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Determination of Factors Associated with Glycemic Control in Women with Type 2 Diabetes: Nutrition and Physical Activity Level

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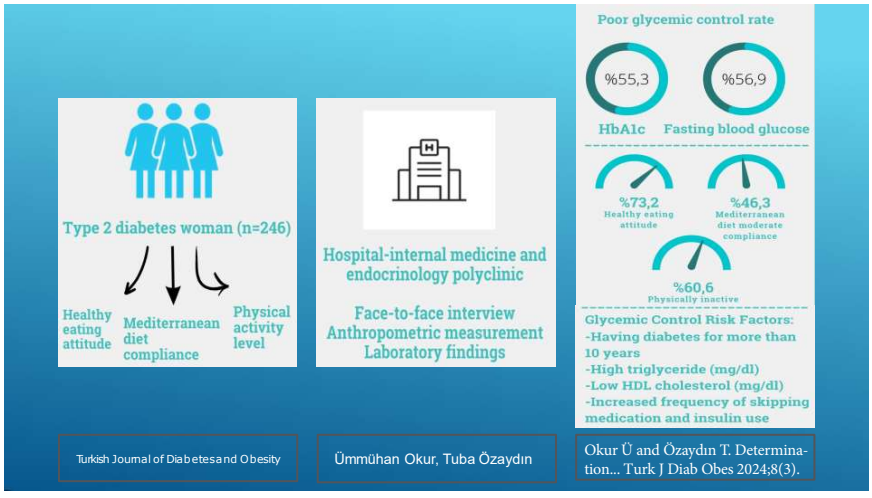
GRAPHICAL ABSTRACT



ABSTRACT

Aim: Effective diabetes management is achieved with adequate glycemic control. Nutrition and physical activity have an important role in glycemic control. This study was conducted to determine the relationship between glycemic control and nutrition attitude, Mediterranean diet adherence and physical activity levels of women with Type 2 diabetes aged 20-64 years who applied to a state hospital in Konya province.

Material and Methods: This correlational study was conducted with 246 women aged 20-64 years with Type 2 diabetes who applied to the Internal Medicine and Endocrinology outpatient clinics of a hospital in Konya. Individuals were selected by random sampling method. Data were collected using a questionnaire form, Attitudes Toward Healthy Eating Scale, Mediterranean Diet Adherence Scale and International Physical Activity Questionnaire Short Form (IPAQ-SF). Descriptive statistics, Chi-Square, Fisher's exact test, Kruskal Wallis test, Spearman correlation analysis and logistic regression analysis were used to analyze the data collected by face-to-face interviews.

Results: In the study, glycated hemoglobin A1c (HbA1c) and fasting blood glucose (FBG) were used to assess glycemic control. 55.3% and 56.9% of the individuals had poor glycemic control in terms of HbA1c and FBG, respectively. According to logistic regression analysis, for HbA1c; having diabetes for more than 10 years (OR=0.291, 95% Cl=0.095-0.894), high triglycerides (OR=0.440, 95% Cl=0.190-1.017) and low high density lipoprotein (HDL) (OR=0.293, 95% Cl=0.114-0.753); For FBG, increased frequency of skipping

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medication and insulin use (OR=2.431, 95% Cl=1.090-5.424) and low HDL level (OR=0.269, 95% Cl=0.110-0.653) were significant risk factors. Among the individuals, 73.2% had a moderate attitude towards healthy eating, 46.3% had a moderate adherence to the Mediterranean diet and 60.6% were physically inactive. In addition, there was a very weak negative significant correlation (p<0.05) between the individuals' FBG and the Attitudes Towards Healthy Eating Scale (r=-0.138) and IPAQ-SF (r=-0.154) scores.

Conclusion: In conclusion, duration of diabetes, triglyceride level, HDL level, medication and insulin skipping frequency are risk factors for glycemic control. The majority of individuals with diabetes have moderate nutritional attitudes and are physically inactive. In order for individuals to achieve glycemic control, positive dietary attitudes should be supported and physical activity should be increased.

Keywords: *Mediterranean diet, Nutrition, Physical activity, Nursing, Type 2 diabetes*

Tip 2 Diyabetli Kadınlarda Glisemik Kontrol ile İlişkili Faktörlerin Belirlenmesi: Beslenme ve Fiziksel Aktivite Düzeyi

GRAFİKSEL ÖZET

ÖZ

Amaç: Etkili diyabet yönetimi yeterli glisemik kontrol ile sağlanmaktadır. Beslenme ve fiziksel aktivitenin de glisemik kontrolü sağlamada önemli bir rolü bulunmaktadır. Bu çalışma Konya ilindeki bir devlet hastanesine başvuran 20-64 yaş arasındaki tip 2 diyabetli kadınların beslenme tutumu, Akdeniz diyeti uyumu ve fiziksel aktivite düzeylerinin glisemik kontrol ile ilişkisinin belirlenmesi amacıyla yapıldı.

Gereç ve Yöntemler: İlişki arayıcı türdeki çalışma Konya'da bir hastanenin Dahiliye ve Endokrinoloji polikliniklerine başvuran 20-64 yaş arası tip 2 diyabetli 246 kadın ile gerçekleştirildi. Katılımcılar gelişigüzel örnekleme yöntemi ile belirlendi. Veriler anket formu, Sağlıklı Beslenmeye İlişkin Tutum Ölçeği, Akdeniz Diyetine Uyum Ölçeği ve Uluslararası Fiziksel Aktivite Anketi Kısa Formu (IPAQ-SF) kullanılarak toplandı. Bireylerle yüz yüze görüşülerek toplanan verilerin analizinde tanımlayıcı istatistikler, Ki-Kare, Fisher'in exact testi, Kruskal Wallis testi, Spearman korelasyon analizi ve lojistik regresyon analizi kullanıldı.

Bulgular: Çalışmada glisemik kontrolün değerlendirilmesinde glikozillenmiş hemoglobin A1c (HbA1c) ve açlık kan glukozu esas alınmış olup, katılımcıların %55,3'ü HbA1c, %56,9'u açlık kan glukozu bakımından kötü glisemik kontrole sahipti. Lojistik regresyon analizine göre HbA1c için; 10 yıldan daha fazla süre diyabete sahip olmak (OR=0,291, %95 Cl=0,095-0,894), yüksek trigliserit (OR=0,440, %95 Cl=0,190-1,017) ve düşük yüksek yoğunluklu lipoprotein (HDL) düzeyi (OR=0,293, %95 Cl=0,114-0,753); açlık kan glukozu için ilaç ve insülin kullanımını atlama sıklığında artış (OR=2,431, %95 Cl=1,090-5,424) ile düşük HDL düzeyi (OR=0,269, %95 Cl=0,110-0,653) önemli risk faktörleridir. Katılımcıların %73,2'si sağlıklı beslenmeye ilişkin orta düzey tutuma, %46,3'ü Akdeniz diyetine yönelik orta düzey uyuma sahip ve %60,6'sı fiziksel olarak hareketsizdi. Ayrıca katılımcıların açlık kan glukozu ile Sağlıklı Beslenmeye İlişkin Tutum Ölçeği (r=-0,138) ve IPAQ-SF (r=-0,154) puanı arasında çok zayıf düzeyde negatif yönlü anlamlı bir ilişki bulunmaktadır (p<0,05).

Sonuç: Sonuç olarak diyabet süresi, trigliserit düzeyi, HDL düzeyi, ilaç ve insülin atlama sıklığı glisemik kontrol için risk faktörleridir. Diyabetli bireylerin çoğunluğu orta düzey beslenme tutumuna sahip ve fiziksel olarak hareketsizdir. Bireylerin glisemik kontrollerini sağlamaları için olumlu beslenme tutumlarının desteklenmesi ve fiziksel aktivitenin artırılması gerekmektedir.

Anahtar Sözcükler: *Akdeniz diyeti, Beslenme, Fiziksel aktivite, Hemşirelik, Tip 2 diyabet*

INTRODUCTION

Diabetes Mellitus (DM) is a chronic disease in which carbohydrates, fats and proteins cannot be used effectively in the human body due to insulin deficiency or insulin-induced disorders, which is common in the society and leads to high rates of disability and death (1,2). The International Diabetes Federation (IDF) reports that approximately 537 million adults in the world have DM and this number is expected to increase. It is also stated that 81% of individuals with DM live in middle-income countries and that DM causes approximately 6.7 million deaths and 966 billion dollars in health expenditures (3).

When hyperglycemia is not controlled in individuals with DM, acute complications lead to death, chronic complications cause damage to many tissues/organ of the body due to insulin deficiency and cause permanent disorders. Type 2 DM decreases the quality of life of individuals as a result of complications, increases hospitalizations, causes an increase in health care costs and creates a significant burden on both individuals and the health system (4-6). Accordingly, the prevention of Type 2 DM is considered an important public health priority (7).

In the literature, women are less adherent to treatment, report more adverse reactions to medications and perform less well in self-monitoring of blood glucose and managing hyperglycemia (8,9). Furthermore, women with DM report less favorable profiles than men on lifestyle and psychosocial factors such as exercise behaviors, perceived glycemic control, self-efficacy, depressive symptoms and family support (10). Studies have also shown that female gender is a risk factor for poor glycemic control (11,12). Since women are the most influential individuals in the formation of healthy lifestyle habits of family members and in the process of diabetes prevention and management (3,7,13). Strengthening self-care practices is of utmost importance. Women are therefore expected to be conscious and healthy for the benefit of themselves and others (12).

Effective DM management is primarily achieved through adequate glycemic control as measured by HbA1c (%) and/or FBG (mg/dl) levels (14). Type 2 DM is partly due to a combination of unhealthy lifestyles, such as diets high in sugar, high alcohol consumption, smoking and lack of physical activity (15,16). Providing lifestyle changes is the first-line treatment of Type 2 DM at any age (17) recommends appropriate diet with physical activity (18,19). Studies show that lifestyle changes in individuals are effective in the management and remission of Type 2 DM (15,16).

In the management of Type 2 DM, medical nutrition therapy provides benefits such as changing negative eating habits of individuals with healthy habits, providing nutritional self-management training, keeping glucose and lipid balance within target ranges with meal planning; while regular physical activity provides benefits such as reduction in cardiovascular risk factors and insulin resistance and weight control (20-22). In addition, the Mediterranean diet is a dietary model recommended for individuals with Type 2 DM for reasons such as providing individuals with healthy eating habits, reducing cardiovascular risk factors and regulating blood glucose (2,23). Mediterranean dietary intake has positive effects on lipid profile, blood glucose, other blood parameters, insulin sensitivity and glycemic control (24,25).

By providing individualized care to individuals, nurses contribute to glycemic control, prevention of complications, reduction of hospitalizations, mortality and cost (26). Considering the important role of women in achieving glycemic control and their disadvantaged position in the society, it is thought that it is important to determine the factors that are effective in achieving glycemic control in women and to take measures for them with this study.

MATERIAL and METHODS

Type and Purpose of the Study

This descriptive correlational study was conducted to determine the glycaemic control level of women with Type 2 DM aged 20-64 years who applied to the Internal Medicine and Endocrinology outpatient clinics of a state hospital in the city centre of Konya, to reveal the relationship between glycaemic control level and dietary attitude, Mediterranean diet compliance and physical activity levels of women and to determine the determinant factors on glycaemic control.

Time and Sample of the Study

The population of the study consisted of adult women diagnosed with Type 2 DM who applied to the relevant outpatient clinics of the designated hospital. Individuals were randomly sampled among women aged 20-64 years with Type 2 DM who applied to the outpatient clinics between April and June 2021. Since aging-related factors have a significant impact on glycemic control, individuals aged 65 years and older were excluded. To determine the sample size of the study "a table recommended for ‘estimating the proportion in a population with a certain accuracy" (27). For the prevalence of the investigated condition (HbA1c control rate in DM), the sample size was determined as 246 with a 95% confidence interval, 5% error and 35.4% prevalence using the rate (35.4%) reported in a study (28).

Women who were diagnosed with Type 2 DM at least six months prior to the study and who voluntarily participated in the study were included in the study. In order to con-

trol the possibility of affecting the level of glycaemic control, women with gestational diabetes, pregnant and breastfeeding, receiving estrogen therapy, renal failure, liver disease, congestive heart disease, cancer diagnosis, diabetic neuropathy and women aged 65 years and over were excluded from the study.

Data Collection

In line with the aim of the study, data were collected using a questionnaire form developed by the researchers based on the literature (29-31), Healthy Eating Attitude Scale, Mediterranean Diet Adherence Scale and International Physical Activity Questionnaire Short Form. After obtaining ethics committee approval from Selçuk University Faculty of Nursing Non-Interventional Clinical Research Ethics Committee (dated 08.03.2021 and numbered 21) and institutional approval from Konya City Hospital Medical Speciality Education Board, the data were collected by face-to-face interviews with individuals applying to the relevant outpatient clinics by the principal investigator (Ü.O), who worked as a nurse in the relevant hospital during the study period. After completing the questionnaire and scale forms, anthropometric measurements of the participants were carried out by the responsible researcher in a suitable room in the outpatient clinic. Then, the laboratory results of the last year requested from the patients by the doctor during routine controls were analysed in the information management system of Konya City Hospital and the values of the relevant variables were recorded. HbA1c (%), FBG (mg/dl), HDL (mg/dl), LDL (mg/dl), total cholesterol (mg/dl) and triglyceride (mg/dl) values were interpreted according to the reference values targeted for individuals with type 2 diabetes in the Turkish Society of Endocrinology and Metabolism Guidelines for the Diagnosis, Treatment and Monitoring of Diabetes and its Complications (2). The principal investigator was present in the relevant outpatient clinics and took part in all the processes of collecting, maintaining and terminating the research data. Each data collection process took approximately 30 minutes.

Data Collection Tools

Questionnaire form: It consists of 31 questions related to sociodemographic, health/disease and nutritional characteristics of the individuals. Anthropometric measurements (body weight, height, body mass index, waist circumference, hip circumference, waist/hip ratio) and biochemical parameters (FBG, HbA1c, triglycerides, total cholesterol, HDL, Low Density Lipoprotein (LDL)) were also included in the questionnaire form. Anthropometric measurements of the individuals were measured by the researcher in a suitable room in the outpatient clinic. Body Mass Index (BMI), waist circumference, hip circumference and waist/hip ratio measurements were evaluated according to the risk classifications of the World Health Organization (WHO). According to this classification, BMI; <18.50 was considered underweight, 18.50-24.99 normal, >25.00 overweight, >30.00 obese. The WHO risk classification for cardiovascular diseases was used in the calculation of waist/hip ratio; men ≥0.90 and women ≥0.85 were considered risky (32,33). Glycemic control was evaluated by FBG (mg/dl) and HbA1c (%) level. For this study, laboratory findings of the individuals for the last year were evaluated.

Attitude Scale on Healthy Nutrition: It was conducted to determine the attitudes of university students towards healthy nutrition. The scale includes 21 questions with four sub-dimensions: knowledge about nutrition, feelings towards nutrition, positive nutrition and poor nutrition. Scores between 21-105 are obtained from the scale. According to the scale, individuals with 21 points have very low, 22-42 points have low, 43-63 points have medium, 64-84 points have high, and 85-110 points have ideally high attitudes towards healthy eating (34). While the Cronbach alpha coefficient of the scale was 0.87 (35). In this study, Cronbach's alpha coefficient of the scale was found to be 0.62.

Mediterranean Diet Adherence Scale: It was developed by Martinez Gonzalez et al. and adapted to Turkish by Pehlivanoğlu et al. (36,37). In the scale items consisting of 14 questions, those who check yes get 1 point and those who check no get 0 points. The total score is between 0-14. According to the scale, individuals with ≤ 5 points have low adaptation, 6-9 points have medium adaptation, and ≥ 10 points have high adaptation. As the score obtained from the scale increases, individuals' compliance with the Mediterranean diet increases (36). While the Cronbach alpha coefficient of the scale was 0.82 (37). In this study, the Cronbach's alpha coefficient of the scale was found to be 0.40.

International Physical Activity Questionnaire Short Form (IPAQ-SF): The validity and reliability study of the scale used to assess the physical activity status and level in the last seven days was conducted in 2010 (38). This form provides information about the time and sitting time individuals spend in light, moderate and vigorous activities. When evaluating activities, the MET (metabolic equivalent) value for each activity level is multiplied by the number of days and duration (min) of physical activity to obtain the "MET-min/week" score. According to the score obtained, individuals are evaluated as <600 MET-min/week inactive, 600 - 3000 MET-min/week minimum active and >3000 MET-min/week active. In addition, to determine how much energy is spent on each physical activity in the form; heavy physical activity = 8.0 METs, moderate physical activity =

4.0 METs, walking = 3.3 METs, and the MET values determined for IPAQ-SF are multiplied by the weekly duration of each activity in minutes. Thus, the energy expenditure of individuals at light, moderate, vigorous activity level and total activity level is calculated (39).

Statistical Analysis

In the study, descriptive statistics were used to determine the mean and standard deviations of the variables and Chi-Square analysis was used to determine the relationship between groups in categorical variables. The assumption of normal distribution of continuous variables was evaluated by Kolmogorov-Smirnov test; Kruskal Wallis analysis and Bonferroni correction test were performed for hypothesis testing in groups of three for data that did not show normal distribution. Logistic regression analysis (Backward Wald) was used to determine the factors associated with glycemic control. In logistic regression analysis, the dependent variables FBG (mg/dl) ≤130=0 and >130=1; HbA1c (%) <7=0 and ≥ 7=1. In the classification and evaluation of HbA1c (%), FBG (mg/dl), triglyceride (mg/dl), total cholesterol (mg/dl), HDL (mg/dl) and LDL (mg/dl) values, the Turkish Society of Endocrinology and Metabolism Guidelines for the Diagnosis, Treatment and Follow-up of Diabetes Mellitus and Its Complications (2024) were taken into consideration (2). IBM SPSS 25 package programme was used for data analysis. All results obtained in the study were evaluated with a margin of error of 0.05 and 95% confidence interval.

RESULTS

The mean age of the individuals who participated in the study was 52.44±8.29 years. Of the participants in the study, 79.7% were primary and secondary school graduates, 90.7% were married, and 94.7% were not currently working. Among women with type 2 DM, 70.7% had a nuclear family structure, 86.6% lived in the province and 87.8% had a moderate income. In addition, 72.8 per cent of the women had reached menopause, only 8.5 per cent smoked and no one drank alcohol. In the study, 76% of women with Type 2 DM had BMI ≥30 kg/m^2, 96.3% had high-risk waist circumference and 88.6% had high-risk waist/hip ratio. Individuals had Type 2 DM for an average of 9.41±6.83 years; 65.4% had Type 2 DM between 1-10 years. As medical treatment, 63% of the individuals used oral antidiabetics, 7.7% used insulin, 20.3% used insulin with oral antidiabetics, and 8.9% used only medical nutrition therapy. Among women using oral antidiabetics and insulin, 50.4% used their medications irregularly and 52.2% skipped medication and insulin use once or more than once a week. Among women with Type 2 DM, 16.3% were hospitalized due to hyperglycemia or hypoglycemia, 87.5% of hospitalizations were due to hyperglycemia and 12.5% were due to hypoglycemia. 57.3% of individuals had high triglycerides (≥150 mg/dl), 57.3% had high total cholesterol (≥200 mg/dl), 54.5% had low HDL (<50 mg/dl) and 76.4% had high LDL (≥100 mg/dl). The proportion of patients with good glycemic control was 44.7% (HbA1c) and 43.1% (FBG).

In the study, the relationship between HbA1c (%) level and smoking was statistically significant ($p<0.05$). The glycemic control of 66.7% of smokers is good. In addition, there was a significant relationship between the FBG (mg/dl) level of the individuals and the place where they lived for a long time ($p<0.05$), and 72.7% of the individuals living in village/district had poor glycemic control (Table 1).

In the study, the relationship between duration of DM, DM treatment, frequency of skipping medication and insulin use, hospitalization due to hyperglycemia and hypoglycemia, triglyceride (mg/dl) and HDL (mg/dl) levels and HbA1c (%); the relationship between duration of DM, DM treatment, frequency of skipping medication and insulin use, hospitalization due to hyperglycemia and hypoglycemia and HDL (mg/dl) levels and FBG (mg/dl) was statistically significant ($p<0.05$) (Table 2).

In the study, according to HbA1c (%) level, 70.3% of individuals with DM for 11 years or more and 82% of individuals using oral antidiabetics and insulin together had poor glycemic control. In addition, 86.4% of the individuals who applied medical nutrition therapy had good glycemic control, while 67.8% of those who skipped their medication or insulin once or more than once a week had poor glycemic control. Among individuals hospitalized due to hyperglycemia or hypoglycemia, 82.5% had poor glycemic control. It was determined that 61% of individuals with high triglyceride levels (≥150 mg/dl) and 63.4% of women with low HDL levels (<50 mg/dl) had poor glycemic control.

When comparisons according to FBG (mg/dl) level were analyzed, 70.3% of individuals with DM duration of 11 years or more and 78% of women using oral antidiabetics and insulin together had poor glycemic control. While 68.2% of women who used only medical nutrition therapy had good glycemic control, 69.5% of individuals who missed their medication or insulin once or more than once a week had poor glycemic control. In the study, 75% of individuals hospitalised due to hyperglycaemia or hypoglycaemia and 62.7% of individuals with low HDL level (<50 mg/dl) had poor glycaemic control (Table 2).

In the study, 73.2% of the individuals had a moderate attitude towards healthy nutrition and 46.3% had a moderate adherence to the Mediterranean diet, while 60.6% were physically inactive. In the study, there was no significant

Table 1: Distribution of glycemic control according to sociodemographic characteristics of individuals with Type 2 DM.

	Glycemic Control Variables (n=246)					
	HbA1c			FBG		
Characteristics, n(%)	**≤7.0%**	**>7.0%**	**p and test value**	**≤130 mg/dl**	**>130 mg/dl**	**p and test value**
Age group						
26-45 years	26 (50.0)	26 (50.0)	p=0.388	26 (50.0)	26 (50.0)	p=0.257
46-64 years	84 (43.3)	110 (56.7)	χ^2 =0.745	80 (41.2)	114 (58.8)	χ^2 =1.284
Education level						
Illiterate	17 (53.1)	15 (46.9)	p=0.544	13 (40.6)	19 (59.4)	p=0.879
Primary and secondary school	86 (43.9)	110 (56.1)	χ^2 =1.218	86 (43.9)	110 (56.1)	χ^2 =0.258
High school and above	7 (38.9)	11 (61.1)		7 (38.9)	11 (61.1)	
Employment status						
Working	7 (53.8)	6 (46.2)	p=0.496	7 (53.8)	6 (46.2)	p=0.421
Not working	103 (44.2)	130 (55.8)	χ^2 =0.463	99 (42.5)	134 (57.5)	χ^2 =0.648
Long-time resident						
Village/District	13 (39.4)	20 (60.6)	p=0.509	9 (27.3)	24 (72.7)	p=0.049
Province	97 (45.5)	116 (54.5)	χ^2 =0.437	97 (45.5)	116 (54.5)	χ^2 =3.888
Cigarette smoking						
Yes	14 (66.7)	7 (33.3)	p=0.034	12 (57.1)	9 (42.9)	p=0.174
No	96 (42.7)	129 (57.3)	χ^2 =4.475	94 (41.8)	131 (58.2)	χ^2 =1.849
BMI (kg/m^2)						
Normal (18.5-24.9 kg/m^2)	4 (30.8)	9 (69.2)	p=0.583	6 (46.2)	7 (53.8)	p=0.945
Overweight (25.0-29.9 kg/m^2)	21 (45.7)	25 (54.3)	χ^2 =1.080	19 (41.3)	27 (58.7)	χ^2 =0.113
Obese (fat) (≥30 kg/m^2)	85 (45.5)	102 (54.5)		81 (43.3)	106 (56.7)	

*Row percentages are taken. χ^2 = Chi-square Analysis

difference between the median score of HbA1c (%) level and the median scores of Attitude Towards Healthy Eating Scale, Mediterranean Diet Adherence Scale and IPAQ-SF (p>0.05) (Table 3).

In addition, in the correlation analysis, which is not included in the tables, there is a very weak and negatively significant relationship (p<0.05) between FBG (mg/dl) and Attitude Towards Healthy Eating Scale (r=-0.138) and between FBG (mg/dl) and IPAQ-SF score (r=-0.154).

According to logistic regression analysis, having Type 2 DM for 11 years or more increases the risk of not being able to maintain glycaemic control (HbA1c) by 0.291 (OR=0.291, 95% Cl=0.095-0.894) times; high triglyceride (mg/dl) level increases this risk by 0.44 times (OR=0.440, 95% Cl=0.190-1.017), and low HDL (mg/dl) cholesterol level increases this risk by 0.293 times (OR=0.293, 95% Cl=0.114-0.753). In addition, skipping medication and insulin use once or more than once a day increases the risk of failure to maintain glycaemic control (FBG) by 2.431-fold (OR=2.431, 95% Cl=1.090-5.424) and low HDL (mg/dl) level by 0.269-fold (OR=0.269, 95% Cl=0.110-0.653) (Table 4).

DISCUSSION

This study was conducted to determine the relationship between nutritional attitude, Mediterranean diet adherence and physical activity levels with glycemic control in women with Type 2 DM who applied to the relevant outpatient clinics in a state hospital in Central Anatolia. As a result of the study, it was determined that more than half of the women with Type 2 DM had poor glycemic control in terms of both HbA1c (55.3%) and FBG (56.9%). However, when risk factors for glycemic control were evaluated, duration of DM, triglyceride (mg/dl) and HDL (mg/dl) levels were found to be important risk factors for HbA1c (%), while frequency of skipping medication and insulin use and HDL (mg/dl) levels were important risk factors for FBG (mg/dl). In addition, 73.2% of the individuals had an attitude towards healthy nutrition and 46.3% had a moderate level of adherence to the Mediterranean diet, and 60.6% were physically inactive.

In the study, it was determined that 55.3% of women with

Table 2: Distribution of glycemic control of individuals with Type 2 DM according to health/disease and nutritional characteristics.

Glycemic Control Variables (n=246)						
	HbA1c			FBG		
Characteristics, n(%)	**≤7.0%**	**>7.0%**	**p and test value**	**≤130 mg/dl**	**>130 mg/dl**	**p and test value**
Duration of diabetes (year's groups)						
Less than 1 year	4 (36.4)	7 (63.6)	p=0.005	6 (54.5)	5 (45.5)	p=0.020
1-10 years	84 (52.2)	77 (47.8)	χ^2 =10.656	78 (48.4)	83 (51.6)	χ^2 =7.859
11 and above	22 (29.7)	52 (70.3)		22 (29.7)	52 (70.3)	
Diabetes treatment						
Oral antidiabetic	78 (50.3)	77 (49.7)		73 (47.1)	82 (52.9)	
Insulin	4 (21.1)	15 (78.9)	p<0.001	7 (36.8)	12 (63.2)	p=0.001
Oral antidiabetics and insulin	9 (18.0)	41 (82.0)	χ^2 =36.147	11 (22.0)	39 (78.0)	χ^2 =16.035
Only medical nutrition therapy	19 (86.4)	3 (13.6)		15 (68.2)	7 (31.8)	
Frequency of skipping medication and insulin use (n=113)						
One or more times a day	31 (57.4)	23 (42.6)	p=0.007	29 (53.7)	25 (46.3)	p=0.012
Once or more than once a week	19 (32.2)	40 (67.8)	χ^2 =7.260	18 (30.5)	41 (69.5)	χ^2 =6.244
Hospitalization due to hyperglycemia or hypoglycemia						
There is	7 (17.5)	33 (82.5)	p<0.001	10 (25.0)	30 (75.0)	p=0.012
No	103 (50.0)	103 (50.0)	χ^2 =14.312	96 (46.6)	110 (53.4)	χ^2 =6.374
Triglycerides (mg/dl) levels						
Normal (0-150 mg/dl)	55 (52.4)	50 (47.6)	p=0.037	50 (47.6)	55 (52.4)	p=0.216
High (≥150 mg/dl)	55 (39.0)	86 (61.0)	χ^2 =4.354	56 (39.7)	85 (60.3)	χ^2 =1.533
Total cholesterol (mg/dl) levels						
Normal (3-200 mg/dl)	64 (46.7)	73 (53.3)	p=0.479	63 (46.0)	74 (54.0)	p=0.304
High (≥200 mg/dl)	46 (42.2)	63 (57.8)	χ^2 =0.500	43 (39.4)	66 (60.6)	χ^2 =1.057
HDL-cholesterol (mg/dl) levels						
Normal (≥50 mg/dl)	61 (54.5)	51 (45.5)	p=0.005	56 (50.0)	56 (50.0)	p=0.045
Low (<50 mg/dl)	49 (36.6)	85 (63.4)	χ^2 =7.905	50 (37.3)	84 (62.7)	χ^2 =4.004
LDL-cholesterol (mg/dl) levels						
Normal (0-100 mg/dl)	24 (41.4)	34 (58.6)	p=0.559	30 (51.7)	28 (48.3)	p=0.129
High (≥100 mg/dl)	86 (45.7)	102 (54.3)	χ^2 =0.342	76 (40.4)	112 (59.6)	χ^2 =2.307

*Row percentages are taken. χ^2 = Chi-square Analysis

Type 2 DM had an HbA1c level >7% and 56.9% had an FBG value >130 mg/dl, considering the last measured HbA1c (%) and FBG (mg/dl) values within the last year. Both HbA1c (%) and FBG (mg/dl) averages were above the target values and the majority of the individuals had poor glycemic control. In studies conducted with individuals with Type 2 DM in the literature, the rate of good glycemic control varies between 15-42% (40-42). These differences in glycemic control status are attributed to existing socioeconomic inequalities and the quality of health care patients receive worldwide (12). Accordingly, it can be said that individuals with Type 2 DM generally have poor glycemic control and are at risk for DM complications. It is thought that the prevalence of obesity in female individuals and their physical inactivity may be effective in the emergence of this finding in the study.

According to the logistic regression analysis, duration of DM, triglyceride and HDL levels were found to be risk factors for HbA1c (%), and frequency of skipping medication and insulin use and HDL (mg/dl) level were found to be risk factors for FBG (mg/dl). In the study, the individuals had Type 2 DM for an average of 9.41±6.83 years and it was observed that the rate of poor glycemic control increased as the duration of DM increased. Studies show that patients recently diagnosed with DM have better glycemic control than those who have had the disease for a longer period of time (43,44). In another study, it was found that treatment

Table 3: Distribution of glycemic control of individuals with Type 2 DM according to attitude towards healthy eating, adherence to Mediterranean diet and physical activity level.

		HbA1c (%)		FBG (mg/dl)	
Scales (n=246)			**p and test value**		**p and test value**
Attitudes Towards Healthy Eating Scale*					
23-42 points (low attitude)	16 (6.5)	7.45 (5.80-12.30)	p=0.171 KW=3.534	136.50 (103.00-394.00)	p=0.034 KW:6.764
43-63 points (moderate attitude)	180 (73.2)	7.50 (5.20-16.20)		149.50 (60.00-563.00)	
64-110 points (high and ideally high attitude)	50 (20.3)	6.80 (5.20-12.40)		121.00 (85.00-397.00)	
Mediterranean Diet Adherence Scale*			**p and test value**		**p and test value**
≤5 points (low compliance)	112 (45.5)	7.60 (5.20-13.60)	p=0.607 KW=0.998	147.00 (60.00-456.00)	p=0.485 KW=1.449
6-8 points (medium compliance)	114 (46.3)	7.20 (5.30-16.20)		135.00 (60.00-563.00)	
≥9 points (high compliance)	20 (8.1)	7.00 (5.40-14.70)		134.00 (88.00-380.00)	
IPAQ-SF *			**p and test value**		**p and test value**
Inactive (<600 MET min/week)	149 (60.6)	7.70 (5.40-16.20)	p=0.312 KW=2.330	146.00 (60.00-563.00)	p=0.073 KW=5.239
Minimum active (600-3000 MET min/week)	92 (37.4)	7.00 (5.20-13.30)		134.50 (60.00-433.00)	
Active (>3000 MET min/week)	5 (2.0)	6.60 (5.30-11.20)		6.60 (5.30-11.20)	

***Data are shown as n(%), median (minimum-maximum).** p<0.05 , KW=Kruskal Wallis Analysis

Table 4: Risk factors

HbA1c risk factors (n=246)	**OR**	**p**	**95% Cl**
Duration of diabetes (years)			
Less than one year		0.094	
1-10 years	0.486	0.508	0.058-4.101
11 years and above	0.291	0.031	0.095-0.894
Triglycerides (mg/dl)	0.440	0.055	0.190-1.017
HDL (mg/dl)	0.293	0.011	0.114-0.753
FBG risk factors (n=246)			
Frequency of skipping medication and insulin use	2.431	0.030	1.090-5.424
HDL (mg/dl)	0.269	0.004	0.110-0.653

OR: Odds Ratio, **Cl:** Confidence Interval

compliance decreased as the duration of disease prolonged in Type 2 DM (45). With the increase in the number of years of life lived with the disease, individuals are more exposed to the limitations and medical interventions brought about by the disease; this may be associated with difficulties in compliance with treatment and gaining healthy lifestyle habits.

High triglycerides (≥150 mg/dl) and low HDL (<50 mg/dl) levels are common in individuals with Type 2 DM, similar to the results of the study (46-48). In the study of Abdullah et al., HDL (mg/dl) levels were found to be significantly lower in people with inadequate glycemic control compared to those with adequate control (49). Different studies have also reported that a poor lipid profile is associated with poor glycemic control (50,51). In this direction, it is thought that it is important for individuals with Type 2 DM to adopt healthy lifestyles in order to keep their glycemic index under control.

In the study, the increased frequency of skipping medication and insulin use increased the risk of not being able to control FBG (mg/dl). Similarly, a study found a positive association between poor medication adherence and poor glycemic control (12). In order to facilitate the use of medication by individuals with such chronic diseases, it is once again important to develop new drugs that will eliminate the need for daily dosage and improve drug compliance.

The majority of the individuals in this study group (73.2%) had moderate attitudes towards healthy eating. In addition, the relationship between FBG and the Attitudes Towards Healthy Eating Scale score was significant. Individuals with moderate attitudes towards healthy eating had a significantly higher median FBG (mg/dl) than those with high/ideal attitudes. In this direction, it is thought that it is important to increase the positive attitudes of individuals towards healthy nutrition and an individualized nutrition plan.

In the study, 46.3% of the individuals had moderate compliance with the Mediterranean diet. In a study conducted in Ankara, 70.1% of individuals (52). In a study in Northern Cyprus, 49.1% of women had moderate adherence to the Mediterranean diet (53). As in the present study, there are studies that did not find a significant relationship between Mediterranean diet adherence and HbA1c level (30,53). A study of 105 women with diabetes found that women with high adherence to the Mediterranean diet had better glycemic control and a reduced risk of developing diabetes complications (54). In this direction, it is recommended that studies with larger sample sizes should be conducted in order to clarify the relationship between adherence to the Mediterranean diet and glycemic control.

In the study, it was determined that the majority of women with Type 2 DM (60.6%) were physically inactive. In the literature, similar to the results of this study, it is reported that individuals with Type 2 DM have a sedentary lifestyle (55,56). A cohort study reported that sedentary lifestyle increases the risk of Type 2 DM in all races and nationalities (57). Therefore, increasing physical activity seems to be important in achieving glycemic control.

This study has several limitations. First, the study was conducted with women with Type 2 DM living in only one province. Therefore, the results cannot be generalized to the entire Type 2 DM population. In addition, the questionnaires and scales used in data collection were based on self-reported data, which may lead to overestimation or underestimation of the results and recall bias. In addition to the data collection tools, anthropometric measurements and laboratory values of the individuals were also included and a detailed evaluation was made, which constitutes the strength of the study.

The results of this study showed that more than half of the women diagnosed with Type 2 DM had poor glycemic control and duration of DM, triglyceride (mg/dl) level, HDL (mg/dl) level, frequency of skipping medication and insulin use were important risk factors for glycemic control. It was also found that these women had a moderate level of adherence to healthy eating and Mediterranean diet and 60.6% of them were physically inactive. This emphasizes the need to raise awareness about glycemic control to protect individuals from the effects of potentially preventable glycemic load. Individuals with diabetes should be encouraged to adopt healthy lifestyle habits, participate in treatment and follow-up, and comply with medications. It is important that treatment and education are individualized and that these follow-ups are carried out and controlled in primary care before complications develop.

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Author Contributions
Authors contributed equally to all stages of the article process. The authors read and approved the final version of the manuscript.

Conflict of Interest
The authors declare no potential conflicts of interest. It is thought that it is important to inform that the principal investigator, who is currently working in a different institution, carried out the data collection process himself after the institutional permission obtained because he was working as a nurse in the relevant hospital at the time of the research.

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Ethics committee approval (dated 08.03.2021 and numbered 21) was obtained from Selçuk University Faculty of Nursing Non-Interventional Clinical Research Ethics Committee. In addition, institutional permission was obtained from the hospital and informed consent was obtained from all individuals. Permission to use the scale was obtained from the authors via e-mail.

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