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Examination of HbA1c and lipid values in patients diagnosed with diabetes mellitus with respect to different regions in Turkey.

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Abstract

Aim: The aim of the present study is to investigate the distribution of HbA1c, LDL, TG, HDL and non-HDL-cholesterol values based on different regions in Turkey as well as sexes; and to determine the differences between regions and sexes in order to achieve target values in 11 health regions of Turkey as defined by the classification of regional units for statistics.

Methods: All data recorded on computers by primary care family physicians are archived by the Ministry of Health, General Directorate of Information Systems. These data included 11 regions based on the classification of regional units for statistics and age, sex, LDL, TG, HDL, total cholesterol and HbA1c (%) of patients. The data obtained will be grouped with respect to regions.

Results: When the compatibility of the blood values for all population are evaluated in relation to the target value; it was found that 5756 (50.4%) individuals were within the target range for HbA1c (6.5%), and 7484 (65.5%) individuals were within the target range for HbA1c (7.0%). 2225 (24.2%) individuals were within the target range for LDL, 4633 (49.8%) individuals for TG, 4776 (50.2%) individuals for HDL, and 1981 (24.5%) individuals for non-HDL cholesterol.

Conclusion: According to the findings of this study, the rate of achieving the target values in type 2 diabetic patients in Turkey are still inadequate. To this end, novel regional and country-wide health-improving policies are required. Patient education, continuing medicine training for physicians and local guidelines may assist in the follow-up and treatment of DM.

Keywords: Type 2 diabetes mellitus, Target rate.

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Introduction

Diabetes Mellitus (DM) is a chronic metabolic disease caused by the lack of or reduced secretion of insulin hormone [1]. DM is an important disease with increasing incidence both in Turkey and all over the world. Currently, there are ~415 million adult DM patients, and the figure is estimated to increase to 642 million by 2040 [2]. DM diagnosis can be made through Fasting Blood Glucose (FBG), Oral Glucose Tolerance Test (OGTT), random glucose test or HbA1c measurement. Presence of one of the criteria including FBG of ≥ 126 mg/dL, a 75 gr 2 h OGTT of ≥ 200 mg/dL, glucose level of ≥ 200 mg/dL in a random blood test, and accompanying diabetes symptoms, or a HbA1c value of ≥ 6.5% provides overt DM diagnosis. Individuals with a HbA1cvalue of 5.7 to 6.4% are regarded to have increased DM risk [3]. Generally, in patients with DM, if there is no risk of hypoglycemia and if the life expectancy is long, the target HbA1c is designated to be <7% in order to reduce microvascular complications. On the other hand, provided that there is no episode of hypoglycemia in conscious patients and in special cases (e.g., at-risk pregnancy), the target HbA1c may be designated as 6-6.5% [4-6].

In the management of DM, risk assessment for cardiovascular disease and achieving the necessary target values is as important as the treatment of the disease. According to a local guideline in Turkey, these values are designated as follows for lipid levels: LDL-cholesterol<100 mg/dL, Triglyceride (TG)<150 mg/dL, HDL-cholesterol>40 mg/dL in males, >50 mg/dL in females, and non-HDL-cholesterol<130 mg/dL [7].

The aim of the present study is to investigate the distribution of HbA1c, LDL, TG, HDL and non-HDL-cholesterol values based on different regions in Turkey as well as sexes; and to determine the differences between regions and sexes in order to achieve target values in 11 health regions of Turkey as defined by the classification of regional units for statistics.

Materials and Methods

All data recorded on computers by primary care family physicians are archived by the Ministry of Health, General Directorate of Information Systems. The data on diabetes mellitus patients who were recorded with relevant ICD (E10-E14) codes by the family physicians providing care in 81 cities of Turkey in the first 6 months of 2017 was obtained from National Health System (NHS) database. These data included 11 regions based on the classification of regional units for statistics and age, sex, LDL, TG, HDL, total cholesterol and HbA1c (%) of patients. The data obtained will be grouped with respect to regions. Approximately 36275 patients were scanned, and the data were randomly selected based on simple random sampling method using IBM SPSS Statistics 21.0 package software, and 11425 individuals were included in the study.

According to the "Classification of Regional Units for Statistics", Turkey is divided into 12 regions at the 1st level; and since no data could be obtained from North-Eastern Anatolia, the study included 11 regions. 11 regions consist of Istanbul (1), West Marmara (2), Aegean (3), East Marmara (4), Western Anatolia (5), Mediterranean (6), Central Anatolia (7), Western Black Sea (8), Eastern Black Sea (9), Middle-Eastern Anatolia (10), and Eastern Anatolia (11), respectively. As many errors were detected in the data obtained from the Eastern Anatolia region, the data was reduced; and the regions of Eastern and South-Eastern Anatolia were evaluated together as the 11th region, namely "Eastern Anatolia".

In our study, in accordance with the guidelines in Turkey; the target values were designated to be 6.5% and 7.0% for HbA1c (%), <100 mg/dL for LDL, >40 mg/dL in males, >50 mg/dL in females for HDL; <150 mg/dL for TG; and <130 mg/dL for non-HDL-cholesterol [7]. Non-HDL-cholesterol values were calculated by subtracting HDL values from total cholesterol values. For the binomial logistic regression analysis used to identify major factors, reference values were designated to be the values obtained in Istanbul for region, and male for sex. Istanbul was chosen as a reference since it represents the country profile due to the fact that it is a region with high immigration rates, and is the biggest metropolis in Turkey. As the number of female participants was higher in the study, males were chosen as a reference; and its effect on female sex was investigated.

Statistical analysis

Continuous data were represented as mean ± standard deviation. Categorical data were shown in percentages (%). Shapiro-Wilk test was used to test the normal distribution of the data. In the comparison of normally distributed groups, independent samples t-test was used for means of 2 groups, and one-way Analysis of Variance (One-Way ANOVA) was used for means of 3 or more groups. For the comparison of non-normally distributed groups, Mann-Whitney U test was used for means of 2 groups, and Kruskal-Wallis H test was used for means of 3 or more groups. In the analysis of cross tables, Pearson's chi-square and Pearson's exact chi-square test were utilized. Logistic regression analysis was used for the determination of risk factors. For the evaluation of the analyses, IBM SPSS Statistics 21.0 software was utilized. A p value of <0.05 was considered to be statistically significant.

Results

HbA1c, LDL, TG, HDL and non-HDL-cholesterol values for 11425 patients with DM were measured, and HbA1c values were examined; and the mean values, minimum and maximum levels are shown in Table 1. Minimum HbA1c (%) was found to be 5.51, maximum HbA1c was 16.90, and the mean HbA1c was 6.99 ± 1.60. The values obtained from the research population and "n" count are shown in Table 1. The mean age of 11425 patients included in the study was 56.92 ± 13.20 y, 56.91 ± 12.97 y in males, and 56.92 ± 13.33 y in females; and there was no significant difference between the sexes in terms of age (p=0.974).

In HbA1c (%) measurements, mean value of 4227 male patients was 7.29 ± 1.76, and it was significantly higher compared to the mean value of 7198 female patients which was 6.82 ± 1.48 (p<0.001). In Table 2, mean values of the blood test with respect to sex, and the difference between the two sexes are examined.

Table 3 presents the difference between blood values of patients with respect to 11 regions. There were significant differences in HbA1c (%), LDL, TG, HDL and non-HDL-cholesterol levels with respect to regions (p<0.001 for each region). Multiple comparison tests were performed for the evaluation of differences in blood values for different regions, and the results are given in the respective column.

In our study; the target values were designated to be 6.5% and 7.0% for HbA1c (%), <100 mg/dL for LDL, >40 mg/dL in males, >50 mg/dL in females for HDL; <150 mg/dL for TG; and <130 mg/dL for non-HDL-cholesterol. In Table 4, target values by sex are examined. Table 5 examines the significance levels of 11 regions with respect to target values. In Tables 4 and 5, compatibility with the target value is indicated by (+), whereas incompatibility with the target value is indicated by (-).

When the compatibility of the blood values for all population are evaluated in relation to the target value ; it was found that 5756 (50.4%) individuals were within the target range for HbA1c (6.5%), and 7484 (65.5%) individuals were within the target range for HbA1c (7.0%). 2225 (24.2%) individuals were within the target range for LDL, 4633 (49.8%) individuals for TG, 4776 (50.2%) individuals for HDL, and 1981 (24.5%) individuals for non-HDL cholesterol.

When the target value HbA1c (%) of 6.5% is taken into consideration and the compatibility of blood values of is examined with respect to sex; it was demonstrated that 3955 (54.9%) of female patients and 1801 (42.6%) of male patients were within the target range; and the rate of female patients who were within the target range was higher (χ^2=162.187;

p<0.001). When the criterion of target value HbA1c (%) of 7.0% is considered, and the compatibility of blood values with the target range is examined with respect to sex; 5058 (70.3%) of female patients and 2426 (57.4%) of male patients were found to be within the target range, and the rate of female patients who were within the target range was higher (χ^2=195.416; p<0.001). Table 4 shows the compatibility of blood parameters with respect to sex.

In Table 5, when the target value of HbA1c (%) is considered to be 6.5%, a significant difference was found between the regions with respect to target range (χ^2=1127.166; p<0.001). The region that exhibited the highest compatibility with the target was Istanbul with 2701 patients (72.5%), and the region that exhibited the lowest compatibility with the target range was Eastern Black Sea (27.4%). When the target range of HbA1c (%) is considered to be 7.0%, there was a significant difference between the regions with respect to the target range (χ^2=815,266; p<0.001). The region with the highest compatibility with the target range was Istanbul with 3088 patients (82.8%), and the region with the lowest compatibility with the target range was Western Black Sea (40.8%). When LDL values of regions are examined with respect to the target range, there was a significant difference between the regions (χ^2=105.471; p<0.001). In terms of compatibility with the target range, the regions with the highest and the lowest rates of compatibility were Western Black Sea (35.7%) and Istanbul (18.4%), respectively. When the TG values of different regions are examined with respect to target range, a significant difference was found between the regions (χ^2=125.570; p<0.001). In terms of the compatibility with the target range, the regions with the highest and the lowest rates compatibility were Istanbul (57.5%) and Eastern Anatolia (30.4%), respectively. When the HDL values in different regions are examined with respect to their relevance to target range, a significant difference was found between the regions (χ^2=110.282; p<0.001). In terms of the compatibility with the target range, the region with the highest rate of compatibility was Aegean (58.3%), whereas the region with the lowest rate of compatibility was Middle-Eastern Anatolia (34.7%). When non-HDL values of different regions are examined with respect to the target range, a there was a significant difference between the regions (χ^2=28.141; p=0.002). In terms of the compatibility with the target range, the regions with the highest and the lowest rate of compatibility were Western Black Sea (36.1%) and Middle-Eastern Anatolia (18.4%), respectively.

Table 1. *Summary of the laboratory findings.*

	n	Mean ± SD Median (Q1-Q3)
HbA1c (%)	11425	6.99 ± 1.60 6.40 (5.90-7.40)
LDL (mg/dl)	9213	125.36 ± 37.85 124.00 (101.00-148.60)
TG (mg/dl)	9294	175.60 ± 110.00 148.00 (106.00-207.00)
HDL (mg/dl)	9514	47.96 ± 11.96 46.00 (40.00-54.00)
Non-HDL-Cholesterol (mg/dl)	8096	159.93 ± 43.25 156.00 (130.00-185.00)

Table 2. *Laboratory findings among sexes.*

	n Mean ± SD Median (Q1 – Q3) Sex		p*
	Male	Female	
n	4227	7198	<0.001
HbA1c (%)	7.29 ± 1.76 6.60 (6.00-7.82)	6.82 ± 1.48 6.30 (5.90-7.20)	
n	3434	5779	<0.001
LDL (mg/dl)	119.89 ± 37.06 119.00 (95.93-144.00)	128.62 ± 37.95 126.80 (104.00-151.00)	
n	3496	5798	<0.001
TG (mg/dl)	186.68 ± 130.48 153.00 (108.00-216.00)	168.93 ± 94.95 146.00 (106.00-202.00)	
n	3587	5927	<0.001
HDL (mg/dl)	43.23 ± 10.24 42.00 (36.00-48.00)	50.83 ± 12.03 49.00 (42.00-57.00)	
n	3028	5068	<0.001
Non-HDL-C (mg/dl)	156.06 ± 43.73 153.00 (125.00-181.00)	162.25 ± 42.81 158.00 (132.00-187.00)	

Table 3. *Laboratory findings according to regions.*

	Regions	n	Mean ± SD Median (Q1-Q3)	Minimum	Maximum	p*	Multiple comparisons
HbA1c (%)	Istanbul [1]	3728	6.45 ± 1.3	5.51	16.1	<0.001	1-2

			6.0 (5.7-6.5)				1-3
	West Marmara [2]	536	7.29 ± 1.72	5.51	14.9		1-4
			6.6 (6.1-7.8)				1-5
	Aegean [3]	2522	7.21 ± 1.74	5.51	16.5		1-6
			6.6 (6-7.7)				1-7
	East Marmara [4]	1906	7.35 ± 1.65	5.51	14.8		1-8
			6.8 (6.2 – 8.0)				1-9
	West Anatolia [5]	605	7.04 ± 1.53	5.51	14.1		1-10
			6.6 (6.1-7.5)				1-11
	Mediterranean [6]	1056	7.1 ± 1.58	5.51	16.9		2-8
			6.7 (6.1-7.7)				3-4
	Middle Anatolia [7]	339	7.35 ± 1.74	5.51	16.3		3-8
			6.7 (6.0-7.6)				4-5
	West Black Sea [8]	213	7.71 ± 1.71	5.51	14		4-6
			7.0 (6.0-8.3)				5-10
	East Black Sea [9]	168	7.28 ± 1.28	5.53	13.3		5-11
			6.8 (6.235-7.8)				5-8
	Middle East Anatolia [10]	196	7.28 ± 1.43	5.54	12.25		5-9
			6.9 (6.3 – 8.0)				6-11
	East Anatolia [11]	156	7.69 ± 1.86	5.53	14.2		6-8
			6.9 (6.2-8.4)				
LDL (mg/dl)	Istanbul [1]	2859	132.72 ± 38.72	34	330.4	<0.001	1-2
			129.0 (107.0 – 155.0)				
	West Marmara [2]	392	109.54 ± 44.73	15	234.16		1-3
			117.0 (83.0-140.2)				
	Aegean [3]	2138	122.36 ± 36.01	23	348		1-4
			120.0 (95.8-145.4)				
	East Marmara [4]	1610	123.24 ± 36.83	6	311		1-5
			122.0 (99.0-147.0)				
	West Anatolia [5]	494	122.96 ± 35.29	19	274		1-6
			122.0 (99.0-145.0)				
	Mediterranean [6]	847	123.14 ± 34.65	21	271		1-8
			122.0 (100.0-145.0)				
	Middle Anatolia [7]	291	128.51 ± 36.81	36.2	242		1-10
			126.0 (100.0-150.0)				
	West Black Sea [8]	157	114.09 ± 36.47	41	258		2-3
			108.0 (89.3-127.1)				
	East Black Sea [9]	140	128.06 ± 44.89	39	293		2-4

			114.0 (93.0-158.0)				
	Middle East Anatolia [10]	166	119.45 ± 32.20	39	257		2-5
			119.0 (98.0-139.0)				2-6
	East Anatolia [11]	119	121.54 ± 39.04	30	306.8		2-7
			118.6 (95.0-147.1)				7-8
TG (mg/dl)	Istanbul [1]	2995	158.86 ± 95.8	24	1396		
			133.0 (97.0-188.0)				1-3
	West Marmara [2]	435	181.32 ± 107.73	11	1065	<0.001	1-5
			156.0 (111.0-209.5)				1-8
	Aegean [3]	1967	182.37 ± 115.45	31	1958		1-10
			163.0 (119.0-225.0)				2-10
	East Marmara [4]	1671	181.58 ± 110.35	31	1050		2-3
			153.0 (113.0-212.0)				3-10
	West Anatolia [5]	518	183.66 ± 106.56	37	1018		3-4
			155.0 (108.0-204.0)				3-5
	Mediterranean [6]	859	181.45 ± 124.69	38	1675		3-6
			152.0 (110.0-213.0)				3-8
	Middle Anatolia [7]	314	195.95 ± 137.92	42	1182		4-10
			172.0 (122.0-240.0)				5-7
	West Black Sea [8]	91	177.21 ± 98.39	58	601		6-10
			146.5 (102.7-212.5)				7-10
	East Black Sea [9]	136	184.86 ± 113.95	46	956		7-8
			151.0 (113.0-201.0)				9-10
	Middle East Anatolia [10]	173	183.17 ± 94.91	39	581		
			156.0 (116.0-239.0)				
	East Anatolia [11]	135	220.7 ± 138.55	56	975		
			176.0 (130.0-217.0)				
HDL (mg/dl)	Istanbul [1]	2973	47.94 ± 11.06	9	113		1-2
			47.0 (40.0-54.0)			<0.001	1-3
	West Marmara [2]	425	47.79 ± 12.87	18.2	109		1-6
			46.0 (39.0-55.0)				
	Aegean [3]	2201	49.72 ± 12.54	16	106		
			47.0 (40.0-55.0)				
	East Marmara [4]	1648	47.36 ± 12.4	15	115		
			46.0 (39.0-54.0)				
	West Anatolia [5]	525	45.68 ± 12.13	12	107		
			44.0 (39.0-52.6)				
	Mediterranean [6]	851	47.52 ± 11.56	14	135		

			46.0 (40.0-54.0)			
	Middle Anatolia [7]	307	48.41 ± 11.41	21	95	
			44.0 (37.0-53.0)			
	West Black Sea [8]	162	44.75 ± 11.7	21	85.8	
			45.0 (38.0-53.9)			
	East Black Sea [9]	144	49.08 ± 12.28	26	83	
			50.0 (37.5-59.5)			
	Middle East Anatolia [10]	144	43.7 ± 12.39	24	99.9	
			43.0 (34.1-50.0)			
	East Anatolia [11]	134	46.01 ± 11.68	21	73	
			47.0 (38.0-55.6)			
Non-HDL-Cl (mg/dl)	Istanbul [1]	2953	163.84 ± 44.16	56	443	
			160.0 (133.0-189.0)			
	West Marmara [2]	422	153.94 ± 41.35	50	291	
			154.0 (128.0-177.0)			
	Aegean [3]	1364	158.54 ± 45	36	697.93	
			155.0 (128.0-184.0)			
	East Marmara [4]	1632	158.29 ± 42.6	16	356	
			155.0 (129.0-185.0)			
	West Anatolia [5]	371	159.61 ± 41.66	33	332.5	
			155.7 (127.5-184.0)			
	Mediterranean [6]	794	155.72 ± 39.14	47	309	
			155.0 (129.0-178.0)			
	Middle Anatolia [7]	154	156.09 ± 37.25	69.79	258	
			151.0 (130.0-177.0)			
	West Black Sea [8]	72	147.18 ± 39.75	67	253	
			141.5 (115.75-169.0)			
	East Black Sea [9]	61	157 ± 54.14	62	342	
			154.0 (117.5-190.0)			
	Middle East Anatolia [10]	141	165.96 ± 41.68	59	281	
			166.0 (135.0-188.0)			
	East Anatolia [11]	132	159.18 ± 43.51	67	375	
			151.2 (125.1-180.9)			

*Kruskal Wallis H Test

Table 4. *The evaluation of the rates of the patients' on target among sexes.*

		Sex		χ^2, p*
		Male	**Female**	
HbA1c (6.5%)	<6.5	1801 (42.6%)	3955 (54.9%)	162.187
	≥ 6.5	2426 (57.4%)	3243 (45.1%)	<0.001
HbA1c (7.0%)	<7.0	2426 (57.4%)	5058 (70.3%)	195.416
	≥ 7.0	1801 (42.6%)	2140 (29.7%)	<0.001
LDL (mg/dl)	<100	1015 (29.6%)	1210 (20.9%)	87.364

	≥ 100	2419 (70.4%)	4569 (79.1%)	<0.001
TG (mg/dl)	<150	1669 (47.7%)	2964 (51.1%)	9.971
	≥ 150	1827 (52.3%)	2834 (48.9%)	0.002
HDL (mg/dl)	E>40	2040 (56.9%)	2736 (46.2%)	102.537
	K>50			<0.001

	E ≤ 40	1547 (43.1%)	3191 (53.8%)	
	K ≤ 50			
Non-HDL-C (mg/dl)	<130	849 (28.0%)	1132 (22.3%)	33.346
	≥ 130	2179 (72.0%)	3936 (77.7%)	<0.001

*Pearson chi-square test.

Table 5. *The evaluation of the rates of the patients' on target among sexes according to regions.*

		Regions											χ^2; p*
		Istanbul [1]	**West Marmara [2]**	**Aegean [3]**	**East Marmara [4]**	**West Anatolia [5]**	**Mediterranean [6]**	**Middle Anatolia [7]**	**West Black Sea [8]**	**East Black Sea [9]**	**Middle East Anatolia [10]**	**East Anatolia [11]**	
HbA1c (6.5%)	<6.5	2701 (72.5%)	218 (40.7%)	1058 (42.0%)	689 (36.1%)	267 (44.1%)	456 (43.2%)	134 (39.5%)	59 (27.7%)	46 (27.4%)	72 (36.7%)	56 (35.9%)	1127.166
	≥ 6.5	1027 (27.5%)	318 (59.3%)	1464 (58.0%)	1217 (63.9%)	338 (55.9%)	600 (56.8%)	205 (60.5%)	154 (72.3%)	122 (72.6%)	124 (63.3%)	100 (64.1%)	<0.001
HbA1c (7.0%)	<7.0	3088 (82.8%)	305 (56.9%)	1508 (59.8%)	1019 (53.5%)	387 (64.0%)	649 (61.5%)	177 (52.2%)	87 (40.8%)	82 (48.8%)	106 (54.1%)	76 (48.7%)	815.266
	≥ 7.0	640 (17.2%)	231 (43.1%)	1014 (40.2%)	887 (46.5%)	218 (36.0%)	407 (38.5%)	162 (47.8%)	126 (59.2%)	86 (51.2%)	90 (45.9%)	80 (51.3%)	<0.001
LDL (mg/dl)	<100	525 (18.4%)	136 (34.7%)	580 (27.1%)	413 (25.7%)	124 (25.1%)	207 (24.4%)	64 (22.0%)	56 (35.7%)	39 (27.9%)	44 (26.5%)	37 (31.1%)	105.471
	≥ 100	2334 (81.6%)	256 (65.3%)	1558 (72.9%)	1197 (74.3%)	370 (74.9%)	640 (75.6%)	227 (78.0%)	101 (64.3%)	101 (72.1%)	122 (73.5%)	82 (68.9%)	<0.001
TG (mg/dl)	<150	1722 (57.5%)	198 (45.5%)	918 (46.7%)	788 (47.2%)	233 (45.0%)	422 (49.1%)	129 (41.1%)	46 (50.5%)	60 (44.1%)	76 (43.9%)	41 (30.4%)	125.57
	≥ 150	1273 (42.5%)	237 (54.5%)	1049 (53.3%)	883 (52.8%)	285 (55.0%)	437 (50.9%)	185 (58.9%)	45 (49.5%)	76 (55.9%)	97 (56.1%)	94 (69.6%)	<0.001
HDL (mg/dl)	E>40	1438 (48.4%)	214 (50.4%)	1283 (58.3%)	788 (47.8%)	213 (40.6%)	425 (49.9%)	160 (52.1%)	61 (37.7%)	78 (54.2%)	50 (34.7%)	66 (49.3%)	110.282
	K>50												
	E ≤ 40	1535 (51.6%)	211 (49.6%)	918 (41.7%)	860 (52.2%)	312 (59.4%)	426 (50.1%)	147 (47.9%)	101 (62.3%)	66 (45.8%)	94 (65.3%)	68 (50.7%)	
	K≤ 50												
Non-HDL-C (mg/dl)	<130	652 (22.1%)	120 (28.4%)	362 (26.5%)	410 (25.1%)	91 (24.5%)	203 (25.6%)	37 (24.0%)	26 (36.1%)	21 (34.4%)	26 (18.4%)	33 (25.0%)	28.141
	≥ 130	2301 (77.9%)	302 (71.6%)	1002 (73.5%)	1222 (74.9%)	280 (75.5%)	591 (74.4%)	117 (76.0%)	46 (63.9%)	40 (65.6%)	115 (81.6%)	99 (75.0%)	

*Pearson chi-square test

Discussion

In the present study, we aimed to evaluate the rates of compatibility of the metabolic parameters of type 2 DM with the target values with respect to different health regions of Turkey, and whether there is a significant difference with respect to region or sex.

Compatibility of HbA1c values with the target range is important for mortality and morbidity associated with DM. Compatibility of HbA1c to the target range protects the patient from complications including retinopathy, nephropathy and neuropathy. The mortality and morbidity in patients whose values are within the target range are significantly lower compared to patients whose values are not. Proper use of anti-diabetic medications and following dietary recommendations is crucial in achieving HbA1c targets. In our study, the rate of values that were compatible with the target values which was 65.5% for HbA1c (7.0%), and 50.4% for HbA1c (6.5%), was higher compared to other studies; and the result suggests that our country is in a good condition in achieving target HbA1c values [8-11].

LDL is one of the main targets in cardiovascular protection, and the main objective of anti-hyperlipidemic therapies is to reduce LDL levels as much as possible. One of the main objectives in cardiovascular protection of these patients is to reduce LDL. In our study, we observed that a substantial proportion of the patient population had cholesterol levels higher than the target values. 24.2% individuals were not within the target range for LDL, 49.8% individuals for TG, 50.2% individuals for HDL, and 24.5% individuals for non-HDL cholesterol. Cardiovascular system is negatively affected in DM, and atherosclerotic vascular diseases frequently occur. Because of diabetes-induced neuropathies affecting the cardiovascular system, conditions such as syncope, arrhythmias, sudden death and perioperative risk increase may occur. Diabetes is certainly a serious and independent risk factor in the development of coronary atherosclerosis. In diabetic patients, the most important reason for morbidity and mortality is atherosclerotic heart disease. Moreover, post-infarction morbidity and mortality rates are high in diabetic patients who have had previous myocardial infarction. 75% of the patients who are hospitalized due to complications of the diabetes have cardiovascular complications [12].

Dyslipidemia is associated with increased LDL cholesterol levels which are usually considered to be a risk factor for coronary artery disease. LDL contains 70% of the cholesterol in blood and target organs. The most characteristic lipid disorders in diabetic cases are TG elevation with or without plasma cholesterol elevation [13]. It is known that high HDL concentrations have a protective effect against the development of cardiovascular diseases. The rate of coronary heart disease at 30 mg HDL cholesterol level was found to be 2-times higher compared to the rate at 60 mg HDL cholesterol level. HDL cholesterol is known to be increased by physical exercise and alcohol intake and decreased by obesity, smoking, oral contraceptive use and uncontrolled diabetes [14-16].

In type 2 diabetes, plasma HDL-cholesterol levels tend to decrease. HDL-cholesterol is inversely correlated to obesity and hypertriglyceridemia in type 2 diabetes. The decrease in HDL cholesterol in diabetes is more pronounced in females, which in turn causes an increase in the incidence of coronary atherosclerosis in diabetic females [17-20].

The treatment of diabetic patients involves a well-balanced diet and exercise schedule, as well as changes in lifestyle including the rehabilitation of other cardiovascular risk factors such as giving up smoking, losing excess weight, controlling the blood pressure.as well as antidiabetic treatment which aims to provide a good glycemic control. When primary prevention studies on the effect of lipid-decreasing treatment are examined; a substantial decrease in cardiovascular risk is observed with statin treatment in subgroup analyses of diabetics [21].

In Heart Protection Study (HPS) consisting of 5963 patients, 37% decrease was reported for myocardial infarction and 20% decrease for cardiovascular death with antilipidemic treatment in the diabetic group; and in high-risk patients, 20-30% decrease in LDL level resulted in a 30% decrease in cardiovascular risk independent from the baseline LDL level [22].

In CARDS (Collaborative Atorvastatin Diabetes Study) study, 37% decrease was obtained for coronary artery disease, 31% decrease for coronary revascularization and 48% decrease for stroke in the treatment group; and these beneficial effects were reported to be observed even when the baseline LDL value was not high. Consequently, when the targeted lipid levels could not be obtained by changes in lifestyle and good glycemic control in these patients, a medication which is appropriate for the predominant lipid component should be added to the treatment [23].

In conclusion; according to the findings of this study, the rate of achieving the target values in type 2 diabetic patients in Turkey are still inadequate. To this end, novel regional and country-wide health-improving policies are required. Patient education, continuing medicine training for physicians and local guidelines may assist in the follow-up and treatment of DM.

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