

# A CROSS-SECTIONAL STUDY ON FACTORS AFFECTING DIETARY QUALITY OF ADOLESCENTS WITH TYPE 1 DIABETES

## TİP 1 DİYABETLİ ADÖLESANLARIN DİYET KALİTESİNİ ETKİLEYEN FAKTÖRLER ÜZERİNE KESİTSEL BİR ARAŞTIRMA

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### ABSTRACT

**Objective:** The diet quality of adolescents with type 1 diabetes is shaped by some individual factors. These include age, gender, sociodemographic characteristics, lifestyle habits, and adaptation to diabetes treatment. This study aims to investigate the factors affecting the diet quality of adolescents with type 1 diabetes.

**Material and Methods:** The sample in this study consisted of adolescents with type 1 diabetes who were followed in the Department of Pediatric Endocrinology of the Faculty of Medicine at the University of Ankara between July 2017-January 2018. The research data was collected using the face-to-face interview technique with a questionnaire. The physical activity levels of the individuals were determined using a '24-hour physical activity level detection form (short)'. Three-day food consumption records were taken and evaluated via BeBis. The Healthy Eating Index-2010 was used to determine diet quality.

**Results:** The study was conducted with a total of 110 adolescents (M:51.8%; F:48.2%) with type 1 diabetes in the 10-19 age range (mean age:14.0±2.40 years). Only 15.5% of all individuals have good diet quality. In a linear regression model formed by the variables of exercise status, physical activity type, and PAL value of individuals, a positive significant relationship was found between exercise status and diet quality ( $\chi^2$  (1,n=110)=1.392, p<0.05).

**Conclusion:** As a result, it was found that the majority of individuals needed to improve their diet quality and that exercise affected the diet quality of type 1 diabetic adolescents. In addition, exercise levels, which have an important role in both diabetes management and improvement of diet quality, should be increased.

**Keywords:** Type 1 diabetes, adolescents, diet quality, exercise

### ÖZET

**Amaç:** Tip 1 diyabetli adölesanların diyet kalitesi bazı bireysel faktörlere göre değişebilmektedir. Bunlar yaş, cinsiyet, sosyodemografik özellikler, yaşam tarzı alışkanlıkları ve diyabet tedavisine uyumu içerir. Bu çalışmanın amacı, tip 1 diyabetli adölesanların diyet kalitesini etkileyen faktörleri incelemektir.

**Gereç ve Yöntemler:** Bu çalışmanın örneklemini, Temmuz 2017-Ocak 2018 tarihleri arasında Ankara Üniversitesi Tıp Fakültesi Çocuk Endokrinolojisi Anabilim Dalı'nda takip edilen tip 1 diyabetli adölesanlar oluşturmuştur. Araştırma verileri yüz yüze görüşme tekniği kullanılarak toplanmıştır. Bireylerin fiziksel aktivite düzeyleri '24 saatlik fiziksel aktivite düzeyi tespit formu (kısa)' ile belirlenmiştir. Üç günlük besin tüketim kayıtları alınmış ve BeBis ile değerlendirilmiştir. Diyet kalitesini belirlemek için Sağlıklı Yeme İndeksi-2010 kullanılmıştır.

**Bulgular:** Çalışma, 10-19 yaş aralığında (ortalama: 14,0±2,40 yıl) 57'si erkek (%51,8), 53'ü kadın (%48,2) olmak üzere toplam 110 tip 1 diyabetli adölesan ile gerçekleştirilmiştir. Tüm bireylerin sadece %15,5'i iyi diyet kalitesine sahipti. Diyet kalitesinin cinsiyete göre dağılımı istatistiksel olarak anlamlı değildi. (p>0,05). Bireylerin egzersiz durumu, fiziksel aktivite türü ve PAL değeri değişkenlerinden oluşan doğrusal regresyon modelinde egzersiz durumu ile diyet kalitesi arasında pozitif yönde anlamlı bir ilişki bulunmuştur ( $\chi^2$  (1,n=110)=1,392, p<0,05).

**Sonuç:** Sonuç olarak, bu çalışmada, katılımcıların çoğunun diyet kalitelerini iyileştirmesi gerektiği ve egzersizin tip 1 diyabetli adölesanların diyet kalitesini etkilediği saptanmıştır. Buna ek olarak, hem diyabet yönetiminde hem de diyet kalitesinin iyileştirilmesinde önemli rolü olan egzersiz düzeylerinin artırılması gerektiği sonucuna varılmıştır.

**Anahtar Kelimeler:** Tip 1 diyabet, adölesanlar, diyet kalitesi, egzersiz

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## INTRODUCTION

One of the basic elements necessary for metabolic control in adolescents with type 1 diabetes is medical nutrition therapy (1). The main goals of medical nutrition therapy for children and adolescents with diabetes are to achieve glycemic control through accessible and applicable meal plans, to minimize acute and chronic complications, and to maintain normal growth and development (2).

Diet quality, one of the components of medical nutritional treatment of adolescents with type 1 diabetes, has an important role in the management of diabetes (3). Good diet quality is defined as hygienic, nutritious, balanced, diverse, satisfying the needs of the individual, and supporting growth and development (4). Although healthy eating plays a crucial role in the management of type 1 diabetes, research shows that adolescents with type 1 diabetes have poor diet quality (4-6). The diet quality of adolescents with type 1 diabetes is shaped by some individual factors. These include age, gender, sociodemographic characteristics, lifestyle habits, and adaptation to diabetes treatment (7). According to a study conducted with individuals with type 1 diabetes, young girls (19-21 years) have higher diet quality compared to boys and younger age groups (13-15 years) (8). According to another study, parents' educational levels and diet quality of adolescents with type 1 diabetes have a positive correlation (9). According to a study by Granado-Casas et al., diet quality and physical activity levels of individuals with type 1 diabetes are associated (10). Because of the limited number of studies in which the factors affecting the diet quality of adolescents with type 1 diabetes are evaluated, this study aims to investigate the factors affecting the diet quality of adolescents with type 1 diabetes.

## MATERIALS AND METHODS

### Subjects

The sample of this study consisted of adolescents with type 1 diabetes aged 10-19 years who were followed up in the Department of Pediatric Endocrinology of the Faculty of Medicine at the University of Ankara between July 2017 and January 2018. The population of the study consisted of adolescents who attended the hospital and provided inclusion criteria during the given time. The purposive sampling method was used for sampling. Individuals who were diagnosed with type 1 diabetes at least one year ago, have a daily insulin dose of >0.5 units/kg, and receive intensive insulin therapy or have used an insulin pump for at least three months were included in the study. Those who were diagnosed with celiac and hyperlipidemia, and have been on an insulin pump for less than three months and use premixed insulin, and who were <10 years old and >19 years old were excluded from the study.

### Data collection

The research data was collected using the face-to-face interview technique with a questionnaire. Sociodemographic characteristics of individuals and some data related to diabetes were obtained through the questionnaire. The physical activity levels of the individuals involved in the study were determined using the '24-hour physical activity level detection form (short)'. Using this form, the physical activity level (PAL) values of the individuals were calculated and classified as light/mild, moderate, and vigorous (11). All participants were asked whether hypoglycemia, defined as fasting blood glucose <70 mg/dL, occurred in the last one month. Food consumption status of the participants was determined by 3-day food consumption records. Dietary intakes were evaluated via the Nutrition Information System for Turkey. The Healthy Eating Index (HEI)-2010 was used to determine how much adolescents comply with dietary guidelines and dietary recommendations in the food pyramid and to measure diet quality (12). The amounts consumed were evaluated on the basis of nutrients in grams per 1000 kcal. Diet quality of individuals was defined according to the total HEI score: ≤50 is "poor diet quality," 51-80 is "needs improvement in diet quality," and 81-100 is "good diet quality" (13).

### Statistic analysis

The analysis of the data obtained from the survey was conducted with the SPSS statistical package program. Descriptive statistics were shown as mean±standard deviation for the variables with a normal distribution, as median and the interquartile range values for the variables with non-normal variables, and the number and percentages (%) of the cases for the nominal variables. The statistically significant difference between qualitative variables, if the assumptions of normal distribution are provided, was determined with the help of the Mann Whitney U-Test. The relationship between two categorical variables was analyzed by the Chi-Square Test. To reveal whether there was a statistically significant relationship between two quantitative variables, the Pearson Correlation Coefficient was used when at least one of the variables provided a normal distribution assumption, but Spearman's Correlation Coefficient was used when the above-mentioned assumption was not met. Logistic regression analysis was performed to determine the factors affecting diet quality. The confidence interval was accepted as 95.0% in all statistical tests and evaluated at p<0.05 significance level.

## RESULTS

The study was conducted with a total of 110 adolescents with Type 1 diabetes in the 10-19 age range, 57 of whom were male (51.8%) and 53 of whom were female (48.2%). Of the participants 46.4% were in high school and 5.5%

were undergraduates. Parents were generally primary/secondary education graduates, with 14.5% of mothers and 21.8% of fathers having a bachelor's degree (Table 1).

When the data related to diabetes were examined, the mean age of the diabetes was statistically significant between groups ( $4.6 \pm 3.32$ ,  $p < 0.05$ ). 98.2% of the participants received diabetes education. 41.3% of them met with a dietitian and 39.0% with a nurse. 60.2% of the trainings received were individual training. 47.2% of the participants counted carbohydrates. In the last month, the rate of individuals who had hypoglycemia was 65.5%. 60.0% of them experienced it 1-3 times and 10.0% experienced it 10 times or more (Table 2).

It was found that 84.5% of all participants needed to improve their diet quality. When this was evaluated by gender, it was determined that 86.0% and 83.0% of boys and girls, respectively, needed to improve diet quality. The ratio of those with good diet quality in boys and girls was 14.0% and 17.0%, respectively. Only 15.5% of all individuals had good diet quality. Distribution of diet quality by gender is not statistically significant ( $p > 0.05$ ) (Table 3).

There was only a weak and negative correlation between diet quality score and age in the general sample ( $p < 0.05$ ) (Table 4).

In the model formed by the variables of exercise status, physical activity type, and PAL value of individuals, a positive significant relationship was found between exercise status and diet quality ( $(1, n=110)=1.392$ ,  $p < 0.05$ ) (Table 5).

## DISCUSSION

The adolescent period is a term in which daily energy and nutrient requirements increase with growth and development, and the attitudes and behaviors gained, including nutrition, affect the individual in the short and long term (14). Since type 1 diabetes is a lifelong disease, acquiring healthy eating habits is extremely important in terms of achieving metabolic control. As a result of our study, it was found that there was a weak and negative correlation between the age and diet quality score of adolescents with type 1 diabetes. This shows that it is more important to provide motivation for treatment rather than age for people with diabetes. In the literature some studies suggest a positive relationship between age and diet quality, and some studies suggest the exact

**Table 1:** Distribution of individuals' education, parents' education by gender and mean ages

	Male (n=57)		Female (n=53)		Total (n=110)		$\chi^2$ p <sup>a</sup>
	n	%	n	%	n	%	
<b>Education status</b>							
Primary education	9	15.8	2	3.7	11	10.0	4.07 0.13
Secondary education	22	38.6	20	38.0	42	38.1	
High school	25	43.8	26	49.0	51	46.4	
Undergraduate	1	1.8	5	9.3	6	5.5	
<b>Mother's education status</b>							
Primary/secondary education	28	49.1	26	49.1	54	49.1	1.82 0.61
High school	22	38.6	17	32.0	39	35.5	
Undergraduate	7	12.3	9	17.0	16	14.5	
Graduate	-	-	1	1.9	1	0.9	
<b>Father's education status</b>							
Primary/secondary education	21	36.8	20	37.7	41	37.3	1.84 0.60
High school	21	36.8	14	26.4	35	31.8	
Undergraduate	11	19.4	13	24.6	24	21.8	
Graduate	4	7.0	6	11.3	10	9.1	
<b>Age (years)</b>							
$\bar{x} \pm SD$	14.6 $\pm$ 2.14		13.5 $\pm$ 2.53		14.0 $\pm$ 2.40		1141.00 0.02 <sup>u*</sup>
Median	13.0		15.0		14.0		
Min-Max	10.0-18.0		10.0-19.0		10.0-19.0		

<sup>a</sup>Chi-Square Test <sup>u</sup>Mann Whitney U Test \* $p < 0.05$   $\bar{x}$ : Arithmetic mean; SD: Standard deviation

**Table 2:** Distribution of individuals' diabetes-related data by gender

	Male (n=57)		Female (n=53)		Total (n=110)		u p
<b>Diabetes diagnosis age (years)</b>							
$\bar{x}\pm$ SD	9.5±3.63		9.1±3.55		9.3±3.58		1431.00
Median	10.0		10.0		10.0		0.63 <sup>b</sup>
Min-Max	3.0-15.0		1.0-15.0		1.0-15.0		
<b>Diabetes age (years)</b>							
$\bar{x}\pm$ SD	4.0±3.18		5.2±3.38		4.6±3.32		<b>1165.00</b>
Median	3.0		5.0		4.0		<b>0.03<sup>b*</sup></b>
Min-Max	1.0-13.0		1.0-14.5		1.0-14.5		
	n	%	n	%	n	%	$\chi^2$ p <sup>a</sup>
<b>Nutrition education</b>							
Did not take	-	-	2	3.8	2	1.8	2.19
Took**	57	100.0	51	96.2	108	98.2	0.13
Dietician	35	41.2	36	41.4	71	41.3	
Nurse	34	40.0	33	37.9	67	39.0	2.70
Doctor	16	18.8	18	20.7	34	19.7	0.60
<b>Type of training **</b>							
Group training	27	39.7	26	40.0	53	39.8	0.31
Individual training	41	60.3	39	60.0	80	60.2	0.85
<b>Carbohydrate counting</b>							
Counting	23	40.4	29	54.7	52	47.2	
Not counting	24	42.1	15	28.3	39	35.5	2.68
Sometimes counting	10	17.5	9	17.0	19	17.3	0.26
<b>Hypoglycemia in the last 1 month</b>							
Did not happen	19	33.4	19	33.0	38	34.5	0.07
Happened**	38	66.6	34	67.0	72	65.5	0.78
1-3 times	21	55.0	22	64.9	43	60.0	
4-6 times	8	21.0	4	11.7	12	17.0	1.68
7-9 times	6	16.0	4	11.7	10	13.0	0.64
10 times and higher	3	8.0	4	11.7	7	10.0	

<sup>a</sup>Chi-Square Test <sup>b</sup>Mann Whitney U Test \*p<0.05  $\bar{x}$ : Arithmetic mean; SD: Standard deviation; \*\*whose answered yes.

**Table 3:** Diet quality score and evaluation of individuals by gender

Diet quality	Male (n=57)		Female (n=53)		Total (n=110)		
	n	%	n	%	n	%	
Needs improvement	49	86.0	44	83.0	93	84.5	$\chi^2=0.18$
Good	8	14.0	9	17.0	17	15.5	p=0.66 <sup>a</sup>
$\bar{x}\pm$ SD	68.95±10.23		70.61±9.03		69.75±9.66		u=1358.00
Median	20.00		69.95		69.68		p=0.36 <sup>b</sup>
Min-Max	42.74-90.03		47.28-92.11		42.74-92.11		

<sup>a</sup>Chi-Square Test <sup>b</sup> Mann Whitney U Test,  $\bar{x}$ : Arithmetic mean; SD: Standard deviation

**Table 4:** Correlation of diet quality score of individuals with some parameters by gender

Some parameters	Male (n=57)	Female (n=53)	Total (n=110)
	r p <sup>a</sup>	r p <sup>a</sup>	r p <sup>a</sup>
Age (years)	-0.237 0.075	-0.170 0.224	-0.191 0.046*
Diabetes age (years)	-0.187 0.164	0.204 0.142	0.020 0.838
Diabetes diagnosis age (years)	-0.021 0.876	-0.254 0.067	-0.125 0.195

<sup>a</sup> Spearman Correlation Test \*p<0.05

**Table 5:** Determination of variables which can be effective in classification of individuals in terms of diet quality by logistic regression analysis

Variables	β	Wald	S.S	p	Odds ratio	Coefficient interval for 95% odds ratio	
						Min	Max
<b>Sociodemographic variables</b>							
Age	0.137	0.393	1	0.531	1.147	0.747	1.760
Gender	0.341	0.374	1	0.541	1.407	0.471	4.203
Education status	-1.242	1.916	1	0.166	0.289	0.050	1.676
Mother's education status	-0.269	0.323	1	0.570	0.764	0.303	1.930
Father's education status	-0.390	1.161	1	0.281	0.677	0.333	1.376
Constant	0.821	0.149	1	0.699	2.273		
<b>Variables about diabetes</b>							
Diabetes diagnosis age	-0.038	0.100	1	0.752	0.963	0.763	1.216
Diabetes age	-0.105	0.632	1	0.427	0.900	0.694	1.167
Frequency of hypoglycemia	-0.337	3.516	1	0.061	0.714	0.502	1.015
Carbohydrate counting status	0.605	2.664	1	0.103	1.831	0.886	3.787
Presence of diabetes in the family	0.758	1.605	1	0.205	2.134	0.661	6.896
Constant	-40.378	0.000	1	0.999	0.000		
<b>Variables about exercise</b>							
PAL value	0.568	0.078	1	0.780	1.765	0.033	94.287
Exercise status	1.392	5.421	1	0.020*	4.024	1.246	12.992
Type of physical activity	0.264	0.060	1	0.806	1.302	0.158	10.739
Constant	-3.511	0.908	1	0.341	0.030		

\* p<0.05, PAL: Physical activity level

opposite (8, 15-17). In a study, it was determined that the education given to adolescents with type 1 diabetes at an early age increases the motivation for treatment and can be an effective factor in achieving glycemic control and preventing complications (15). According to another study, the age of children and adolescents between the ages of 4-16 increase their adaptation to diet at

earlier ages. According to another study, children and adolescents between the ages of 4-16 years increase their ability to adapt to diets at earlier ages (16). According to Kleiser et al., it was found that healthy eating scores decreased in adolescence compared to childhood (17). In conclusion, it is thought that it will be easier to adapt to nutritional therapy by giving responsibility not only to

parents but also to children, and enabling earlier self-care of diabetes in adolescents with type 1 diabetes.

The delivery of diabetes and nutritional education by an experienced pediatric diabetes team to adolescents with type 1 diabetes is crucial in terms of achieving glycemic control and improving the prognosis of diabetes (18). In this study, it was found that the most of the participants received nutrition education and almost half of them received it from a dietician. The reason why the majority of adolescents need improvement in their diet quality may be related to their not having met with a dietician. This is because the dietician, while ensuring the optimal body weight of the diabetic, also improves the compliance of the diabetic with the individual meal plan. Carbohydrate counting applications can determine the appropriate insulin dose for the carbohydrate taken and prevent acute and chronic complications. In addition, the adherence of adolescents to treatment is monitored during frequent follow-up and the meal plan is updated when necessary (2). In a study conducted by Karagüzel et al., the diabetes team, consisting of two dieticians, provided diabetes education to adolescents with type 1 diabetes who were taken to diabetes camp for seven days. HbA1c levels of the participants were significantly lower in the 6<sup>th</sup> and 12<sup>th</sup> months compared to the pre-camp levels (19). These results show that it is important to provide nutritional education at certain intervals as of the time of diagnosis in order to improve the diet quality of adolescents with diabetes.

In our study, the educational status of the adolescent and his family did not affect the diet quality score. The reason for this is the homogeneous distribution of diabetic subjects in terms of diet quality. Similarly, according to the study by Lipsky et al., educational level does not affect diet quality (20). However, in another study, adolescents whose parents were educated at university and above had higher diet quality (21). According to a similar study, higher education level is associated with better diabetes self-care, and this plays an important role in improving diet quality and thus in achieving glycemic control (22). In addition, parents with a high level of education are thought to be efficient in understanding the treatment of type 1 diabetes and helping the adolescent to make it a lifestyle. Parents mostly play an active role in the treatment of type 1 diabetes, especially in childhood and early adolescence. In this context, high educational level of the parents is very important for the prognosis of treatment.

Exercise, the third major treatment component for type 1 diabetes after nutrition and insulin, is a specific form of physical activity planned to improve physical health. Exercise was established to play an important role in providing glycemic control, to decrease the risk of cardiovascular disease and to be protective against obesity (18). Exercise therapy and medical nutrition therapy should

not be considered separately. For example, exercise may cause hypoglycemia or even coma if enough carbohydrates are not taken (23). In our study, logistic regression analysis found that the exercise status of individuals had a statistically significant effect on diet quality. Accordingly, exercise status increases good diet quality by 4.024 times. In a study by Storey et al., a significant severe relationship was found between poor diet quality of individuals with insufficient physical activity level (24). In another study, similar results were obtained and good diet quality was associated with moderate to vigorous physical activity (20). In An's study, inadequate physical activity and poor diet quality were associated with obesity (25). This suggests that physically active individuals pay more attention to their diet and regular exercise facilitates adherence to diabetes treatment.

As a result, in this study, it was found that the majority of individuals needed to improve their diet quality, and exercise affected the diet quality of type 1 diabetic adolescents. Therefore, healthy food choices and diet quality of adolescents with type 1 diabetes should be improved. In this context, it is important to include dieticians, who are involved in the regulation of medical nutrition therapy, in the diabetes treatment team. Treatment should continue with regular, effective, and frequent trainings. In addition, exercise levels, which have an important role in both diabetes management and the improvement of diet quality, should be increased.

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**Ethics Committee Approval:** This study was approved by the Ankara University Clinical Research Ethics Committee (Date: 22.05.2017, No: 10-526). A 'Research Permit' dated 12.04.2018 and numbered 15255985-302.01.08[774.99]-E.10299 was obtained from Ankara University Faculty of Medicine Cebeci Hospital Pediatric Endocrine Polyclinic.

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