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ON THE RELATIONSHIP OF TRADITIONAL AND NON-TRADITIONAL LIPID PARAMETERS WITH THE RISK OF PREDIABETES AND TYPE 2 DIABETES MELLITUS IN PATIENTS WITH CORONARY HEART DISEASE IN THE UZBEK POPULATION

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ABSTRACT

The aim of this study was to compare the TG/HDL relationship andother non-traditional lipid parameters with pre-DM and T2DM in the Uzbek population of patients with coronary heart disease, and to test the association of high TG/HDL levels based on gender-specific thresholds with pre-DM and T2DM.

Material and methods of research.We studied the age characteristics of the surveyed rural population of Tuprok-Kal district in the Khorezm region. There were 132 women and 107 men. Of the 239 individuals, 100 patients with carbohydrate metabolism disorders and type 2 diabetes were identified. Among the 100 individuals with identified carbohydrate metabolism disorders, 46 patients with coronary heart disease were identified.

The following methods were used in the population survey: epidemiological, clinical, biochemical, instrumental and statistical.

Study results. Significant differences were observed in a number of parameters compared to the group without NMD. Significant differences were found in family history of type 2 diabetes, systolic blood pressure, diastolic blood pressure, smoking, alcohol abuse, and hypertension compared to all studied patient groups ($p < 0.005$). Patients with IFG+IGT and type 2 diabetes demonstrated the highest significance of differences in family history of type 2 diabetes, $p < 0.0001$.

Regarding biochemical parameters, it was revealed that the reliability of differences in the lipid spectrum was detected in patients with type 2 diabetes ($p < 0.005$), while in the other groups such differences were not detected.

KEYWORDS

Type 2 diabetes mellitus, coronary heart disease, correlation.

Conclusions. In addition to traditionally defined lipid parameters, non-traditional lipid parameters were significantly correlated with IFG, IGT, IGT+IGT and T2DM in patients with CAD, among which TG/HDL showed a stronger correlation in all groups.

Introduction

Type 2 diabetes mellitus (T2DM) and coronary heart disease (CHD) are two chronic diseases that pose a huge public health burden [1]. CHD is often accompanied by diabetes, possibly because both conditions arise from the same risk factors, such as abnormal inflammatory responses or abnormal lipid metabolism [2]. Moreover, as a significant risk factor for coronary heart disease, diabetes may aggravate the progression of atherosclerosis, leading to poor clinical outcomes [3,4].

Therefore, it is particularly important to control glucose metabolism in patients with coronary heart disease. However, abnormal blood glucose metabolism, including prediabetes (pre-DM) and DM, is becoming increasingly common; by 2045, more than 600 million people are estimated to develop pre-diabetes mellitus, and a similar number will develop diabetes mellitus, according to the 2017 global diabetes prevalence estimates and projections for 2045 [6]. Furthermore, Asians are more susceptible to diabetes mellitus, especially type 2 diabetes mellitus (T2DM), and other complications of coronary heart disease than Westerners due to various factors [7].

Dyslipidemia often accompanies abnormal glucose metabolism [8]. In addition to traditional lipid parameters including triglycerides (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C), non-traditional lipid parameters such as TG/HDL-C, LDL-C/HDL-C, non-HDL-C, TC/HDL-C, and non-HDL-C/HDL-C are closely associated with the occurrence and development of pre-DM and T2DM. The reason may be that excessive cholesterol accumulation leads to β-cell dysfunction, thereby impairing glucose tolerance and affecting insulin secretion. Furthermore, cholesterol deposition in islets may lead to increased aggregation of islet amyloid polypeptide and increased islet amyloid formation, which further impairs β-cell function and affects glucose homeostasis [9,10,11,12].Of these, TG/HDL-C has been recognized as a potential predictive marker of insulin resistance (IR), which is a key trigger for the development of T2DM. Elevated TG/HDL-C ratios have been shown to indicate a higher risk of incident T2DM in some studies [13]. Furthermore, past studies have examined in detail sex-specific cutoff points for TG/HDL-C that classify participants as having high or low risk of IR and cardiovascular disease (CVD) [14.15].

The aim of this studywas to compare the TG/HDL relationship andother non-traditional lipid parameters with pre-DM and T2DM in the Uzbek population of patients with coronary heart disease, and to test the association of high TG/HDL levels based on gender-specific thresholds with pre-DM and T2DM.

Material and methods of research. The study material was based on the examination data carried out at the Khorezm Regional Endocrinology Dispensary in 2020. A total of1,893,059 persons, including 1,205,335 adults and 624,275 children and adolescents.

The following patients were excluded: (1) younger than 35 years or older than 75 years; (2) patients with cancer, infection, or serious liver or kidney disease; (3) those with missing data on TG, TC, HDL-C, LDL-C, fasting blood glucose (FBG), and hemoglobin A1c (HbA1c). Ultimately, 28,476 eligible subjects were included in the final analysis.

The study material was 239 people, representing a 95% representative sample of the rural population of the Tuprokkal district of the Khorezm region.

The population survey utilized the following methods: epidemiological, clinical, biochemical, instrumental, and statistical. In addition, we used a questionnaire we developed and refined to assess the risk of prediabetes and type 2 diabetes: FINDRISC. Risk factors were also identified and assessed using the criteria of the WHO, the Russian Association of Endocrinologists (2017), and the EASD and ADA (2015, 2018).

Research results. All examined persons were representatives of the indigenous population (Uzbeks – 95%, as well as Kazakhs, Tatars, and Russians) (Table 1).

The age distribution of those examined was as follows (WHO, 2021): 7 (2.9%) aged 18-34 years; 82 (34.3%) aged 35-44 years; 89 (37.2%) aged 45-54 years; 52 (25.2%) aged 55-64 years; 9 (21.7%) aged ≥65 years.

We then examined the age characteristics of the surveyed rural population of Tuprok-Kal district, Khorezm region (Table 1). Table 1 shows that there were 132 women and 107 men. Of the 239 individuals, 100 patients with carbohydrate metabolism disorders and type 2 diabetes were identified.

Table 1 Characteristics of the surveyed rural population Tuprokkala district of Khorezm region

Age groups	Total rural population		Female population		Male population	
	N	%	N	%	N	%
18-34	-	-	-	-	-	-
35-44	89	37.3	49	37.1	40	37.4
45-54	89	37.2	56	42,42	33	25.0
55-64	52	25.2	20	15.15	32	29.90
≥ 65	9	21.7	7	5:30	2	3.7
Total	239	100.0	132	55.23	107	1.9

We studied the age-related features of the epidemiology of prediabetes and type 2 diabetes among the rural population of Tuprokkal district of Khorezm region (Table 2).

Table 2 Distribution of carbohydrate metabolism disorders and type 2 diabetes in the population of Tuprokkal district of Khorezm region

Carbohydrate metabolism disorders	Groups			
	NGN n=70	NTG n=24	Newly diagnosed type 2 diabetes n=6	Population without NVO n=20
Male population	n = 42	n=15	n=4	n=11
Female population	n=28	n=9	n=2	n=9

Note:IFG - impaired fasting glycemia, IGT - impaired glucose tolerance, T2DM - type 2 diabetes mellitus, *p <0.05, ** <0.001 differences in data relative to individuals without IM are significant

As shown in Table 2, carbohydrate metabolism disorders were detected in 38.2% of the individuals examined in the Tuprok-Kal district of the Khorezm region. The prevalence of IFG was 70 cases (29.3%), IGT was 24 cases (10.04%), and T2DM was 6 cases (2.5%). Prediabetes was significantly more frequently diagnosed than T2DM ($p < 0.005$).

Thus, among 100 individuals with identified carbohydrate metabolism disorders, 46 patients with coronary heart disease were identified.

The next objective of our study was to examine the baseline characteristics of 100 patients withcarbohydrate metabolism disorders and type 2 diabetes (Table 3).

Table 3 Baseline characteristics of 100 patients withcarbohydrate metabolism disorders and type 2 diabetes

Indicators	**NGN n = 70**	**NTG n=24**	**Type 2 diabetes n=6**	**without NOU p=20**
Family history of diabetes (%)	5.0±0.9*	9.5±1.2*	22.5±8.2**	1.2±0.3
GARDEN (mmHg)	129.4±8.5 *	131.6±9.7*	155.6±11.3*	123.8±10.6
DBP (mmHg)	87.6±9.5*	85.3±7.3*	93.7±8.7*	80.8±11.5
Alcohol consumption (%)	6.3±1.3*	9.7±1.2*	35.6±7.9*	1.7±0.3
Smoking (%)	5.3±1.9*	12.8±3.4*	39.8±9.4*	2.6±0.8
Hypertension (%)	7.2±2.3*	11.9±4.6*	38.4±8.9*	2.8±0.7
Hyperlipidemia (%)	5.3±0.8	16.7±3.8	29.5±6.5	1.8±0.5
HbA1c (%)	5.8*±1.5	6.2*±1.8	8.3*±2.3	4.6±1.5
GKN (mmol/L)	5.0±1.3	6.2±1.5	9.0±1.4	5.1±1.6
TG (mmol/L)	1.3±0.4	1.5*±0.4	1.6*±0.6	1.1±0.7
OX (mmol/L)	4.4±0.9	4.5±1.1	4.5±1.3	4.2±2.5
HDL-C (mmol/L)	1.1±0.3	1.1±0.3	1.2±0.8	1.1±0.4
LDL (mmol/L)	2.7±1.2	2.8*±0.8	2.8*±0.9	2.3±0.9
LDL/HDL	2.5±0.5	2.6±0.8	2.7*±0.7	2.1±0.8
OX/HDL	4.0±1.2	4.1±0.9	4.4*±0.9	3.1±0.7
TG/HDL	1.2±0.7	1.4±0.3	1.6±0.4	1.0±0.5
LDL-C/HDL	2.5±0.6	2.6±1.3	2.7*±0.5	2.1± 0.9*

Note: HbA1c: glycated hemoglobin; FBG: fasting blood glucose; TG: triglycerides; TC: total cholesterol; HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; * - significance of differences with the group without HMO, where * is $p < 0.005$, and ** is $p < 0.0001$.

As can be seen from the data presented in Table 3, there were significant differences in a number of indicators compared with the group without NMD. Thus, significant differences were found in family history of type 2 diabetes, systolic blood pressure, diastolic blood pressure, smoking, alcohol abuse, and hypertension with all studied patient groups ($p < 0.005$). Moreover, patients with IFG + IGT and

type 2 diabetes had the highest significance of differences in family history of type 2 diabetes, $p < 0.0001$.

Regarding biochemical parameters, it was revealed that the reliability of differences in the lipid spectrum was detected in patients with type 2 diabetes ($p < 0.005$), while in the other groups such differences were not detected.

The next objective of our research was to study correlations between the ratio of triglycerides and lipid parameters with the risk of prediabetes in 46 patients with coronary heart disease withcarbohydrate metabolism disorders and type 2 diabetes (Table 4).

Table 4 Correlation (R) between the ratio of traditional and non-traditional lipid parameters with the risk of prediabetes in 46 patients with coronary heart disease withcarbohydrate metabolism disorders and type 2 diabetes

Indicators	**NGN n=25**	**NTG n=11**	**Type 2 diabetes n=10**	**without NOU p=0**
Traditional lipid parameters				
TG (mmol/L)	0.98**	1.26**	1.07**	-
OX (mmol/L)	1.07**	1.10**	1.05**	-
HDL-C (mmol/L)	1.20**	1.10**	1.14**	-
LDL (mmol/L)	1.16**	1.10**	1.12**	-
Unconventional lipid parameters				
LDL/HDL	1.22**	1.12**	0.87**	-
OX/HDL	1.23**	1.23**	0.84**	-
TG/HDL	1.33. **	1.29**	1.32**	-
LDL-C/HDL	0.97**	1.06**	1.28**	-

Note: ;*- reliability of differences with the group without NOU, where** - this is $p < 0.0001$.

From Table 4 it follows that there was a direct correlation with a high degree of reliability in relation tocorrelations (R) between the ratio of traditional and non-traditional lipid parameters with the risk of prediabetes in 46 patients with coronary heart disease withcarbohydrate metabolism disorders and type 2 diabetes. The highest correlation was observed with TG/HDL in all groups.

Conclusions

1. There were significant differences in a number of parameters compared to the group without NMD. Thus, significant differences were found in family history of type 2 diabetes, systolic blood pressure, diastolic blood pressure, smoking, alcohol abuse, and hypertension with all studied patient groups ($p < 0.005$). Moreover, patients with IFG+IGT and type 2 diabetes had the highest significance of differences in family history of type 2 diabetes, $p < 0.0001$.
2. Regarding biochemical parameters, it was revealed that the reliability of differences in the lipid spectrum was detected in patients with type 2 diabetes ($p < 0.005$).
3. In addition to traditionally defined lipid parameters, non-traditional lipid parameters were significantly correlated with IFG, IGT, IGT+IGT and T2DM in patients with CAD, among which TG/HDL showed a stronger correlation in all groups.

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