest proportion of normal cholesterol (90%) and optimum HDL level (30%). High TG was in highest percentage (42.4%) in income group of Tk 11000-30000. Income group of Tk 30000-50000 had highest Proportion (72.1%) of abnormal LDL. Majority of the respondents had abnormal LDL and HDL level. Family size had no significant influence on Lipid Profile.

Discussion

This was a cross sectional study carried out among 124 diagnosed adult type 2 diabetic patients. Patients having diabetic complications were excluded from the study. Patients having severe physical and mental illness were also excluded from the study.

In this study type 2 diabetic patients aged 20 to 60 years were selected. The mean $\pm$ SD of age of the respondents was 46.65 ± 8.62 years and 40.3% respondents were of 46 to 55 age group. The study included higher proportion of females (72.6%) than males. Data were mostly collected at working hours which might be the reason for presence of high proportion of females in the study place. But in a study done by M. Sergio showed that diabetic male/female ratio was less than 1.[12]

Most of the respondents resided in the urban area (95.2%). This was due to purposive selection of study place, which was a diabetic hospital located in the center of the capital city Dhaka. So urban people naturally had more chance for being included in the study.

Most of the respondents were at least graduates (41.1%). Only 7.3% were illiterate. The selection of study place may be the reason of higher proportion of educated respondents.

Majority of the respondents were housewives (58.1%) as female subjects constituted three-fourth of the samples. Among the males the second highest group was service holders (25.8%) and 16.1% were business men.

Most of the respondents were of high income category because majority of them resided in affluent society. High income status explained overall higher educational status of the respondents.

In this study TC, TG, LDL and HDL data were collected from record and reviewed. A study done by Arora et al. shows that abnormal lipid profile is common in diabetic patients and is an important predictor for metabolic disturbence.[13] Therefore one of the important target for diabetes management is to keep lipid profile within normal limit. This study revealed that most of the respondents had total cholesterol and triglyceride within normal limit but majority had abnormal LDL (about 60%) and HDL (82%) level.

A study done in India by Smith and Lall reveals that diabetic males have significantly higher level of cholesterol.[14] But in this study, the influence of sex on lipid profile was not statistically significant. Another study shows that South Asian men and women had lower total cholesterol and a higher proportion of them also had lower HDL.[15]

Businessmen had highest mean cholesterol (40%) and TG (45%) among all occupation groups. Housewives had highest mean HDL (42.94 ± 7.59mg/dl). T. cholesterol, TG and LDL was not statistically significant but the difference of HDL was statistically significant between housewives and respondents of other occupation (F = 5.87, p < 0.05). This cannot be explained why the housewives had significantly higher level of HDL than other occupational groups. It may be due to less psychosocial stress or dietary habit or household physical activities or may have combined influence. The study had several limitations. Had this study included anthropometry and dietary intake it could have some chances to explain further. Probably due to small sample size associations of lipid fractions with age, sex, education, occupation and family-income could not be estimated. The study did not include the duration of diabetes which could also have influence on the interaction of the said socio-demographic characteristics. The other important limitation is that there were no reference values of lipid fractions for Bangladeshi population for valid comparison.

Conclusion

The study concludes that considering the NCEP-ATPIII dyslipidemia was prevalent among the T2DM subjects. Of the lipid fractions, Low HDL was found most common followed by high LDL. TC and TG were also found high but not so predominant as HDL and LDL. The study also revealed that dyslipidemia was found common irrespective of age, sex and social classes, indicating the importance of controlling dyslipidemia within recommended level as considered important for the controlling hypertension and hyperglycemia. A prospective cohort study may be undertaken to elucidate the abnormal level (cut-off) of lipid fractions that affects T2DM to develop complications.

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