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GLYCEMIC CONTROL AND BLOOD LIPID PARAMETERS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS IN KABUL CITY OF THE REPUBLIC AFGHANISTAN

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The purpose of this study was to evaluate glycemic control and its relationship with lipid parameters in patients with type 2 diabetes mellitus at the Noble Clinic OPD of Kabul-Afghanistan. The cross-sectional study involved 1486 patients with type 2 diabetes with at least 1 year of diabetes experience (897 women and 589 men) aged 18 years and older, who visited the clinic between March 2020 and April 2021.

7.7% of patients had adequate glycemic control (HbA1c less than 7%). High levels of H b A1c were statistically significantly associated with the duration of the disease and high levels of blood lipids, while no dependence was esTableished on the gender, age of patients, body mass index and the presence of obesity. It is necessary to study the factors that determine glycemic control, the correction of which will improve metabolic parameters and reduce the risk of developing complications in diabetes.

Keywords: type 2 diabetes mellitus, glycemic control, lipid profile, dyslipidemia, Afghanistan.

Introduction. Diabetes mellitus (DM) is a chronic disease often complicated by microvascular and macrovascular complications. According to the International Diabetes Federation (IDF), the global prevalence of diabetes among people aged 20–79 years in 2021 was estimated at 10.5% (537 million people) and is expected to rise to 12.2% (783 million people) in 2045. [9].

Maintaining optimal blood glucose concentrations helps prevent serious complications leading to disability, mortality, and decreased quality of life for patients [1]. Despite a large arsenal of drugs, insufficient glycemic control still remains a problem in real clinical practice [6; 12; 15]. Thus, according to a 2022 systematic review including 12 studies (5765 patients) with type 2 diabetes, the prevalence of insufficient glycemic control ranged from 45.2% to 93% [6]. A systematic review of 34 studies of patients with type 2 diabetes treated with insulin found that 76% of patients did not achieve good glycemic control [15].

The aim of the study was to evaluate glycemic control and its relationship with lipid parameters in patients with type 2 diabetes mellitus at the Noble Clinic OPD Kabul-Afghanistan.

Materials and methods. The article presents the results of a cross-sectional study conducted at the Noble Clinic OPD (NOPDC) in the Afghan capital Kabul. The study protocol was approved by the ethics committee of the Institutional Review Board of the Ethics and Research Committee of Kabul University of Medical Sciences, KUMS (RIB protocol number: 22 dated December 7, 2021). The study was conducted among 2000 patients with diabetes mellitus with at least one year of disease experience who visited the Noble Clinic OPD between March 2020 and April 2021. Of these, 514 were excluded due to failure to meet inclusion criteria or refusal to participate in the study. All participants signed informed voluntary consent to participate in the study.

Inclusion criteria: 1. An esTableished diagnosis of type 2 diabetes mellitus (according to the ADA criteria of the American Diabetes Association); 2. Men and women over 18 years of age.

Exclusion criteria: 1. Patients in serious condition; 2. Pregnant women; 3. Patients with other types of diabetes; 4. Patients who refused to participate in the study.

The following information was extracted from outpatient records: gender, age, laboratory data (total cholesterol (TC), triglycerides, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL), very low-density lipoprotein cholesterol (VLDL), glycated hemoglobin (HbA 1c), fasting glucose); height, body weight, diabetes experience. All patients took lipid-lowering drugs.

Fasting blood samples were collected by a trained technician using standard lipid measurement methods. Height and weight were measured at the time of enrolment by two well-trained technicians.

The target levels were taken to be an HbA1c level of less than 7.0% and a fasting glucose level of less than 7 mmol/L [1]. The level of glycated hemoglobin (HbA 1c) is considered the most reliable criterion characterizing the state of carbohydrate metabolism [1].

Statistical methods of analysis. IBM software was used to analyze the study data SPSS Statistics, v.26.

Categorical variables are presented as frequencies and percentage distributions in the format n (%), quantitative variables as mean with standard deviation (M (SD)) or quartile distribution (Me (Q_1-Q_3)). When comparing groups, Pearson χ^2 and Mann-Whitney tests were used. At p values <0.05, differences were considered statistically significant. Spearman's rank correlation analysis was used to assess the relationship between quantitative variables. The kappa coefficient was used to assess the agreement between the two criteria. The sensitivity and specificity of the test were also assessed with 95% confidence intervals.

Results. The study involved 1486 patients with type 2 diabetes (897 women and 589 men). The average age of the population was 55.3 (10.9) years. Men and women did not differ significantly in age (p=0.740). The average age of women was 55.4 (10.4) years, men - 55.2 (11.8) years.

The average length of experience with type 2 diabetes was 8.3 (3.2) years. In men, the average duration of diabetes was statistically significantly shorter than

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in women (8.1 and 8.5 years, respectively, p = 0.008). The quartile distribution of HbA1c in men and women was not statistically significantly different (p=0.895) and corresponded to 9.4% (7.9-11.4).

Table 1 presents the characteristics of those examined with different levels of glycated hemoglobin (HbA1c). Overall, across the entire sample, 7.7% of patients had an HbA1c level of less than 7%. Men and women did not differ statistically significantly in the proportion of individuals with optimal levels of glycated hemoglobin (p=0.141). There were no statistically significant differences in the average age of patients in the two groups (p=0.084). Among young people, the proportion of patients with HbA1c less than 7% was slightly higher than in other age groups, but the differences did not reach a statistically significant level (p = 0.144). Statistically significant differences were esTableished in the average duration of the disease at different levels of glycemia according to H b A1c (p < 0.001) . The average length of service in the group of patients with H b A1c less than 7% was 5.8 years versus 8.5 years in the group with high levels of glycated hemoglobin (p < 0.001) . This relationship is reflected in the proportion of patients achieving target H b A1c levels. Thus, in 26% of patients with a disease experience of up to 5 years, the level of H b A1c corresponded to the target (less than 7.0%), while among patients with an experience of 10 years or more, the proportion of such persons was 2.8% (<0.001) . Spearman's rank correlation coefficient between H b A1c level and disease duration was 0.35, p < 0.001.

Thus, based on the assessment results, glycemic control should be considered unsatisfactory in more than 90% of patients. Patients with a short history of the disease more often achieved the target level of H b A1c.

Table 2 presents the characteristics of those examined depending on the level of fasting glycemia. The proportion of people with an optimal level of fasting glycemia (less than 7 mmol/l) was generally 12.4%; no statistically significant differences were found between men and women (p = 0.668), patients of different ages (p = 0.353) and length of disease (p=0.355). Thus, there were no statistically significant differences in these characteristics between the two groups.

Spearman's rank correlation coefficient between the H b A1c fraction and fasting glucose level was 0.54, p < 0.001 (Table 3). When divided into groups by age, a stronger relationship between H b A1c and fasting glucose levels was ob-

Table 1

Characteristics of patients depending on H b A1c level

Group		HbA1c (%)		p
		<7,0 (n=115)	≥7 (n=1371)	
Women	n (%)	62 (6.9)	835 (93.1)	0.141
Men	n (%)	53 (9.0)	536 (91)	
Both sexes	N (%)	115 (7.7)	1371 (92.3)	
Age, years				
Women	M (SD)	53.6 (12.4)	55.5 (10.2)	0.060
Men	M (SD)	53.1 (13.9)	55.4 (11.6)	0.227
Both sexes	M (SD)	53.3 (13.1)	55.5 (10.8)	0.084
Age group, years				
20-44	n (%)	26 (11.5)	201 (88.5)	0.144
45-59	n (%)	48 (7.0)	636 (93.0)	
60-74	n (%)	35 (6.9)	470 (93.1)	
75 and older	n (%)	6 (8.6)	64 (91.4)	
Length of diabetes mellitus, years				
Women	M (SD)	5.7 (3.3)	8.7 (2.9)	<0.001
Men	M (SD)	5.9 (3.8)	8.3 (3.3)	<0.001
Both sexes	M (SD)	5.8 (3.5)	8.5 (3.1)	<0.001
Groups by diabetes experience, years				
Up to 5	n (%)	54 (26.0)	154 (74.0)	<0.001
5-9	n (%)	47 (6.1)	723 (93.9)	
10 or more	n (%)	14 (2.8)	494 (97.2)	
Groups by body mass index category				
<25 kg/m2	n (%)	19 (7.5)	235 (92.5)	0.929
25-29.9 kg/m2	n (%)	52 (7.6)	636 (92.4)	
≥30 kg/m2	n (%)	44 (8.1)	500 (91.9)	

Note: M (SD) - mean (M), standard deviation (SD); p is the achieved level of significance when comparing groups (Pearson $\chi^{2\,test}$).

Table 2

Characteristics of patients depending on the level of fasting glycemia

Group		Fasting glucose, mmol/l		p
		<7.0 (n=185)	≥7 (n=1301)	
Women	n (%)	109 (12.2)	788 (87.8)	0.668
Men	n (%)	76 (12.9)	513 (87.1)	
Both sexes	N (%)	185 (12.4)	1301 (87.6)	
Age, years				
Women	M (SD)	54.9 (10.4)	55.4 (10.4)	0.828
Men	M (SD)	56.5 (12.6)	54.9 (11.7)	0.278
Both sexes	M (SD)	55.6 (11.3)	55.3 (10.9)	0.579
Age group, years				
20-44	n (%)	34 (15.0)	193 (85.0)	0.353
45-59	n (%)	75 (11.0)	609 (89.0)	
60-74	n (%)	68 (13.5)	437 (86.5)	
75 and older	n (%)	8 (11.4)	62 (88.6)	
Length of diabetes mellitus, years				
Women	M (SD)	8.2 (2.8)	8.5 (3.0)	0.310
Men	M (SD)	8.0 (3.4)	8.1 (3.4)	0.916
Both sexes	M (SD)	8.2 (3.0)	8.4 (3.2)	0.401
Groups by diabetes experience, years				
Up to 5	n (%)	23 (11.1)	185 (88.9)	0.355
5-9	n (%)	105 (13.6)	665 (86.4)	
10 or more	n (%)	57 (11.2)	451 (88.8)	
Groups by body mass index category				
<25 kg/m2	n (%)	29 (11.4)	225 (88.6)	0.851
25-29.9 kg/m2	n (%)	88 (12.8)	600 (87.2)	
≥30 kg/m2	n (%)	68 (12.5)	476 (87.5)	

served in the group of patients 75 years and older (r = 0.67, p < 0.001). The proportion of H b A1c positively correlated with the length of the disease in all age groups, except for persons 75 years and older.

When analysing the consistency between indicators of diabetes compensation in terms of H b A1c level and fasting glucose level, it was found that in the group as a whole, the estimates coincided in 82.6% of cases (kappa coefficient = 0.049, p = 0.049).

If we consider the HbA1c level as the "gold standard" for assessing compensation in diabetes, then the sensitivity of fasting glycaemia ≥ 7 mmol/l in diagnosing decompensation is 88.0% (86.2-89.7%), specificity 18.3% (95% CI 12.3-26.3%).

Analysis of the relationship between the level of H b A1c and body mass index did not show the presence of certain patterns. A statistically significant weak negative correlation between H b A1c and body mass index was observed only in the group of people 75 years of age and older (r = -0.28, p = 0.019).

Among all those examined, the proportion of people with an optimal level of H b A1c was 7.5% for low and normal body weight (body mass index <18.5 kg/m2) , among people with overweight (body mass index 18. 5-24.9 kg/m2) – 7.6%, among obese individuals (body mass index ≥30 kg/m2) –8.1% (p=0.929).

Lipid metabolic disorders are common in diabetes mellitus because key enzymes and lipid metabolic pathways are affected due to deficiencies in insulin production and secretion [8].

In the present study, men and women differed statistically significantly in triglyceride levels (p=0.002) and HDL cholesterol (<0.001). There were no strong correlations between age and blood lipid parameters. The maximum Spearman rank correlation coefficient (r) was 0.14, <0.001 for total cholesterol. A weak pos-

Table 3

Spearman's rank correlation coefficients between H b A1c with diabetes experience, glucose level and body mass index

Age group, years	N	Fasting glucose, mmol/l		Diabetes experience, years		BMI, kg/ m^2	
		r	p	r	p	r	p
20-44	227	0.53	<0.001	0.45	<0.001	0.02	0.716
45-59	684	0.54	<0.001	0.42	<0.001	0.03	0.374
60-74	505	0.52	<0.001	0.35	<0.001	0.004	0.929
75 over	70	0.67	<0.001	0.08	0.491	-0.28	0.019
All ages	1486	0.54	<0.001	0.35	<0.001	0.009	0.735

Note: r is the Spearman rank correlation coefficient; p is the achieved level of significance of the correlation coefficient.

Table 4

Lipid spectrum indicators at different levels of HbA1c *

Indicator, mmol/l	HbA1c, %		p
	<7.0	≥7.0	
Women			
	n=62	n=835	
Triglycerides	2.5 (2.0-2.8)	3.0 (2.5-3.6)	<0.001
Total cholesterol	5.8 (5.5-6.4)	6.9 (6.1-8.1)	<0.001
HDL cholesterol	1.2 (1.0-1.3)	1.3 (1.2-1.4)	<0.001
LDL cholesterol	3.6 (3.0-3.9)	4.1 (3.5-5.0)	<0.001
VLDL cholesterol	1.2 (0.9-1.4)	1.5 (1.2-1.8)	<0.001
Cholesterol is not HDL	4.7 (4.4-5.1)	5.6 (4.9-6.7)	<0.001
Men			
	n=53	n=536	
Triglycerides	2.5 (2.1-3.1)	3.1 (2.6-4.0)	<0.001
Total cholesterol	5.9 (5.3-7.2)	7.0 (6.1-8.3)	<0.001
HDL cholesterol	1.2 (1.0-1.4)	1.4 (1.2-1.6)	<0.001
LDL cholesterol	3.6 (3.1-4.5)	4.1 (3.5-4.8)	0.004
VLDL cholesterol	1.2 (1.0-1.4)	1.5 (1.2-1.9)	<0.001
Cholesterol is not HDL	4.8 (4.2-5.7)	5.6 (4.9-6.7)	<0.001

Note: * data are presented as median (Me) and interquartile range (Q_1-Q_3) in Me format (Q_1-Q_3); p — achieved level of significance when comparing groups (Mann-Whitney test).

Table 5

Glycemic control in patients with type 2 diabetes in selected countries

A country	Population	Criterion	Frequency, %	Source
Jordan	N=287, 18 years and older	HbA1c <7%	42	[14]
Brazil	N=338, 18 years and older	HbA1c <7%	53	[7]
Jakarta	N=126, 18 and older years	HbA1c ≤7%	45.2	[5]
Saudi Arabia and the people of the Tabuk region	N=697, 18 years and older	HbA1c <7%	18.5	[4]
Southwestern Cameroon	N=131, 30 and older	HbA1c <7%	19.1	[10]
Ethiopia	N=124, 30-83 years old	HbA1c <7%	39.5	[3]
Iraq	N=520, 18 years and older	HbA1c <7%	23.5	[13]
Pakistan	896, 18-75 years old	HbA1c <7%	14.5	[2]
China	N=13972, 18 years and older	HbA1c <7%	44	[11]

itive correlation was noted between the duration of diabetes and the content of triglycerides (r=0.20, p <0.001), total cholesterol (r =0.23, p <0.001), VLDL cholesterol (r =0.21, p <0.001), not HDL cholesterol (r =0.23, p <0.001).

The level of H b A1c positively correlated with the content of triglycerides (r=0.31, p<0.001), total cholesterol (r=0.30, p<0.001), LDL cholesterol (r=0.22, p<0.001), cholesterol VLDL (r=0.30, p<0.001), non-HDL cholesterol (r=0.30, p<0.001).

Comparison of groups of patients with different H b A1c levels showed that glycemic compensation of diabetes is accompanied by an improvement in the metabolic profile (Table 4).

Discussion. The work assessed the control of glycemic levels depending on gender, age and duration of type 2 diabetes mellitus, as well as its relationship with the blood lipid profile in patients of one of the clinics in the Republic of Afghanistan. It was found that only 7.7% of patients had the target H b A1c level, which is significantly lower than in studies conducted with similar criteria in other countries (Table 5). The reasons for poor glycemic control in this population are unknown. A systematic review including 12 studies found that factors influencing glycemic control may include educational level, gender, body mass index, obesity, diabetes history, hypertension, number of antidiabetic medications, diabetes treatment regimens, medication adherence and exercise [6].

Glycemic control was better in patients with recent onset of the disease. Patients with type 2 diabetes with H b A1c levels≥7.0% had statistically significantly higher blood lipid levels than patients with H b A1c <7.0%. Moreover, this also applied to the level of HDL cholesterol among both men and women (Table 4), which requires further study.

Thus, the present study revealed that insufficient glycemic control was observed in 92% of patients with type 2 diabetes. High levels of H b A1c were statistically significantly associated with the duration of the disease and high levels of blood lipids, while no dependence was esTableished on the gender, age of patients, body mass index and the presence of obesity. It is necessary to study the factors that determine glycemic control, the correction of which will improve metabolic parameters and reduce the risk of developing complications in diabetes.

Limitations of the study. A limitation of the study is the recruitment of participants from only one center, which affects the generalizability of the study results. At the same time, Noble Clinic OPD (NOPDC), located in the capital of Afghanistan, Kabul, is one of the large centres that receives patients from all over Afghanistan. Also, the completeness of the assessment is affected by the lack of data on factors possibly associated with glycemic control, such as education level, income, comorbidities, patient adherence to treatment, drug therapy, and others.

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