International Journal of Community Medicine and Public Health
Siddiqui SRA et al. Int J Community Med Public Health. 2025 Jun;12(6):2470-2475
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20251683

Original Research Article

Association between duration of diabetes and fasting lipid profile in Bangladeshi type-2 diabetic patients: a series of hundred one cases

Syeda Rumman Aktar Siddiqui[1]*, Mohammad Zillur Rahman[2]

[1]Department of Biochemistry Chittagong Medical College, Chattogram, Bangladesh
[2]Department of Pathology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh

Received: 01 March 2025
Revised: 26 April 2025
Accepted: 02 May 2025

***Correspondence:**
Dr. Syeda Rumman Aktar Siddiqui,
E-mail: siddiquirumman@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Type 2 diabetes mellitus is a growing global health problem, with its prevalence rising significantly in developing nations. This chronic metabolic condition is characterized by persistent hyperglycemia and is strongly associated with dyslipidemia, a prime risk factor for cardiovascular diseases (CVD). The aim of this study was to evaluate the association of the length of type 2 diabetes with fasting lipid profiles of the type 2 diabetic patients.
Methods: This cross-sectional descriptive type of study was carried out at the Department of Laboratory Medicine, Epic Health Care Limited, in Chattogram, Bangladesh, from December 2023 to May 2024. A total of 101 type 2 medicated diabetic cases were employed in this study. The data were analyzed using Statistical Package for Social Sciences (SPSS), Version-23.0.
Results: A total of 101 type 2 medicated diabetic cases were employed in this study. The mean age of the patients was 50.11±11.87 years. The females constituted the majority 61 (60.6%). The average duration of diabetes of the participants was 8.46±6.12 years. A statistically significant association between HDL levels and the varying duration of type2 diabetes was observed (p=0.000) while the association between cholesterol, LDL, and triglycerides levels with varying duration of diabetes was not found statistically significant (P>0.05).
Conclusions: This study investigated a significant association between HDL levels and the varying duration of type2 diabetes while the association between cholesterol, LDL, and triglycerides levels with varying duration of diabetes was not found statistically significant.

Keywords: Association, Duration, Fasting, Lipid profile, Patients, Type 2 diabetes

INTRODUCTION

Type 2 diabetes mellitus is a growing global health problem, with its prevalence rising significantly in developing nations like Bangladesh. Prolonged hyperglycemia is a hallmark of this chronic metabolic disorder, which is closely linked to dyslipidemia, a significant risk factor for cardiovascular diseases (CVD).[1] Diabetic dyslipidemia typically manifests as elevated triglycerides (TG), decreased high-density lipoprotein cholesterol (HDL-C), and higher concentrations of small dense low-density lipoprotein cholesterol (LDL-C). These lipid abnormalities greatly contribute to the substantial burden of CVD, which remains the major cause of mortality among individuals with T2DM.[2,3] Lifestyle factors, including diet and physical activity, are closely linked to LDL cholesterol levels, related with metabolic syndrome.[4,5] The atherogenic potential of small LDL particles stems from their ability to infiltrate the arterial wall, making them prone to oxidation and indirectly

contributing to coronary artery disease.[6,7] Coronary artery disease encompasses a range of conditions, from angina pectoris, myocardial infarction, and sudden death to silent myocardial ischemia.[8] Silent myocardial ischemia is reported to occur in 10–20% of individuals with diabetes, compared to 1–4% in non-diabetic populations.[9] In Bangladesh, factors such as rapid urbanization, shifting dietary habits, and increasingly sedentary lifestyles have worsened the occurrence of both diabetes and dyslipidemia. Research prevails that the duration of diabetes significantly influences the development of fasting lipid profile abnormalities, as prolonged hyperglycemia and insulin resistance adversely affect lipid metabolism. Despite the rising prevalence of diabetes-related complications in Bangladesh, there is limited research exploring the connection between the duration of T2DM and fasting lipid profile changes.[10,11] This research sought to examine the relationship between the duration of T2DM and fasting lipid profile variations among Bangladeshi patients. By investigating this link, the study aims to shed light on the progression of metabolic disturbances in T2DM and emphasize the importance of early lipid management to mitigate long-term cardiovascular risks.[12]

METHODS

This cross-sectional analysis was conducted at the Department of Laboratory Medicine, Epic Health Care Limited, in Chattogram, Bangladesh, from December 2023 to May 2024. Informed agreement was obtained when the study volunteers were informed of the challenges and advantages of the research in their native tongue and a sequence of 101 type 2 diabetic cases of all ages and sexes who were recommended to Epic Health Care Limited for testing fasting lipid profile and serum plasma glucose level, were incorporated into this research on the basis of Cohen's effect size sampling technique for Chi-square test of independence, inclusion and exclusion criteria. Confirmed diagnosis of type 2 diabetes mellitus based on ADA (American Diabetes Association) criteria, Bangladeshi nationality, age between 30 and 70 years, duration of diabetes of at least 1 year and fasting blood sample available for complete lipid profile (total cholesterol, LDL, HDL, triglycerides) were included. Exclusion criteria were patients with type 1 diabetes mellitus, gestational diabetes, or secondary forms of diabetes. Patients taking lipid-lowering drugs (e.g., statins, fibrates) within the last 3 months. Pregnant or lactating women. Patients with chronic liver disease, renal failure, hypothyroidism, or other metabolic/endocrine disorders that may affect lipid metabolism. Blood samples were drawn of fasting and after meals to evaluate the t participants' lipid profiles and glycemic control. Venus blood sampling (Laboratory Methods) measured the postprandial serum glucose level, while glucose oxidase-pre-oxidase methods measured the fasting plasma glucose level. Enzymatic colorimetric techniques were utilized to test the parameters of the fasting lipid profile includes, total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C). The demographic data including duration of diabetic were collected through face-to-face interview using a pre-structured questionnaire and using a case record form (CRF), lipid profile parameters, fasting plasma glucose levels, and postprandial plasma glucose levels were gathered from test reports of medical records.

Inclusion criteria

Confirmed type-2 diabetic medicated cases. Age: patients of any age. Sex: patients of both sexes. Referred cases for testing fasting lipid profile.

Exclusion criteria

Non-diabetic cases, type-1 diabetic cases, non-medicated type-2 diabetic cases were excluded.

Statistical analysis

The collected data were processed and analyzed using Statistical Package for Social Sciences (SPSS), Version-23.0. Chi-square tests were applied to identify the association of duration of type2 diabetes with fasting lipid profile of the diabetic patients, where $p<0.05$ was set as the level of significance. Sample size calculation, inclusion and exclusion criteria were as follows:

Sample size calculation based on Cohen's effect size (w) for Chi-square test of independence:

The formula is:

$$N = \frac{(Z1 - \alpha/2 + Z1 - \beta)2}{W2}$$

Where:

N = required sample size

Significance level (α):0.05

Z1−α/2 = 1.96 (Z-score corresponding to significance level (α=0.05).

Z1−β = 0.84(Z-score corresponding to desired power (80%).

w = 0.3(Moderate effect size).

Plug in to the formula, the estimated sample size is

$$\frac{(1.96+0.84)^2}{(0.3)^2}$$

$$=87.1$$

Therefore, the required sample size is 88. But considering non-response and missing data 15% of total calculated sample size was increased:

88+ (88×0.15)

=101.2

Finally, the sample size rounded up into 101.

RESULTS

In all, 101 cases with type 2 diabetes were employed in this investigation. The patients' ages ranged from 25 to 77 years old, with an average age of 50.11±11.87 years, a median of 50 years, and a mode of 45 years. Regarding gender distribution, females constituted the majority, with 61 (60.6%) patients, compared to 40 (39.6%) males (Table 1).

Table-1: Distribution of the study patients by age and sex (n=101).

Age groups (years)	Frequency	
	N	(%)
25-34	8	7.9
35-44	25	24.8
45-54	31	30.7
55-64	19	18.8
65-74	16	15.8
≥ 75	2	1.98
Total	101	100
Mean age(years)	50.11±11.87	
Median	50	
Mode	45	
Range	25-77	
Sex		
Male	40	39.6
Female	61	60.6
Total	101	100

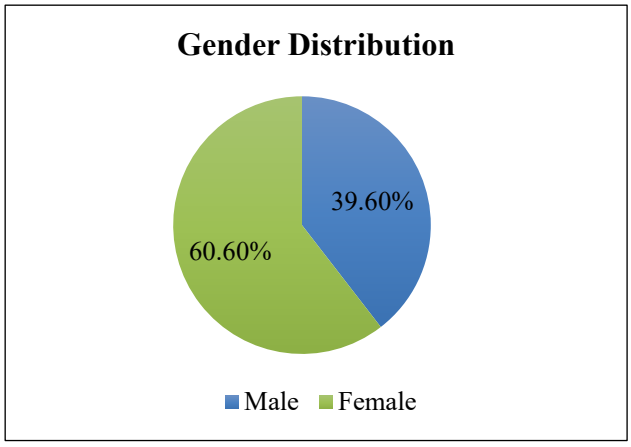

Figure 1: The gender distribution of the study patients (n=101).

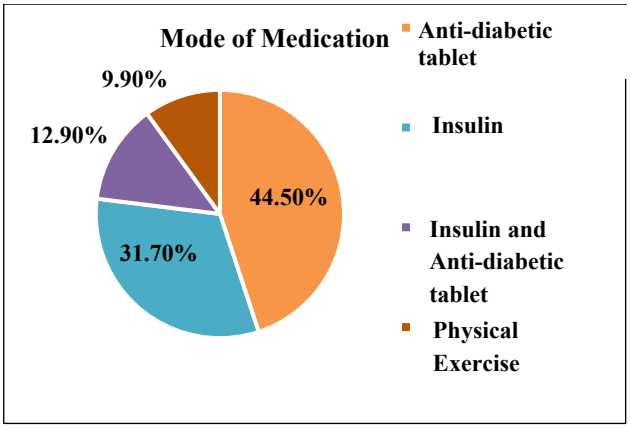

Figure 2: The distribution of mode of medication of the study patients (n=101).

Table 2: Distribution of the study patients by fasting serum plasma glucose (n=101).

Fasting plasma glucose level((mmol/l)	Frequency	
	N	%
3.9-5.5	44	43.6
5.6-6.9	12	11.9
7.0-10	27	26.7
10.1-15	14	13.9
≥ 15	4	4
Total	101	100
Mean fasting plasma glucose level (mmol/l)	10.53±4.59	

The majority, 46 (45.5%), were on anti-diabetic tablets, followed by 32 (31.7%) who were using insulin, 13 (12.9%), were on a combination of insulin and anti-diabetic. Additionally, 10 (9.9%) of the patients managed their condition through physical exercise alone (Figure 2). After two hours, the research participants' mean postprandial serum plasma glucose level was 13.51±5.21 mmol/l, demonstrating a wide range of glycemic control (Table 3).

Table 3: Distribution of the study patients by postprandial plasma glucose level (after 2- hours) (n=101).

	Frequency	
Postprandial plasma glucose level (after 2- hours) (mmol/l)	**N**	**(%)**
<7.8	13	12.9
7.8-11.0	26	26.7
11.1-15.0	25	24.8
15.1-20	22	21.8
≥ 20	15	14.85
Total	101	100
Mean postprandial plasma glucose level after 2- hour (mmol/l)	13.51±5.21	

The research participants had type-2 diabetes for an average of 8.46 ± 6.12 years, reflecting variability in the length of disease progression (Table 4).

Table 4: Distribution of duration of type-2 diabetes of the study patients (n=101).

Duration of type 2 diabetes (years)	Frequency	
	N	%
1-5	35	34.7
6-10	45	44.6
11-15	8	7.9
16-20	9	8.9
21-25	2	2
26-30	1	1
31-36	1	1
Total	101	100
Mean duration of type 2 diabetes (years)	8.46±6.12	

Among 101 type 2 diabetics patients, a desirable cholesterol level (<200 mg/dl) was observed in 60 (59.40%) patients, most frequently in those with a diabetes duration of 6–10 years (29, 28.71%), followed by 1–5 years (15, 14.85%), 16–20 years (7, 6.93%), 11–15 years (6, 5.94%), 21–25 years (2, 1.98%), and 31–36 years (1, 0.99%). Cholesterol levels of 200–239 mg/dl were recorded in 21 (20.79%) patients, primarily within 1–5 years (9, 8.91%) and 6–10 years (7, 6.93%), while levels ≥240 mg/dl were seen in 20 (19.80%) patients, mostly in 1–5 years (11, 10.89%). There was no significant correlation (P=0.223) between the duration of diabetes and cholesterol levels.74 patients (73.26%) had HDL values less than 40 mg/dl, mostly those with 6–10 years of diabetes (34, 33.66%), followed by those with 1–5 years (24, 23.79%), and lesser percentages in other durations. While only 3 (2.97%) individuals had HDL ≥60 mg/dl throughout a range of periods, 24 (23.76%) patients had HDL values of 40–59 mg/dl, mostly in those aged 1–5 years (11, 10.89%) and 6–10 years (10, 9.90%). There was a significant association (P=0.000) between HDL levels and the duration of diabetes. LDL levels <99 mg/dl were found in 46 (45.54%) patients, with the highest prevalence in 6–10 years (18, 17.82%) and 1–5 years (13, 12.87%). LDL levels of 100–129 mg/dl and 130–159 mg/dl were each observed in 24 (23.79%) patients, distributed mainly in shorter durations, while levels ≥160 mg/dl were noted in 7 (6.93%) patients, with a concentration in 1–5 and 6–10 years. There was no significant association seen between the duration of diabetes and LDL levels (P=0.557).34 (33.66%) individuals had triglyceride levels less than 150 mg/dl, mostly those who had diabetes for the duration of 6–10 years (17, 16.83%) and 1–5 years (7, 6.93%). There was no discernible pattern between durations, with 24 patients (23.79%) having levels between 150 and 199 mg/dL and 36 patients (35.64%) having levels between 200 and 499 mg/dl. Six (5.94%) individuals had levels ≥500 mg/dl, mostly during shorter time periods. Triglyceride levels and the length of diabetes did not statistically significantly associated (P=0.782) (Table 5). These results suggest that HDL levels and the length of type 2 diabetes are significantly associated, although there was no statistically significant association found between diabetes and the other fasting lipid profile components of cholesterol, LDL, and triglycerides.

Table 5: Association of duration of type2 diabetes with fasting lipid profile of the study patients (n=101).

Fasting lipid profile	Duration of type 2 diabetes (years)							Total N (%)	P value
	1-5 N (%)	6-10 N (%)	11-15 N (%)	16-20 N (%)	21-25 N (%)	26-30 N (%)	31-36 N (%)		
Cholesterol level (mg/dl)									
<200	15 (14.85)	29 (28.71)	6 (5.94)	7 (6.93)	2 (1.98)	0 (0.0)	1 (0.99)	60 (59.40)	0.223
200-239	9 (28.71)	7 (6.93)	2 (1.98)	2 (1.98)	0 (0.0)	1 (0.9)	0 (0.0)	21 (20.79)	
≥ 240	11 (10.89)	9 (8.91)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	20 (19.80)	
Total	35 (34.65)	45 (44.45)	8 (7.92)	9 (8.91)	2 (1.9)	1 (0.9)	1 (0.99)	101 (100)	
HDL level (mg/dl)									
<40	24 (23.79)	34 (33.66)	7 (6.93)	7 (6.93)	2 (1.9)	0 (0.0)	0 (0.0)	74 (73.26)	0.000
40-59	11 (10.89)	10 (9.90)	1 (0.99)	1 (0.99)	0 (0.0)	1 (0.9)	0 (0.0)	24 (23.76)	
≥ 60	0 (0.0)	1 (0.99)	0 (0.0)	1 (0.99)	0 (0.0)	0 (0.0)	1 (0.99)	3 (2.97)	
Total	35 (34.65)	45 (44.50)	8 (7.92)	9 (8.91)	2 (1.9)	1 (0.9)	1 (0.99)	101 (100)	
LDL level (mg/dl)									
<99	13 (12.87)	18 (17.82)	5 (4.95)	7 (6.93)	2 (1.9)	0 (0.0)	1 (0.99)	46 (45.54)	0.557
100-129	8 (7.92)	14 (13.86)	2 (1.98)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	24 (23.79)	
130-159	11 (10.89)	9 (8.91)	1 (0.99)	2 (1.98)	0 (0.0)	1 (0.9)	0 (0.0)	24 (23.79)	
≥160	3 (2.97)	4 (3.96)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (6.93)	
Total	35 (34.65)	45 (44.50)	8 (7.92)	9 (8.91)	2 (1.9)	1 (0.9)	1 (0.99)	101 (100)	

Continued.

Fasting lipid profile	Duration of type 2 diabetes (years)							Total N (%)	P value
	1-5 N (%)	6-10 N (%)	11-15 N (%)	16-20 N (%)	21-25 N (%)	26-30 N (%)	31-36 N (%)		
Triglycerides level (mg/dl)									
<150	7 (6.93)	17 (16.83)	3 (2.97)	3 (2.97)	2 (1.90)	1 (0.99)	1 (0.99)	34 (33.66)	
150-199	10 (9.90)	10 (9.90)	2 (1.98)	3 (2.79)	0 (0.0)	0 (0.0)	0 (0.0)	24 (23.79)	
200-499	16 (15.84)	15 (14.85)	2 (1.98)	3 (2.97)	0 (0.0)	0 (0.0)	0 (0.0)	36 (35.64)	0.782
≥ 500	2 (1.98)	3 (2.97)	1 (0.99)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (5.94)	
Total	35 (34.65)	45 (44.50)	8 (7.92)	7 (6.93)	2 (1.98)	1 (0.99)	1 (0.99)	101 (100)	

Chi-square tests were performed to assess the association of duration of type2 diabetes with fasting lipid profile of the tyope2 diabetic patients, where $p<0.05$ considered as the level of significance with 95% CI.

DISCUSSION

The observed results of this study demonstrated a statistically significant association between the length of type 2 diabetes mellitus and HDL levels among the observed patients (p=0.000), while no statistically significant relationship was noted for other fasting lipid profile components, such as cholesterol, LDL, and triglycerides(P>0.05). These results align with and expand upon existing literature regarding the relation between diabetes and lipid metabolism. Some recent researches have claimed that the prevalence of dyslipidemia in patients with T2DM, particularly the impact on HDL levels. Rai et al. (2022) investigated that Patients with diabetes had considerably lower HDL levels than those without the disease., suggesting a consistent association between diabetes and impaired lipid metabolism.[13] This study corroborates such findings, emphasizing the persistence of low HDL levels regardless of diabetes duration, which is a critical factor contributing to the increased cardiovascular risk in T2DM patients. In a similar vein, Nesto et al. (2003) found that low HDL is a major risk factor for cardiovascular disease and a defining feature of diabetic dyslipidemia.[14] The findings of this investigation reinforce this understanding, showing a statistically significant relation between the duration of type2 diabetes and HDL levels (p=0.000). This upholds the importance of early and ongoing interventions to manage HDL levels in diabetic patients. However, the lack of a significant association between the duration of serum plasma glucose and other fasting lipid profile components, such as cholesterol, LDL, and triglycerides, aligns with some additional research suggesting that these lipid markers may be more influenced by factors other than diabetes duration, including genetic predispositions, lifestyle, and glycemic control.[15] Further comparison with studies in Bangladesh provides additional context. According to a research conducted in Dhaka by Rahman et al. (2021), low HDL values were the most common anomaly among individuals with diabetes., consistent with the current findings.[16] Similarly, a study by Akter et al. (2020) observed that dyslipidemia, particularly low HDL and elevated triglycerides, was prevalent among Bangladeshi T2DM patients.[17] Moreover, Islam et al. (2022) in their study on Bangladeshi T2DM patients emphasized the prevalence of low HDL and its association with uncontrolled glycemic status, reinforcing the critical role of glycemic control in lipid metabolism.[18] The findings align with global trends and emphasize the unique challenges in South Asian populations where genetic predisposition and dietary habits exacerbate the risk of dyslipidemia in T2DM.[19] In this study, the subjects' mean fasting and postprandial serum plasma glucose 19 after two hours show worse than ideal glycemic control. It has been found that inadequate glycemic management aggravates lipid problems, particularly HDL and triglycerides, as noted in a study by Taskinen (2002), which emphasized the interplay between hyperglycemia and lipid metabolism in diabetes.[20] The predominance of low HDL levels across varying type 2 diabetes durations underscores the critical need for comprehensive lipid management strategies. Lifestyle modifications, such as diet and exercise, alongside pharmacological interventions targeting HDL levels, should be integral to diabetes care to mitigate cardiovascular disease risk. For more nuanced conclusions, future research should examine long-term changes in fasting lipid profiles and how they interact with glycemic management interventions.

Limitations of the study

The cross-sectional methodology is one of its drawbacks as it makes it impossible to determine a link between changes in fasting lipid profiles and the length of type 2 diabetes. The single-center design and small sample size (101 individuals) restrict how broadly the results may be applied. Therefore, a longitudinal study is recommended on a large scale to justify the results of this study.

CONCLUSION

This study investigated a significant association between HDL levels and the varying duration of type2 diabetes while the association between cholesterol, LDL, and triglycerides levels with varying duration of diabetes was not found statistically significant. The importance of proactive care of dyslipidemia in diabetic patients is highlighted by this study, which confirms the strong association between HDL levels and the length of type-2 diabetes. These results suggest that targeted lipid profile control may be the means of preventing cardiovascular problems in patients with type 2 diabetes.

Recommendations

Regular fasting lipid profile monitoring and early intervention techniques, especially for HDL control, are advised to treat dyslipidemia in patients with type 2 diabetes. Finally, a longitudinal study is recommended on a large scale to justify the results of this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Afsana F, Habib SH, Wahab N, Huda MK, Sayeed MA, Ali L. Dyslipidemia and cardiovascular risk factors in Bangladeshi type 2 diabetic patients. BMC Public Health. 2019;19:301.
2. Islam S, Majumder AK, Akhter T, et al. Prevalence of dyslipidemia and associated factors in type 2 diabetic patients in Bangladesh. Diabetes Metab Syndr Obes. 2021;14:3495–504.
3. Hussain A, Zafar Iqbal M, Hoque S, et al. Serum Fasting lipid profile and glycemic control in Bangladeshi patients with T2DM. PLOS Glob Public Health. 2022;2:e0000689.
4. Analava M, Bhattacharya D, Reys. Dietary influence on type 2 diabetes (NIDDM). J Hum Ecol. 2007;21:139–47.
5. Goldfine and Beckman. Life and death in Denmark: lessons about diabetes and coronary heart disease. Circulation. 2008;117:1914–7.
6. Kunsisto J, Mykknen L, Laakso M. NIDDM and its metabolic control predict coronary heart disease in elderly subjects. Diabetes. 1994;43:960–7.
7. Mozaffarian D, Martijn B, Alberto A, Mer J. Trans fatty acids and cardiovascular diseases. N Engl J Med. 2006;354:1601–13.
8. Ronald M, Krauss M. Lipids and lipoproteins in patients with type 2 diabetes. Diabetes Care. 2004;27:1496–504.
9. Azad Khan AK, Hussain A, Holmboe-Ottesen G, et al. Lipid profile abnormalities in rural Bangladeshi adults with diabetes. Int J Environ Res Public Health. 2018;15(9):1944.
10. Rahman T, Islam S, Ahmed T. Trends in lipid profiles among type 2 diabetes patients in Bangladesh. Front Endocrinol (Lausanne). 2021;12:663789.
11. Ali N, Akram R, Islam F, Karim MR, Alam F, Haque T. Association between lipid profiles and glycemic control in type 2 diabetes patients. PLoS One. 2020;15(5):e0234044.
12. Zaman MM, Rahman MM, Karim MN, Chowdhury SR, et al. The burden of cardiovascular disease associated with diabetes in Bangladesh. BMJ Open Diabetes Res Care. 2019;7:e000634.
13. Rai SK, Rai R, Mishra R, Shrestha B. Lipid profile abnormalities in type 2 diabetes mellitus patients in a tertiary care hospital in Nepal. J Diabetes Res. 2022;2022:756872.
14. Nesto RW. Lipid management in patients with type 2 diabetes. Am J Med. 2003;115(8A):29S–34S.
15. Goldberg IJ. Diabetic dyslipidemia: causes and consequences. J Clin Endocrinol Metab. 2001;86(3):965–71.
16. Rahman MM, Hasan MZ, Akter S. Dyslipidemia among patients with type 2 diabetes in Bangladesh: current prevalence and risk factors. Diabetes Metab Syndr Clin Res Rev. 2021;15(6):102274.
17. Akter S, Rahman MM, Abe SK, Sultana P. Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: a nationwide survey. Bull World Health Organ. 2020;98(4):217–27.
18. Islam MT, Khan MAR, Saha SK. Dyslipidemia and its correlates in type 2 diabetes mellitus: a study from Bangladesh. Diabetes Metab Syndr Clin Res Rev. 2022;16(6):102386.
19. Ahmad S, Islam SMS, Hossain MA. Lipid abnormalities in type 2 diabetes mellitus: evidence from South Asia. Int J Diabetes Dev Ctries. 2021;41(2):203–10.
20. Taskinen MR. Diabetic dyslipidemia: from basic research to clinical practice. Diabetologia. 2002;45(6):733–49.

Cite this article as: Siddiqui SRA, Rahman MZ. Association between duration of diabetes and fasting lipid profile in Bangladeshi type-2 diabetic patients: a series of hundred one cases. Int J Community Med Public Health 2025;12:2470-5.