

# Investigation of the Relationship Between Socio-Demographic Characteristics, Metabolic Variables, and Treatment Adherence in Individuals with Diabetes

## Abstract

**Aim:** This study was conducted to examine the relationship between socio-demographic characteristics, metabolic variables, and treatment adherence in individuals with diabetes.

**Methods:** The study population consisted of individuals who were treated in Balıkesir State Hospital Endocrinology Clinic, and the study sample included 260 individuals with diabetes who met the inclusion criteria and volunteered to participate in the study. The data were collected between November 30, 2015, and September 30, 2016, by using the face-to-face interview method. In the evaluation of the data, the Shapiro Wilk test was used to analyze the normality of the variables, and Mann-Whitney *U* and Kruskal-Wallis *H* tests were used to analyze the differences between the groups. In case of significant differences from the Kruskal-Wallis *H* test, a post hoc multiple comparison test was employed, and Spearman's correlation coefficient was used for variables that did not show a normal distribution.

**Results:** Of the individuals with diabetes, 79.23% were female, 40.77% were in the 56-65 age group, 95.77% stated that they followed the recommended treatment regularly, and 95.38% reported that they accepted the treatment. It was determined that 93.08% of the individuals followed their blood sugar, 22.69% regularly applied medical nutrition therapy, 28.84% did regular exercise, 23.46% paid attention to their foot care, and 88.08% had received education on diabetes before. The examination of individuals' metabolic control levels indicated that the mean HbA1c was  $8.57 \pm 2.11$ , the mean total cholesterol was  $206.55 \pm 48.62$  mg/dL, the mean systolic/diastolic blood pressure was  $129.88 \pm 16.31/78.08 \pm 14.39$ , and the mean body mass index was  $29.39 \pm 5.65$  kg/m<sup>2</sup>. There was a statistically significant difference between gender and acceptance of the treatment, age groups and doing regular exercise, education level and doing regular exercise, paying attention to foot care and previous education on diabetes, HbA1c value and doing regular exercise, and BMI value and regular application of medical nutrition therapy.

**Conclusion:** It was found that the majority of the individuals with diabetes accepted the treatment and controlled their blood sugar, but that the majority of them did not pay attention to their medical nutrition, exercise, and foot care. The healthcare team, especially diabetes nurses, has considerable responsibilities in the treatment and care of individuals with diabetes. Since metabolic variables provide clues about treatment adherence in individuals with diabetes, it is important to monitor patients' metabolic parameters as well as their body mass index. In this context, it is recommended to evaluate the treatment adherence of individuals with diabetes and their needs in this respect.

**Keywords:** Diabetes, socio-demographic characteristics, metabolic variables, treatment adherence

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Cite this article as: Yıldız Aslan G, Tekir Ö, Yıldız H. Investigation of the relationship between socio-demographic characteristics, metabolic variables, and treatment adherence in individuals with diabetes. *J Educ Res Nurs.* 2022;19(1):7-16.

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Received: March 14, 2020  
Accepted: July 15, 2020



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## Introduction

Diabetes mellitus (DM) is a highly serious and progressive chronic metabolic disease that causes disturbances in carbohydrate, protein, and fat metabolism as a result of an absolute and relative deficiency of insulin secretion and/or insulin action due to the interaction of genetic, environmental factors, and lifestyle changes.<sup>1,2</sup> With the rapid lifestyle changes, diabetes is recognized as epidemic disease and a global threat in all developed and developing societies. With the addition of genetic, environmental, behavioral, socioeconomic, and cultural factors, the prevalence of especially type 2 diabetes is increasing rapidly and is still one of the main causes of mortality. Also, it is an important public health problem because it causes problems, such as blindness, nerve damage,

and kidney failure, that negatively affect the quality of life and social and professional life of people.<sup>3-10</sup> About 422 million people worldwide have diabetes, and the majority of them live in low- and middle-income countries. Nearly 1.5 million deaths are directly attributed to diabetes each year.<sup>11</sup>

Individuals with diabetes have to make changes in their lifestyle to adhere to the treatment rules, which may cause them to have problems adapting to and accepting the disease. Patients' adherence to treatment is affected by some factors, such as health personnel-patient communication, challenges of the treatment, socioeconomic status, level of education, acceptance of the disease, and psychological status.<sup>12-14</sup> The ability of an individual to manage diabetes is possible by learning and practicing the behaviors necessary for individual management. Therefore, the individual with diabetes should be considered as a whole in the diagnosis and treatment process, with their social, physical, biological, emotional, and cultural aspects. The diagnosis and treatment process includes many activities, such as ensuring that the individual adheres to the disease and treatment, providing them with information about the disease, teaching and encouraging them about how to live with the disease, performing important care activities together, and individual's planning and examining their own treatment and care. In the study by Özkaptan<sup>12</sup>, it was determined that there was a significant and positive relationship between participants' treatment adherence levels and HbA1c, fasting plasma glucose (FPG), postprandial blood glucose, and body mass index (BMI).<sup>12</sup> It was revealed that good glycemic control level was significantly correlated with medication adherence in type 2 DM.<sup>17</sup>

This study was conducted to examine the relationship between socio-demographic characteristics, metabolic variables, and adherence to treatment in individuals with diabetes.

## Material and Methods

### Type of the Study

A descriptive and cross-sectional design was used in the study to examine the relationship between socio-demographic characteristics, metabolic variables, and treatment adherence in individuals with diabetes.

### Population and Sample of the Research

The study population consisted of individuals with diabetes who were hospitalized in Balikesir State Hospital Internal Medicine and Endocrinology Departments or received outpatient treatment in Internal Medicine and Endocrinology Polyclinics, Diabetes and Obesity Education Unit between November 30, 2015, and September 30, 2016. Inclusion criteria for the study were being between the ages of 18 and 65, not having been diagnosed with diabetic foot, having been diagnosed with DM at least 6 months ago, having stable metabolic status (no health problems requiring emergency intervention due to diabetes, etc.), and having no sensory loss such as hearing or speech and consciousness and psychiatric problems. The study sample was calculated as 235 individuals using a power analysis on the Raosoft software in line with the information obtained from the hospital and based on a 5% acceptable margin of error and a confidence interval of 95%. The study was conducted on 260 individuals with diabetes who met the inclusion criteria and volunteered to participate in the study.

### Data Collection Forms

The study data were collected by using a questionnaire form that included a total of 64 items and 3 sections, namely, socio-demographic characteristics (age, gender, marital status, educational status, employment status), diabetes and treatment adherence in diabetes (diabetes complication history, adherence to treatment and treatment modalities, self-monitoring, status of having received education about diabetes), and metabolic control variables (HbA1c, total cholesterol, blood pressure, height, weight, and BMI).

### Data Collection

The data were collected by using the questionnaire between November 30 and September 30, 2016, from individuals with diabetes who were hospitalized in the Internal Medicine and Endocrinology Services of Balikesir State Hospital or were treated as outpatients in the Internal Medicine and Endocrinology Polyclinics, Diabetes and Obesity Education Unit. In the study, data about individual characteristics on the questionnaire form were obtained by using the face-to-face interview technique, and data on metabolic variables (HbA1c, glucose, total cholesterol) were obtained from medical records in the hospital system. Patients with missing records of metabolic values in the system were excluded from the study. Blood pressure measurements and BMI measurements were made by the researcher. It took an average of 45 minutes to fill out the questionnaire.

### Ethical Aspects

Institutional approval of Balikesir Provincial Public Hospitals Association and ethics committee approval of Balikesir University Faculty of Medicine Clinical Research Ethics Committee were obtained to conduct the study (2016/47). The individuals participating in the study were first informed about the study and then their written consent was obtained.

### Data Analysis

The data obtained from this study were analyzed on the IBM Statistical Package for the Social Sciences statistics Version 20 software package (IBM SPSS Corp.; Armonk, NY, USA). The Shapiro Wilk test was used to analyze the normality of the variables, and Mann-Whitney *U* and Kruskal-Wallis *H* tests were employed to analyze the differences between the groups. In case of significant differences from the Kruskal-Wallis *H* test, a post hoc multiple comparison test was employed, and Spearman's correlation coefficient was used for variables that did not show a normal distribution. While the results were being interpreted, the significance level was taken as  $P < .05$ .

## Results

Of the individuals with diabetes participating in the study, 79.23% were female, 40.77% were in the 56-65 age group, 81.15% were married, 69.23% were primary school graduates, 71.54% were housewives, and 22.69% were retired. Also, it was found that 95.77% of the individuals with diabetes regularly applied the recommended treatment and that 95.38% accepted the treatment. In addition, the participants had some difficulties with insulin (15.79%), oral medication treatment (52.63%), diet (15.79%), and doing exercise (15.79%). The percentage of the participants who monitored blood sugar was 93.08%. Moreover, 22.69% of the individuals with diabetes in the study regularly applied medical nutrition therapy (MNT), 28.84% exercised regularly, 23.46% paid attention to foot care, and 88.08% had received education on diabetes before (Table 1).

Table 1. Distribution of Characteristics About Treatment Adherence of Individuals with Diabetes		
Characteristics About Treatment Adherence of Individuals	n	%
Regular application of the treatment		
Yes	249	95.77
No	11	4.23
Acceptance of treatment		
Yes	248	95.38
No	12	4.62
Area of difficulty in treatment (n=19)		
Insulin use	3	15.79
Use of the pill	10	52.63
Dieting	3	15.79
Doing exercise	3	15.79
Monitoring the blood sugar		
Yes	242	93.08
No	18	6.92
Application of medical nutrition treatment		
Regularly	59	22.69
Sometimes	127	48.85
Never	58	22.31
Irregularly	16	6.15
Doing regular exercise		
Yes	75	28.84
No	153	58.85
Sometimes	32	12.31
Paying attention to foot care		
Yes	61	23.46
No	199	76.54
Previous diabetes education		
Yes	229	88.08
No	31	11.92

The mean HbA1c of individuals with diabetes was  $8.57 \pm 2.11$ , the mean total cholesterol was  $206.55 \pm 48.62$  mg/dL, the mean systolic/diastolic blood pressure was  $129.88 \pm 16.31/78.08 \pm 14.39$ , and the mean BMI was  $29.39 \pm 5.65$  kg/m<sup>2</sup>.

A statistically significant relationship was found between the gender of the individuals with diabetes and their acceptance of treatment ( $P < .05$ ). The majority of the females (97.09%) and males (88.89%) stated that they accepted the treatment (Table 2). A statistically significant relationship was found between age groups and doing regular exercise ( $P < .05$ ). Of the participants, 44.44% of those aged  $\leq 45$ , 41.54% of those aged 46-55, 28.30% of those aged 56-65, and 17.50% of those aged  $\geq 66$  stated that they exercised regularly (Table 3).

There was no statistically significant relationship between marital status and regular application of MNT, doing regular exercise, regular application of the recommended treatment, acceptance of treatment, blood sugar monitoring, paying attention to foot care, and previous education on diabetes ( $P > .05$ ). Although not statistically significant, 95.26% of the married participants and 66.67% of the single ones accepted the treatment. Also, 92.89% of the married and 66.67% of the singles monitored their blood sugar, 22.75% of the married regularly applied MNT, 29.38% of the married and 33.33% of the singles did regular exercise, 93.84% of the married and 66.67% of the singles used their medication regularly, and 23.7% of the married paid attention to foot care (Table 4). A statistically significant relationship was

Variables of Treatment Adherence	Gender						Chi Square**	P
	Female		Male		Total			
	n	%	n	%	n	%		
Medical nutrition therapy							3.119**	.374
Status of regular application of the diet								
Yes	47	22.82	12	22.22	59	22.69		
Sometimes, but not regularly	98	47.57	29	53.70	127	48.85		
Never	50	24.27	8	14.81	58	22.31		
Irregularly	11	5.34	5	9.26	16	6.15		
Status of doing regular exercise							0.681	.712
Yes	58	28.16	17	31.48	75	28.85		
No	121	58.74	32	59.26	153	58.85		
Sometimes	27	13.11	5	9.26	32	12.31		
Regular application of the recommended treatment							Fisher's exact	.703
Yes	198	96.12	51	94.44	249	95.77		
No	8	3.88	3	5.56	11	4.23		
Acceptance of the treatment							Fisher's exact	.02
Yes	200	97.09	48	88.89	248	95.38		
No	6	2.91	6	11.11	12	4.62		
Status of monitoring blood sugar							Fisher's exact	1
Yes	192	93.20	50	92.59	242	93.08		
No	14	6.80	4	7.41	18	6.92		
Status of paying attention to foot care due to the disease							0.09	.764
Yes	47	22.82	14	25.93	61	23.46		
No	159	77.18	40	74.07	199	76.54		
Previous diabetes education							0.251	.461
Yes	183	88.83	46	85.19	229	88.08		
No	23	11.17	8	14.81	31	11.92		

\*Monte Carlo simulation technique was used. \*\*Chi-square test.

found between education status and doing regular exercise, paying attention to foot care, and previous education about diabetes ( $P < .05$ ). Of the university graduates, 57.14% did exercise regularly, 57.14% paid attention to foot care, and 100% had received diabetes education before.

There was no statistically significant relationship between the presence of complications and regular application of MNT, doing regular exercise, regular application of the recommended treatment, acceptance of treatment, monitoring blood sugar, paying attention to foot care, and previous education on diabetes ( $P > .05$ ).

As seen in Table 5, a statistically significant difference was found between the regular exercise status of individuals with diabetes

in terms of HbA1c values ( $P < .05$ ). However, there was no statistically significant difference between individuals' status of regular application of MNT, monitoring blood sugar, paying attention to foot care, and previous education about diabetes in terms of their HbA1c values ( $P > .05$ ). Although it was not statistically significant, it was found that the HbA1c value was higher in participants who irregularly applied MNT, did not monitor blood sugar, did not pay attention to foot care, and had not received education on diabetes before (Table 5). There was no statistically significant difference between the participants' status of regular application of MNT, doing regular exercise, monitoring blood sugar, paying attention to foot care, and previous education about diabetes in terms of their total cholesterol values ( $P > .05$ ). There was no statistically significant difference

Table 3. Comparison of Age Groups and Variables of Treatment Adherence

Variables of Treatment Adherence	Age Groups										Chi-Square**	P
	≤45		46-55		56-65		≥66		Total			
	n	%	n	%	n	%	n	%	n	%		
Regular application of medical nutrition therapy (diet)											*	.774
Yes, regularly	0	0	17	26.15	24	22.64	18	22.50	59	22.69		
Sometimes, but not regularly	7	77.78	31	47.69	50	47.17	39	48.75	127	48.85		
Never	1	11.11	14	21.54	26	24.53	17	21.25	58	22.31		
Irregularly	1	11.11	3	4.62	6	5.66	6	7.50	16	6.15		
Status of doing regular exercise											15.792	<b>.015</b>
Yes	4	44.44	27	41.54	30	28.30	14	17.50	75	28.85		
No	3	33.33	33	50.77	59	55.66	58	72.50	153	58.85		
Sometimes	2	22.22	5	7.69	17	16.04	8	10	32	12.31		
Status of regular application of the recommended treatment											*	.335
Yes	8	88.89	61	93.85	104	98.11	76	95	249	95.77		
No	1	11.11	4	6.15	2	1.89	4	5	11	4.23		
Status of accepting the treatment											*	.524
Yes	8	88.89	62	95.38	103	97.17	75	93.75	248	95.38		
No	1	11.11	3	4.62	3	2.83	5	6.25	12	4.62		
Status of monitoring blood sugar											*	.963
Yes	8	88.89	61	93.85	98	92.45	75	93.75	242	93.08		
No	1	11.11	4	6.15	8	7.55	5	6.25	18	6.92		
Status of paying attention to foot care due to the disease											1.454	.693
Yes	1	11.11	14	21.54	28	26.42	18	22.50	61	23.46		
No	8	88.89	51	78.46	78	73.58	62	77.50	199	76.54		
Status of doing foot-leg exercises											3.708	.295
Yes	1	11.11	12	18.46	21	19.81	8	10	42	16.15		
No	8	88.89	53	81.54	85	80.19	72	90	218	83.85		
Previous diabetes education											2.145	.543
Yes	8	88.89	56	86.15	97	91.51	68	85	229	88.08		
No	1	11.11	9	13.85	9	8.49	12	15	31	11.92		

\*Monte Carlo-Simulation technique was used. \*\*Chi-square test.

Table 4. Comparison of Variables of Marital Status and Treatment Adherence

Variables of Treatment Adherence	Marital Status												Chi-Square**	P			
	Married			Widowed			Single			Divorced					Total		
	n	%		n	%		N	%		n	%				n	%	
Regular application of medical nutrition therapy (diet)																	
Yes, regularly	48	22.75	10	23.81	0	0	1	25	59	22.69							.806
Sometimes, but not regularly	102	48.34	22	52.38	1	33.33	2	50	127	48.85							
Never	46	21.80	9	21.43	2	66.67	1	25	58	22.31							
Irregularly	15	7.11	1	2.38	0	0	0	0	16	6.15							
Status of doing regular exercise																	
Yes	62	29.38	11	26.19	1	33.33	1	25	75	28.85							.953
No	121	57.35	27	64.29	2	66.67	3	75	153	58.85							
Sometimes	28	13.27	4	9.52	0	0	0	0	32	12.31							
Status of regular application of the recommended treatment																	
Yes	202	95.73	41	97.62	2	66.67	4	100	249	95.77							.124
No	9	4.27	1	2.38	1	33.33	0	0	11	4.23							
Status of accepting the treatment																	
Yes	201	95.26	41	97.62	2	66.67	4	100	248	95.38							.131
No	10	4.74	1	2.38	1	33.33	0	0	12	4.62							
Status of monitoring blood sugar																	
Yes	196	92.89	40	95.24	2	66.67	4	100	242	93.08							.27
No	15	7.11	2	4.76	1	33.33	0	0	18	6.92							
Status of paying attention to especially foot care due to the disease																	
Yes	50	23.70	9	21.43	0	0	2	50	61	23.46							.466
No	161	76.30	33	78.57	3	100	2	50	199	76.54							
Previous diabetes education																	
Yes	184	87.20	40	95.24	2	66.67	3	75	229	88.08							.198
No	27	12.80	2	4.76	1	33.33	1	25	31	11.92							
Total	211	100	42	100	3	100	4	100	260	100							

\*Monte Carlo-Simulation technique was used. \*\*Chi-square test.

Table 5. Examination of the Relationship Between the HbA1c Value and the Variables of Treatment Adherence

Variables of Treatment Adherence	HbA1c							H'	P
	n	Mean	Median	SD	Min.	Max.	Mean Ranking		
Regular application of medical nutrition therapy (diet) (n=159)								1.782*	.619
Yes, regularly	34	8.59	7.45	2.73	6	16.90	73.68		
Sometimes, but not regularly	83	8.47	8.3	1.92	6	14.69	78.95		
Never	31	8.65	8.36	1.82	6.3	12.71	86.05		
Irregularly	11	9.01	8	2.27	6.2	12.4	90.41		
Status of doing regular exercise (n=159)								6.623	.036
Yes	47	8.25	7.63	1.92	6	14.02	73.36		
No	93	8.89	8.36	2.21	6	16.90	87.28		
Sometimes	19	7.77	7.18	1.76	6	11.90	60.76		3-2**
*The data in the table were analyzed by using the Kruskal-Wallis H test.									
**Groups with differences were determined by post hoc multiple comparisons.									
HbA1c									
Status of regular application of the recommended treatment (n=159)	n	Mean	Median	SD	Min.	Max.	Mean Ranking	Z	P
Yes	155	8.54	8.12	2.12	6	16.90	78.56	-	.107
No	4*	9.70	9.25	1.35	8.61	11.66	104.06	1.614	.262
Status of accepting the treatment (n=159)									
Yes	155	8.48	8.12	2.04	6	16.90	73.36		
No	4*	11.99	12.03	2.26	9.2	14.69	87.28		
*Since the number of subjects in the groups was less than 5, it could not be analyzed.									
HbA1c									
Status of monitoring blood sugar (n=159)	n	Mean	Median	SD	Min.	Max.	Mean Ranking	Z	P
Yes	150	8.47	8.06	2.02	6	16.9	78.56	-	.107
No	9	10.14	9.20	3.00	6	14.69	104.06	1.614	.262
Status of paying attention to foot care due to the disease (n=159)									
Yes	38	8.21	7.40	1.89	6	13.07	72.70	-	.752
No	121	8.68	8.30	2.17	6	16.9	82.29	1.121	.752
Previous diabetes education (n=159)									
Yes	145	8.56	8.30	2.11	6	16.90	79.64	-	.752
No	14	8.70	7.76	2.19	6.2	12.71	83.71	0.316	.752

\*The data in the table were evaluated by using the Mann-Whitney U test.  
SD, standard deviation.

between the participants' status of regular application of MNT, doing regular exercise, regular application of the recommended treatment, acceptance of treatment, monitoring blood sugar, paying attention to foot care, and previous education about diabetes in terms of their blood pressure values ( $P > .05$ ). A statistically significant difference was found between the participants' status of regular application of MNT in terms of their BMI values ( $P < .05$ ). The BMI values of those who regularly and occasionally applied MNT were significantly lower than those who did not apply it at all. On the other hand, there was no statistically significant difference between the participants' status of doing regular exercise, applying the recommended treatment regularly, accepting the treatment, monitoring blood sugar, paying attention to foot care, and previous diabetes education in terms of their BMI values ( $P > .05$ ).

## Discussion

It was determined that 95.38% of the individuals with diabetes adhered to treatment, 22.69% regularly applied MNT, 28.84% did regular exercise, 93.08% followed blood sugar, 23.46% paid attention to foot care, and that 88.08% had received education on diabetes before. In the study conducted by Arslan<sup>13</sup> on 400 individuals with diabetes, it was reported that 57.30% of the individuals had good adherence to treatment, 30% exercised, and that 57.50% had attended a diabetes education program. In their study on individuals with diabetes, Çıtlı et al<sup>18</sup> stated that 57.50% of the participants exercised, 33.30% measured their blood sugar at home, 66.70% did not measure blood pressure, 19.40% had received education about diabetes, and that 61.20% paid attention to foot care. It was determined that there was a significant difference between the previous diabetes education and contribution of the education to diabetes management and the mean score obtained from the Acceptance of Disease Scale ( $P = .002$ ) and that the education positively affected the level of acceptance of the disease.<sup>19</sup> Baykal and Kapucu<sup>20</sup> determined that 66.20% of the individuals showed good adherence to treatment, 56.80% did exercise, and 61% had not received education about diabetes. Taha et al<sup>21</sup> reported that 56.30% of individuals with diabetes followed treatment, but that those who did not pay attention to their medical nutrition (diet) and exercise had poor treatment adherence.<sup>21</sup> According to the results of the study, the participants' adherence to treatment was higher than participants in other studies. This may be because there was a diabetes education nurse in the center where the research was conducted, and accordingly, diabetes education was carried out regularly.

Regarding the metabolic criteria results of the individuals with diabetes in this study, the mean HbA1c value was  $8.57 \pm 2.11$ , mean total cholesterol was  $206.55 \pm 48.62$  mg/dL, mean systolic/diastolic blood pressure was  $129.88 \pm 16.31/78.08 \pm 14.39$ , and the mean BMI was  $29.38 \pm 5.65$  kg/m<sup>2</sup>. In the study of Arslan<sup>13</sup>, the mean HbA1C value of people with good treatment adherence was 8.60, while the mean HbA1C value of those with poor treatment adherence was 9.20.

In our study, a statistically significant relationship was found between gender and acceptance of treatment ( $P < .05$ ). The majority of the females (97.09%) and males (88.89%) stated that they accepted the treatment. It was observed that the majority of both males and females in the study monitored blood sugar, adhered to the recommended treatment, tried to apply their medical nutrition, though not completely, had received diabetes education, but that the majority of them were inadequate in doing exercise and foot care. In our study,

no statistically significant correlation was found between age groups and acceptance of treatment ( $P > .05$ ). Although not statistically significant, it was seen that the majority of all age groups accepted the treatment. It was also seen that the majority of all age groups monitored blood sugar, but that the majority of them did not adhere to nutrition, exercise, and foot care. When evaluated in terms of marital status, it was seen in our study that all groups accepted the treatment and controlled blood sugar, but the majority did not adhere to nutrition, exercise, and foot care. In our study, there was no statistically significant relationship between educational status and acceptance of treatment ( $P > .05$ ). Although not statistically significant, 96.97% of the illiterate, 93.89% of the primary school graduates, and 100% of the literate, secondary school graduates, and high school/college/university graduates were found to accept the treatment. In addition, it was seen that most of the participants controlled blood sugar and did not pay much attention to their nutrition, although the difference between education levels was few. The distribution in exercise and foot care was different. That is, it changed according to the education level, and as the education level increased, the number of people who exercised and paid attention to foot care also increased. Arslan (2011) stated that there was no statistically significant relationship between the gender of the patients included in the study and their acceptance of treatment. In addition, no statistically significant difference was found between marital status, job, and treatment adherence. Also, 56.30% of the illiterate patients and 71.20% of those with secondary and above education were found to have good treatment adherence ( $P = .042$ ).<sup>13</sup> Park et al<sup>22</sup> conducted a study with 265 patients with diabetes in Korea and found that the variables of gender and marital status were not correlated with the level of treatment adherence. Taha et al<sup>21</sup> found that 43.70% of the individuals with diabetes, 47.50% of the literate, and 40.50% of the illiterate individuals adhered to treatment. Özönük<sup>23</sup> stated that females had higher diabetes treatment adherence scores than males. In the study of Jansiraninatarajan<sup>24</sup>, males with diabetes were found to adhere to treatment more, and in the study of Korkmaz<sup>25</sup>, males were reported to have higher mean adherence scores than females. Sayiner<sup>26</sup> found no significant relationship between gender, age, marital status, and treatment adherence. While there are results in the literature claiming that there is no statistically significant difference between treatment adherence by age,<sup>27</sup> there are also results showing that treatment adherence decreases with age.<sup>28</sup> Our results differ from other study results. This may stem from sample sizes of the studies, socio-cultural structure of the study settings, different inclusion criteria, and the negative effect of disabilities due to aging. In our study, no statistically significant relationship was found between the presence of complications and the status of accepting treatment, monitoring blood sugar, regular application of medical nutrition therapy, doing regular exercise, and paying attention to foot care ( $P > .05$ ). Arslan<sup>13</sup> found that 52.70% of the patients with no complications and 63.80% of those with complications had good treatment adherence ( $P = .028$ ).<sup>13</sup> In their study on patients with type 2 diabetes in Southern Ethiopia, Teklay et al<sup>29</sup> found that patients with complications had a higher level of non-adherence to treatment.<sup>29</sup> On the other hand, in their study in France, Bezie et al<sup>30</sup> found that complications affected treatment adherence, but that patients with fewer complications had poor treatment adherence. It can be thought that the difference between our study results and those of other studies may be due to the different complication rates of the patients included in the studies.



In our study, there was a statistically significant difference between the participants' status of doing regular exercise in terms of their HbA1c values ( $P < .05$ ). The HbA1c values of those who occasionally exercised were significantly lower than those who did not exercise regularly. However, there was no statistically significant difference between the participants' status of accepting treatment, following blood sugar, paying attention to foot care, and previous education about diabetes in terms of their HbA1c values. In our study, a statistically significant difference was found between the participants' status of regular application of MNT in terms of their BMI values ( $P < .05$ ). The BMI values of those who regularly and occasionally applied medical nutrition therapy were significantly lower than those who did not apply it at all. However, in terms of BMI values, there was no statistically significant difference between the participants' status of accepting treatment, following blood sugar, paying attention to foot care, and previous education about diabetes. In the study conducted by Arslan (2011) on 344 patients, the mean HbA1c value of people with good treatment adherence was 8.60, but that it was 9.20 in people with poor treatment adherence. Although there was a difference between the mean values of the groups with good treatment adherence in terms of FPG and total cholesterol values, 54.60% of the patients had a total cholesterol value within the normal range, and there was no statistically significant difference between BMI values and treatment adherence, 80% of the patients had a BMI value of over 25 kg/m<sup>2</sup>.

## Conclusion

It was observed that most of the individuals with type 2 diabetes who participated in the study had chronic complications, applied treatment regularly, and accepted treatment. The participants in the study followed their blood sugar, but they stated that "it was difficult to apply MNT, so they did not adhere to it." The majority of the individuals with diabetes who participated in the study stated that they could not achieve foot care. It was observed that the rate of those who stated that they had received education on diabetes before was 88.08%. The mean HbA1c value of individuals with diabetes was 8.57, total cholesterol value was 206.55 mg/dL, blood pressure was 130.59 mm/Hg, and BMI was 29.38 kg/m<sup>2</sup>. The comparison of the participants' socio-demographic characteristics, data on the disease, metabolic criteria, and some treatment adherence criteria indicated that the majority of individuals with diabetes accepted the treatment but had difficulty in applying it.

The healthcare team, especially diabetes nurses, has considerable responsibilities in the treatment and care of individuals with diabetes. Since metabolic variables provide clues about treatment adherence in individuals with diabetes, it is important to monitor the patient's metabolic parameters as well as BMI. In this context, it is recommended to evaluate the treatment adherence and needs of individuals with diabetes.

Since diabetes education will prevent possible complications related to the disease and be effective in the treatment of complications, it is recommended that education programs should be carried out gradually and in a planned way that is tailored to the individual's needs. During the education, determination of the factors causing the patient to have difficulties in fulfilling recommendations, such as recommended treatment, diet, and the like, is important in the effectiveness of education. For this reason, it is recommended to increase

studies on treatment adherence in individuals with diabetes and to develop solutions for the identified problems.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Balıkesir University Faculty of Medicine Clinical Research (date and number: March 09, 2016, 47).

**Informed Consent:** Written and verbal consent was obtained from individuals with diabetes who participated in the study.

**Peer Review:** Externally peer-reviewed.

**Author Contributions:** Concept – G.Y.A., Ö.T.; Design – G.Y.A., Ö.T.; Supervision – Ö.T., H.Y.; Resources – G.Y.A., Ö.T., H.Y.; Materials – G.Y.A., Ö.T., H.Y.; Data Collection and/or Processing – G.Y.A.; Analysis and/or Interpretation – G.Y.A., A.G., Ö.T., H.Y.; Literature Search – G.Y.A., Ö.T.; Writing Manuscript – G.Y.A.; Critical Review – Ö.T., H.Y.

**Acknowledgments:** The authors would like to thank Mr. Ahmet Gül for his support in the statistics stage.

**Declaration of Interests:** The authors have no conflict of interest to declare.

**Funding:** The authors declared that this study has received no financial support.

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