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Original Article

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Long duration of diabetes is associated with inadequate glycemic control and lipid profile

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Abstract

***Background & Aims*:** Type 2 diabetes mellitus (T2DM) occurs due to insulin resistance causing improper glucose metabolism and hyperglycemic milieu producing micro and macro vascular complications. Regarding prevalence of diabetes, Saudi Arabia ranks 2nd highest in Middle East countries and 7th in the world. There could be several factors affecting the glycemic control in diabetes. We investigated the role of duration of diabetes in glycemic control and lipid profile of diabetics.

***Materials & Methods*:** This cross-sectional study recruited 267 T2DM patients presenting at a Primary Health Care center located in Al-Mansak area of Abha city of Saudi Arabia. Based upon the duration of diabetes patients were divided into group 1 (N = 88, diabetes duration ≤ 5 years), group 2 (N = 84, diabetes duration 5-10 years), and group 3 (N = 95, diabetes duration ≥ 15 years). Patient's' demographic data, glycemic control indicators like fasting blood glucose (FBS), random blood glucose (RBS), glycated hemoglobin (HbA_{1c}) levels, and lipid profile were recorded. Data was statistically analyzed using SPSS software version 20.

***Results*:** ANOVA showed that there were statistically significant differences in age, FBS, HbA_{1c}, total cholesterol (TC), LDL cholesterol (LDL-C), and triglycerides (TG) across the three groups. The association for the male gender was also significant. Duration of diabetes had a significant positive correlation with age, FBS, LDL-C, and triglyceride.

***Conclusion*:** Long duration of diabetes is associated with poor glycemic control and dyslipidemia. Diabetics especially those with long duration must be regularly followed up and monitored for glycemic control and lipid profile to prevent complications in the future.

***Keywords*:** Correlation, Diabetes Mellitus, Duration of Diabetes, Dyslipidemia, Glycemic Hba1c, Lipid Profile

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Introduction

Type 2 diabetes mellitus (T2DM) is a clinical condition which occurs due to insulin resistance, thereby causing improper glucose metabolism and leads to hyperglycemia. Diabetes is a chronic disease which progresses gradually and silently and most of the time, patients are not even aware that they are suffering from diabetes. The hyperglycemic milieu in the blood over a period of time brings about microvascular and macro vascular complications such as retinopathy, neuropathy, nephropathy, peripheral arterial disease, coronary artery disease, stroke, and diabetic foot. Moreover, the prevalence of diabetes is rapidly increasing all over the world. According to WHO as per the data of the year 2021, presently 537 million adults have diabetes on a global level. It is predicted that there will 643 million diabetics by year 2030 and 783 million by 2045 (1). The prevalence of T2DM is around 31% in Saudi Arabia (2) which is quite high. Besides this, Saudi Arabia is the 2nd highest country in the Middle East and ranks 7th in the world regarding the prevalence of diabetes (3). Diabetes can affect any individual of any age, gender, nationality,

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and socio-economic status. There can be several factors that can affect the glycemic control in diabetes. In this study, we wanted to investigate the effect of duration of diabetes on the glycemic control and lipid profile of diabetics.

Materials & Methods

The study was a cross-sectional study carried out in the year 2022. After taking the ethical permission from the scientific committee of research of our organization, an informed consent was taken from the patients for recruiting them in the study. In total, 267 known cases of T2DM patients were enrolled in the study who presented at a Primary Health Care center located in Al-Mansak area of the Abha city of Aseer province of Saudi Arabia. These patients were further divided into three groups. Group 1 (N = 88) included those patients whose duration of diabetes was ≤ 5 years, group 2 (N = 84) included those whose duration of diabetes was in the range of 5-10 years, and group 3 (N = 95) included those whose duration of diabetes was ≥ 15 years. Patients having a history of any other metabolic disorder were excluded from study to avoid confounding results. Patients of type 1 diabetes were also excluded from the study. All the patients' demographic data namely age, gender and body mass index (BMI) was collected. All the study patients' biochemical lab investigations at the time of enrolment in the study were also recorded to assess the status of their glycemic control and lipid profile. The glycemic control was assessed using indicators such as fasting blood glucose (FBS), random blood glucose (RBS), and glycated hemoglobin (HbA_{1c}) levels. The lipid profile assessment was done using indicators such as serum total cholesterol (TC), LDL cholesterol (LDL-C), HDL cholesterol (HDL-C), and triglycerides (TG). The data collected from the patients was compiled and statistically analyzed between the three groups.

Statistical Analysis:

The data was checked for normality. Parameters such as age, BMI, FBS, RBS, HbA1c, TC, LDL-C, HDL-C, and TG were found to be parametric and has been expressed as mean ± standard deviation (SD), and were compared across the three groups using one-way ANOVA test (Table 1). Data related to gender has been expressed as frequencies and has been analyzed using the Chi Square test (Table 1). Correlation analysis was further carried out to check the association of duration of diabetes with indicators of glycemic control and lipid profile using Pearson's correlation (Table 2). *P value* <0.05 has been considered significant. The statistical analysis was done using SPSS software version 20.

Results

The results of Table 1 show that when the three groups of patients having diabetes for different durations of time were compared with each other, it was found that there was a statistically significant difference in age (*P value* = 0.000), FBS (*P value* = 0.000), HbA_{1c} (*P value* = 0.037), TC (*P value* = 0.001), LDL-C (*P value* = 0.018), and triglycerides (*P value* = 0.000). However the difference was not statistically significant with regards to BMI, RBS and HDL. The association for the male gender was also significant (*P value* 0.036). Correlation analysis showed that duration of diabetes had a significant positive correlation with age (*P value* 0.000), FBS (*P value* 0.000), TC (*P value* 0.003), LDL-C (0.021), and triglyceride (0.010) as shown in table 2 and Figure 1.

Table 1. Comparison of demographic, glycemic and lipid profiles in type 2 diabetes according to duration of diabetes.

Variables	Group 1 (Duration of diabetes ≤ 5 years) N = 88	Group 2 (Duration of diabetes 5-10 years) N = 84	Group 3 (Duration of diabetes ≥ 15 years) N = 95	Pvalue
Age (years)	47.92 ± 11.17	56.88 ± 8.93	59.01 ± 12.25	0.000*
Gender				
Male	58/88 (66%)	50/84 (60%)	45/95 (47%)	0.036*
Female	30/88 (34%)	34/84 (40%)	50/95 (53%)	
BMI (kg/m^2)	30.09 ± 5.84	30.29 ± 4.81	29.07 ± 5.77	0.284
FBS (mg/dl)	178.15 ± 50.12	222.42 ± 61.69	222.34 ± 51.24	0.000*

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Variables	Group 1 (Duration of diabetes ≤ 5 years) N = 88	Group 2 (Duration of diabetes 5-10 years) N = 84	Group 3 (Duration of diabetes ≥ 15 years) N = 95	Pvalue
RBS (mg/dl)	295.33 ± 85.55	319.17 ± 74.85	307.51 ± 60.09	0.109
HbA1c (%)	10.24 ± 2.44	11.28 ± 2.69	10.71 ± 2.74	0.037*
Total cholesterol (mg/dl)	208.27 ± 55.86	226.45 ± 47.49	237.74 ± 58.61	0.001*
LDL-C (mg/dl)	116.63 ± 38.55	122.87 ± 36.41	132.19 ± 36.41	0.018*
HDL-C (mg/dl)	39.47 ± 10.60	35.29 ± 8.46	39.38 ± 16.90	0.225
TG (mg/dl)	172.71 ± 86.55	242.16 ± 104.86	243.55 ± 98.55	0.000*

* *P value* < 0.05 is statistically significant

Table 2. Correlation between duration of diabetes and biochemical profile.

Variables	Correlation coefficient (r)	*P value*
Duration of diabetes and age	0.5	0.000*
Duration of diabetes and FBS	0.3	0.000*
Duration of diabetes and RBS	0.1	0.168
Duration of diabetes and HbA1c	0.1	0.132
Duration of diabetes and total cholesterol	0.2	0.003*
Duration of diabetes and LDL cholesterol	0.2	0.021*
Duration of diabetes and HDL	0.1	0.442
Duration of diabetes and TG	0.2	0.010*

* *P value* < 0.05 is statistically significant

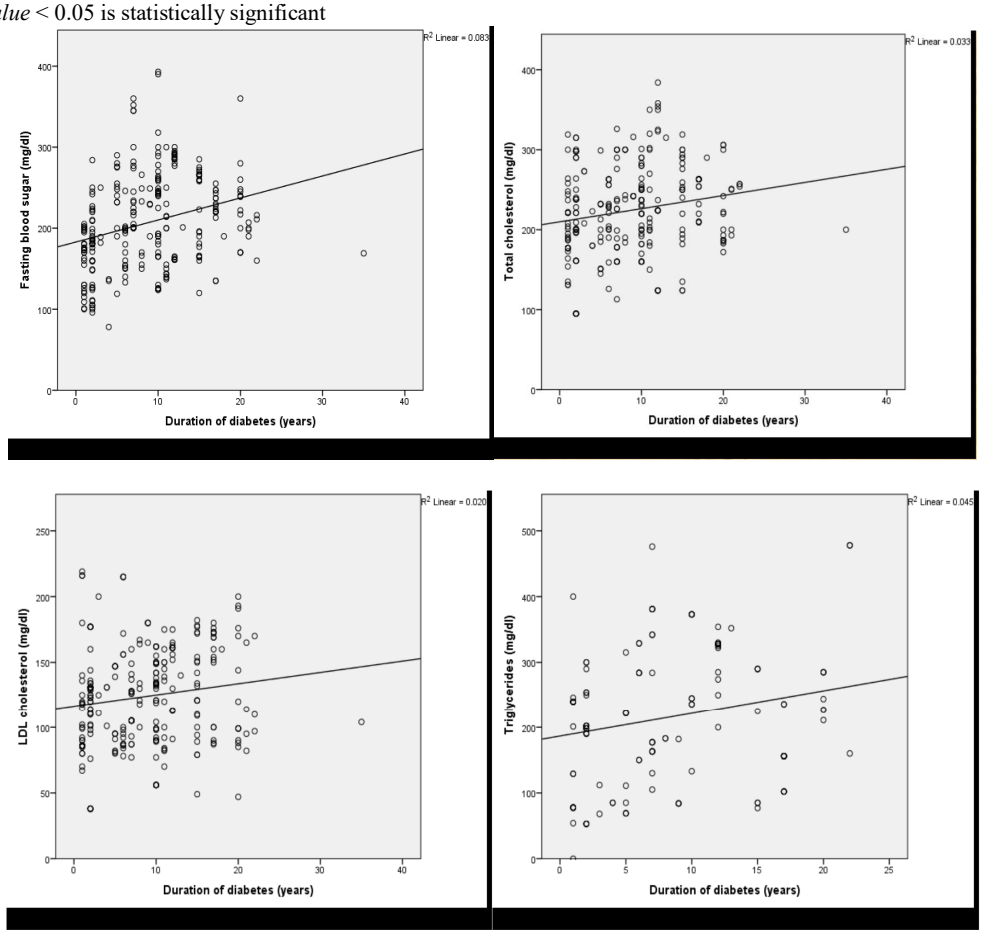

Fig. 1. Correlation between duration of diabetes and fasting blood sugar, total cholesterol, LDL cholesterol, triglycerides

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Discussion

In our study, it was found that the glycemic control in the three diabetic groups having diabetes durations of ≤ 5 years, 5-10 years, and > 10 years was significantly altered as reflected in their fasting blood glucose and HbA1c data. This means that as the chronicity of the disease increases, there is a tendency that the disease also progresses. We know from studies in literature, that though patients are prescribed anti-diabetic drugs yet the disease burden remains high due to poor follow-up (4) and improper compliance of patients towards the drugs (5). However, duration of disease also remains one of the contributing factors which is associated with poor glycemic control (6, 7).

In this study, the lipid profile analysis revealed that total cholesterol, LDL-C, and TG showed significant difference across the three groups. All the three study groups had a dyslipidemic profile (TC > 200 mg%, LDL-C > 100 mg%, HDL-C < 40 mg% and TG > 15 mg%), which warrants that patients of diabetes must be routinely screened and managed for dyslipidemia as well. It is known that hyperglycemic environment predisposes diabetes to dyslipidemia (8,9). Moreover, in this study it was found that duration significantly correlated with lipid profile parameters namely TC, LDL-C, and TG. To the best of our literature search, this is the first study which has found a correlation between duration of diabetes with TC, LDL-C, and TG.

Thus, patients of diabetes must not only be evaluated for their glycemic profile but also for their lipid profiles so that appropriate drugs or lifestyle management can be prescribed to them. Besides this, the patients who are diagnosed with diabetes must be counseled regarding the importance of a regular follow up to ensure proper drug compliance, review of medicines, dose adjustments, and evaluation of their clinical profile. A study has found that longer diabetes duration and poorer glycemic control were associated with elevated risks of CVD and mortality (10). A study has reported that diabetes with longer duration of diabetes also requires complex treatment regimens (11). Thus, it becomes essentially more important to give more dedicated attention to patients with long-standing diabetes as their management is not only complicated but also because of their standing at a higher risk for complications.

Conclusion

The longer duration of diabetes is associated with poor glycemic control and dyslipidemia. Patients of diabetes, especially those who have diabetes for long duration, must be regularly followed up for consistent monitoring of their glycemic control and lipid profile so that their drug regimen and doses can be reviewed and managed efficiently in order to prevent development of medical and surgical complications in the future. Beside of this importance for self-monitoring of glucose at home, dietary and lifestyle measures must be explained to the patients to further manage the disease effectively.

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Conflict of interest

The authors have no conflict of interest in this study.

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