ORIGINAL ARTICLE

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Evaluation of Compliance to Diabetes Treatment, Care Standards in Diabetes Treatment and Follow-up and Awareness of Patients

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Abstract

Objective: Diabetes is a lifelong disease caused by the deficiency or ineffectiveness of insulin hormone. The aim of diabetes treatment is to keep blood sugar regulated thus improving quality of life and preventing the development of long-term complications. In this study, the sociodemographic characteristics that cause diabetes regulation and the complications that may occur because of the disease are examined. We compared the regulation of diabetes and complications and awareness by determining the complications, awareness of patients and the other factors that affect the regulation of diabetes.

Methods: A questionnaire form was applied to 216 patients with diabetes older than 18 years old who applied to the Endocrinology, Diabetes and Internal Medicine outpatient clinics of Okmeydani Training and Research Hospital. Data on sociodemographic information, awareness levels, the values and factors effecting the disease regulation and complications were analyzed.

Results: 58.7% of the patients were female and 41.3% were male. 70.8% of the patients were over 50 years old. 26.3% of the patients did not have any graduation and 49% were primary school graduates. 48.6% of the patients had an income level of 2,000 TL and below. The rate of patients with regulated HbA1c was 30.5%. The rate of patients using insulin was 54.6%. In our study, the mean HbA1c of the retinopathy group was found to be significantly higher than that of the non-retinopathy patients, but there was no significant difference between HbA1C levels and nephropathy. The awareness points of the HbA1c group, which were not regulated, were significantly lower than the ones in the regulated group.

Conclusion: Determining the factors affecting diabetes regulation, the presence of complications and awareness levels play an important role in the follow-up and treatment of diabetes.

Keywords: Diabetes mellitus, complication, related factors, awareness, diabetes

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder in which the organism cannot make sufficient use of carbohydrates, fats, and proteins due to insulin deficiency or disorders in the effect of insulin. It is important to inform and educate health workers and patients to reduce the risk of acute complications and to prevent long-term treatment costs and most importantly, chronic (retinal, renal, neural, cardiac, and vascular) complications (1). The awareness level of patients with DM increases the compliance of the treatment and thus the treatment success. Especially in diseases such as diabetes, where the patient himself is a part of the treatment, it is of great importance in terms of awareness, compliance and treatment success. Our aim is to regulate blood sugar in patients and to prevent future complications and related mortality and morbidity. For this reason, awareness is of great importance to ensure that the treatment given to the patient is used properly and that the patients comply with the

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recommendations for lifestyle changes. Simultaneously, the internet can be a powerful support for diabetes nutrition, self-care and self-management. In our study, sociodemographic features, awareness levels, the frequency of macrovascular and microvascular complications, which are of great importance in the control with diabetes, and the effects of the recommendations presented in the follow-up of the patients on the control with diabetes were compared.

METHODS

A questionnaire was applied to 216 patients who were admitted to the endocrinology, Internal Medicine and Diabetes Outpatient Clinics of University of Health Sciences Turkey, Okmeydani Health Application and Research Center with a diagnosis of DM for more than 6 months, who were older than 18 years, who were pregnant and had no previous history of gastrointestinal system surgery. A questionnaire was prepared as our data collection tool. After sociodemographic characteristics such as age, sex, weight, height, body mass index (BMI), education level, income level, smartphone and internet usage, type of diabetes treatment, type, and year of DM, presence of micro and macrovascular complications and treatment and in the follow-up, the suggestions and applications to the branches related to the complications were questioned. Simultaneously, albumin/creatinine ratios in the spot urine, epidermal growth factor receptor (GFR), low-density lipoprotein, fasting blood sugar and HbA1c levels were recorded. In the last part of the study, parameters were determined by questions about the level of awareness of patients, smoking, diabetes education, exercise, and nutrition recommendations, blood sugar measurement at home and frequency of admission to the physician.

The Ethical Committee approved this study at University of Health Sciences Turkey, Okmeydani Health Application and Research Center on 21.11.2017 no: 48670771-514.10. All patients were informed and consent forms were obtained.

Statistical Analysis

Statistical analysis in this study were performed using the Number Cruncher Statistical System (NCSS) 2007 Statistical Software (Utah, USA) package program.

In the power analysis performed using the G*power 3.1 program related to our study, the effect size for HbA1c ≤7 among the study groups was found to be 0.10 (Quality of Care for Patients with Type 2 Diabetes Mellitus in Dubai: A HEDIS like assessment) (alpha error probability: 0.05); the total number of patients required to be taken in total was found to be at least 160 in the sample size analysis performed with a power value of 0.80.

In addition to descriptive statistical methods (mean, standard deviation, frequency and percentage distributions) in the evaluation of data, we used

- One-Way analysis of variance for intergroup comparison of normally distributed variables (One-Way ANOVA),

- Independent t-test for comparison of paired groups,

- Mann-Whitney U test for comparing non-normally distributed variables between binary groups.

RESULTS

There was a statistically significant difference between the HbA1c averages of no graduation, primary school, high school and university groups ($p<0.001$). HbA1c averages of the no graduation group were found to be significantly higher than the high school and university groups ($p<0.001$, $p=0.001$). HbA1c averages of the primary school group were found to be statistically higher than the high school and university groups ($p=0.006$, $p=0.033$). There was no statistically significant difference between the other groups ($p>0.05$).

The mean HbA1c of the smartphone users was found to be statistically lower than the ones who don not use smartphones ($p<0.001$) (Table 1).

The mean HbA1c of the internet users was found to be significantly lower than the patients who did not use internet ($p=0.002$) (Table 1).

A statistically significant difference was observed between the HbA1c averages of the income groups <1,000 TL, 1,000-2,000 TL, 2,000-3,000 TL, 3,000-5,000 TL, and >5,000 TL ($p=0.0001$) (Table 1). HbA1c averages of <1,000 TL income group were found to be significantly higher than the income groups 2,000-3,000 TL, 3,000-5,000 TL, and >5,000 TL ($p=0.006$, $p=0.012$), HbA1c averages of the income group 1,000-2,000 TL were found to be statistically higher than the income groups 2,000-3,000 TL, 3,000-5,000 TL, and >5,000 TL ($p<0.001$, $p=0.002$), there was no statistically significant difference between the other groups ($p>0.05$) (Table 1).

The mean HbA1c of the dietary group was significantly lower than that of the non-dietary group ($p<0.001$) (Table 2).

A statistically significant difference was observed between the mean HbA1c of the exercise groups not doing, once a week and >2 times a week ($p<0.001$). The HbA1c averages >2 times a week were found to be significantly lower than those who did not exercise ($p<0.001$), and no statistically significant difference was observed between the other groups ($p>0.05$) (Table 2).

The mean HbA1c of oral antidiabetic (OAD) users was significantly lower than those without OAD (p=0.023) (Table 2).

The mean HbA1c levels of the insulin users were significantly higher than those of the non-insulin users (p<0.001) (Table 2).

The mean HbA1c of the group that used treatment regularly was significantly lower than that of the group that uses treatment irregularly (p<0.001) (Table 2).

The mean HbA1c of the DM year ≤10 group was found to be significantly lower than the DM year >10 group (p=0.004) (Table 2).

There was a statistically significant difference between the mean HbA1c of diabetic retinopathy (DRP) unknown, none and existing groups (p=0.019). The mean HbA1c of the DRP existence group was found to be significantly higher than the no DRP group (p=0.01), but no statistically significant difference was observed between the other groups (p>0.05) (Table 3).

No statistically significant difference was observed between the mean of the control visit recommendations for the branches about DM complications of the ≤7 HbA1c and >7 HbA1c groups (p=0.703) (Table 4).

The mean examination score for the branches with DM complications in the >7 HbA1c group was statistically significantly lower than that in the ≤7 HbA1c group (p=0.013) (Table 4).

Table 1. Comparison of mean HbA1c levels and demographic characteristics

		n	HbA1c	p
Age	**20-40**	21	7.96±1.9	0.284
	41-50	42	8.68±2.37	
	51-60	67	7.87±1.53	
	61-70	58	8.27±2.03	
	>71	28	8.44±2.4	
Sexuality	**Female**	127	8.12±1.96	0.389
	Male	89	8.36±2.07	
Education status	**No graduation**	57	9.04±2.13	**<0.001**
	Primary school	106	8.33±1.97	
	Collage	43	7.2±1.44	
	University	10	6.62±0.78	
Smart phone usage	**Not using**	136	8.63±2.11	**<0.001**
	Using	80	7.51±1.59	
Internet usage	**Not using**	163	8.46±2.05	**0.002**
	Using	53	7.47±1.67	
Income status	**<1,000 TL**	12	9.43±3.13	**<0.001**
	1,000-2,000 TL	93	9.1±1.94	
	2,000-3,000 TL	59	7.46±1.29	
	3,000-5,000 TL	39	7.25±1.52	
	>5,000TL	13	7.08±2.06	

The awareness score averages of >7 HbA1c groups were significantly lower than the ≤7 HbA1c group (p<0.001) (Table 4).

DISCUSSION

Turkish Diabetes Epidemiology Study (TURDEP) is the most comprehensive research guideline in which epidemiological diabetes is examined nationally. According to TURDEP I and II, diabetes is seen more frequently in women in our country and 58.7% of the participants were women in our study (Table 1). When the TURDEP II results are examined, cigarette consumption has decreased from 30% to 17.3% in the last 12 years. The smoking rate of the patients in our study was found to be 26% (2).

Although type 2 diabetes may be seen in young people, although less frequently, it is usually seen in the population aged 40 years and over. In an other study, the mean age of type 2 diabetic patients was found to be 53.99±7.75 (3). In our study, 70.8% of

Table 2. Comparison of clinical features and mean HbA1c levels

		n	HbA1c	p
BMI	<20 BMI	7	7.67±2.22	0.117
	20-25 BMI	28	7.42±1.33	
	25-30 BMI	72	8.37±2.23	
	>30 BMI	109	8.36±1.95	
Diet	Not in diet	89	9.39±2.13	**<0.001**
	In diet	127	7.39±1.42	
Exercise	None	119	8.91±2.12	**<0.001**
	Once in a week	6	8.27±2.14	
	2 or more times in a week	91	7.30±1.41	
OAD	Not using	33	8.94±1.95	**0.023**
	Using	183	8.08±1.99	
Insulin	Not using	98	7.2±1.4	**<0.001**
	Using	118	9.06±2.05	
Treatment regularity	Regularly	33	10.52±1.79	**<0.001**
	Irregularly	183	7.8±1.75	
DM age	≤10 years	149	7.95±1.89	**0.004**
	>10 years	67	8.80±2.14	
DM type	Type I	9	8.77±1.76	0.401
	Type II	207	8.19±2.02	
FPG	≤120	65	6.67±0.9	<0.001
	>120	151	8.87±1.98	
LDL	≤100	9	7.87±1.87	**0.166**
	>100	207	8.31±2.05	

BMI: Body mass index, OAD: Oral antidiabetic, DM: Diabetes mellitus, FPG: Fasting plasma glucose, LDL: Low-density lipoprotein

Table 3. Comparison of systemic features and mean HbA1c levels

		n	HbA1c	p
DNP	**Unknown**	14	8.02±2.01	0.506
	None	154	8.11±1.99	
	Microalbuminuria	23	8.63±2.21	
	Proteinuria	14	8.93±1.9	
	Renal failure	11	8.22±1.92	
DRP	**Unknown**	38	8.51±1.99	**0.019**
	None	128	7.91±1.82	
	Exist	50	8.78±2.34	
Diabetic neuropathy	**Unknown**	127	8.33±1.99	0.285
	None	74	7.94±1.92	
	Exist	15	8.64±2.51	
Chronic ischemic heart disease	**None**	162	8.23±1.95	0.850
	Exist	54	8.17±2.2	
HT	**None**	128	8.13±1.99	0.463
	Exist	88	8.34±2.04	
CVD	**None**	205	8.19±1.97	0.412
	Exist	11	8.7±2.72	
PAD	**None**	214	8.19±1.99	0.057
	Exist	2	10.9±3.39	
Diabetic foot	**None**	213	8.18±1.98	**0.026**
	Exist in past and healed	1	13.3±	
	Still exist	2	9.45±1.34	
Diabet education	**None**	178	8.38±2.01	**0.008**
	Exist	38	7.43±1.8	
Weight loss advice	**No**	5	6.86±1.81	0.127
	Yes	211	8.25±2	
Diet advice	**No**	3	7.5±2.07	0.535
	Yes	213	8.23±2.01	
Exercise advice	**No**	7	7.34±1.52	0.243
	Yes	209	8.24±2.02	
Smoking cessetion advice	**Yes**	47	8.95±1.96	**0.017**
	No	9	8.14±1.33	
	Not using	160	8±2.01	
Frequency of physician control	**0-3 months**	125	7.81±1.93	**0.004**
	3-6 months	57	8.64±2	
	6-12 months	21	9.1±1.96	
	>12 months	13	8.84±2.08	
Home blood glucose measurement	**No**	40	8.64±2.19	0.136
	Yes	176	8.12±1.96	

DN: Diabetic nephropathy, DRP: Diabetic retinopathy, HT: Hypertension, CVD: Cardiovascular disease, PAD: Peripheral artery disease

the patients with diabetes were found to be over 50 years of age (Table 1).

Another study found that most patients had a low educational level and had a disease duration of more than 5 years (3). The patients in our study had similar characteristics in this respect (Table 2).

HbA1c averages of patients with smartphone and internet usage were lower than those without use (Table 1). In a study by Grant et al. (4), it was found that those who did not use the internet were older and had lower education levels and therefore, some differences were found in treatment and complications.

As it is known, factors such as high income level, diet and exercise have positive effects on diabetes regulation. The mean HbA1c levels of the groups with an income of 2,000 TL or more, who paid attention to their diet and fed regularly and exercised 2 or more times a week were found to be significantly lower than the other groups (Tables 1, 2). In a meta-analysis, positive effects of diet and exercise on type 2 DM were reported (4). In a study by Houle et al. (5), it also shows that low education and socioeconomic factors have negative effects on diabetes regulation.

There is strong and consistent evidence that obesity management can delay the transition from prediabetes to type 2 diabetes and is useful for treating type 2 diabetes (6). In our study, the presence of BMI above 25 and more was significantly higher in the HbA1c >7 group than in the HbA1c ≤7 group, and the mean BMI of patients who have HbA1c above 7 was significantly higher than the other group (Table 2). In another study, Oğuz et al. (7) it has been stated that obesity is a major problem in providing diabetes regulation.

Diabetes age and regular use of treatment are important factors for diabetes regulation. In our study, the mean HbA1c levels were lower in the group receiving regular treatment and in the group with DM age less than 10 years compared to the other groups (Table 2). Simultaneously, the mean year of DM was significantly lower in patients with regulated HbA1c than non-regulated ones (Table 2). In a study by Ahmad et al. (8), each 1 year increase in the duration of DM was associated with a 5% reduction in the probability of achieving target glycemic control. In another study, HbA1c levels showed a significant increase as diabetes duration increased (9).

In our study, the percentage of patients with regulated HbA1c levels was found to be 30.5%. In a study by Oğuz et al. (7), the percentage of patients with regulated HbA1c was 36%.

Table 4. Comparison of awareness and complication scores in between blood glucose regulation groups				
	All patients n=216	**≤7 HbA1c n=71**	**>7 HbA1c n=145**	**p**
Control visit advice for complications	1.79±1.15	1.83±1.16	1.77±1.14	**0.703**
Control visit for complications	4.58±3.31	5.39±3.41	4.18±3.19	**0.013**
Awareness score	4.29±3.38	5.69±3.4	3.61±3.17	**<0.001**

DRP is one of the common complications of diabetes. In our study, the incidence of retinopathy was found to be 23.1% (Table 3). In a study conducted in 2016, retinopathy was associated with advanced age, early onset of the disease, longer disease duration, uncontrolled blood sugar, hypertension and insulin use, and the presence of neuropathy and nephropathy and retinopathy was found to be 36.4% (10).

Another important complication associated with diabetes is nephropathy. In a study in Albania, the prevalence of microalbuminuria in patients with type 2 diabetes was 26.3%. Ahmed et al. (10) found a rate of 16.6% patients with microalbuniria. In our study, the rate of microalbuminuria was 10.6%, the rate of macroalbuminuria was 6.4% and patients with GFR below 60 were 5% (Table 3). In our study groups, differences in disease regulation rates and disease duration were thought to be effective the differences between the results determined in the literature.

According to the data of a study conducted in our country dealing with the relationship between target glycemic values and complication frequencies; there was a weak positive correlation between diabetic nephropathy and retinopathy rates and mean HbA1c values, but no statistically significant correlation was found between microalbuminuria and neuropathy rates (11). In our study, the mean HbA1c values of the group with DRP were significantly higher than those without DRP, but no significant difference was found between HbA1c levels with and without DNP.

In terms of control visit frequency for complications, the mean HbA1c levels of the 0-3 months group were found to be significantly lower than those of the other groups (Table 4). In another study, they also mentioned that HbA1c monitoring frequency is associated with diabetes control (12).

The awareness level of diabetes patients is a critical factor in reaching the target glycemic values in the disease. Awareness also plays an important role in preventing complications and achieving treatment success. In our study, a significant relationship was found between the awareness questionnaire score and the regulation of the disease (Table 4). Awareness of the non-regulated HbA1c group was significantly lower than that of the regulated group (Table 4). Increasing the awareness of patients in a chronic disease such as diabetes will make a significant contribution to the regulation of diabetes.

CONCLUSION

It is also important to achieve the goals of glycemic control and to identify other factors that are effective in preventing complications.

As mentioned in our study, the factors that are adversely affecting diabetes regulation, such as; low level of education and income, advanced age of diabetes, the use of technological devices such as smart phones and the internet, frequency of physician control, smoking and obesity, will create serious complications in the short and long term and will also cause serious economic burden is obvious.

With the help of larger studies, it is possible to achieve clearer and more effective results and thus, short- and long term complications of diabetes can be prevented using both conventional and technological methods and to increase the quality of life of patients and decrease the economic burden of diabetes.

Ethics

Ethics Committee Approval: The Ethical Committee approved this study at University of Health Sciences Turkey, Okmeydani Health Application and Research Center on 21.11.2017 no: 48670771-514.10.

Informed Consent: All patients were informed and consent forms were obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: O.Y., M.A., Concept: O.Y., M.A., Design: O.Y., M.A., Data Collection or Processing: O.Y., M.A., Analysis or Interpretation: O.Y., M.A., Literature Search: O.Y., M.A., Writing: O.Y., M.A.

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