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Research Article

Evaluation of Nutritional and Food Addiction Status of Individuals with Type 2 Diabetes Presenting to Ankara Baskent Hospital

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Abstract

Aim: It is known that diabetes is an important health problem worldwide with increasing prevalence over the years. In this context, identifying the nutritional tendencies of individuals with diabetes and determining related factors such as food addiction may positively affect the management of diabetes. This study was carried out to evaluate the daily energy, carbohydrate, protein, and fat intake and food addiction of individuals with and without Type 2 diabetes and to determine the impact of food addiction on the intake of the specified nutrients.

Materials and Methods: The study consisted of a total of 128 individuals, including 64 diagnosed with Type 2 diabetes and 64 with no Type 2 diabetes, who were aged between 18 and 65 and presented to Başkent University Ankara Hospital Endocrinology Department. A questionnaire was used to collect data about demographic characteristics, disease information, and lifestyle characteristics of the participants. Food addiction status was determined with the "Yale Food Addiction Scale". A 3-day food consumption form was administered to evaluate the daily energy and nutrient intake of the individuals.

Findings: A total of 128 individuals, including 92 females (71.9%) and 36 males (28.1%), made up the study sample. Sixty-four of the participants had already been diagnosed with Type 2 diabetes. The mean age was 47.23 ± 9.95 years. It was found that 25 (39.1%) of the individuals with Type 2 diabetes had a food addiction but that 39 (60.9%) did not. On the other hand, 19 (29.7%) of the individuals with no Type 2 diabetes had a food addiction, but 45 (70.3%) did not. The difference between the two groups was not statistically significant ($p > 0.05$). A comparison of daily average energy, carbohydrate, protein, and fat intakes of individuals with and without food addiction was made according to their diabetes status. The average daily energy intake of individuals with a diagnosis of food addiction and Type 2 diabetes was found to be statistically significantly higher than those without Type 2 diabetes ($p < 0.05$).

Conclusion: There was no statistically significant difference between individuals with and without Type 2 diabetes in terms of food addiction. A significant difference was found between daily energy intakes of individuals with food addiction according to their Type 2 diabetes status.

Keywords: Diabetes; Nutrition; Food Addiction; Obesity; Nutritional Content

Introduction

Diabetes is a metabolic disease characterized by hyperglycemia that emerges as a result of hereditary or environmental factors and is caused by impairment in insulin secretion and activity, or both [1]. Diabetes is one of the leading chronic diseases with a rapidly

increasing incidence in the world. The increase in its incidence is well above the estimates every year [2]. According to the 9th edition of the IDF Diabetes Atlas, which is updated every two years, the number of patients with diabetes, which was 425 million worldwide in 2017, increased to 463 million in 2019. It is estimated that this figure will increase to 578 million in 2030 and 700 million in 2045, with a 51% increase [3]. The incidence of diabetes tends to increase also in Turkey as well as all over the world. According to the results of the Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Diseases-I (TURDEP-I), the prevalence of patients with diabetes was 7.2%, and the prevalence of impaired glucose tolerance was 6.7% in 1998 [4]. According to the results of TURDEP-II, it was determined that the prevalence of diabetes in the Turkish adult population increased to 13.7% [5].

Type 2 diabetes is a multifactorial disease associated with genetic and environmental factors. Obesity, which is a result of an unhealthy diet and sedentary lifestyle, is an important risk factor for Type 2 diabetes. According to the data of the World Health Organization, more than 1.9 billion (39%) adults were overweight and more than 650 million (13%) were obese worldwide in 2016 [6]. As a result of the increasing prevalence of obesity over the years, the popularity of the term 'food addiction', which is thought to be associated with obesity, has increased [7-10]. Food addiction was first described by Theron Randolph in 1956 [11]. However, systematic studies within the framework of the concept of 'food addiction' and the increase in academic publications gained speed especially after 2006 [12]. It is defined as a chronic and recurrent condition that emerges with the interaction of many complex variables that cause excessive cravings for certain foods (especially sugary, fatty, and salty foods) [13].

Studies have shown that in individuals with food addiction, similar to substance addiction, dopaminergic signals are disrupted and the reward center is activated especially with sugar, fat, and salt intake [14,15]. While evaluating individuals in terms of food addiction, the criteria for substance use disorders in the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) are followed. In a study conducted by Denis., *et al*. it was determined that substance use disorder criteria were applicable in the diagnosis of food addiction [16]. It has been stated that considering concepts such as food addiction with a multi-dimensional perspective while evaluating the nutritional patterns of individuals or making suggestions on changes in their eating habits may produce more successful results [17].

Aim of the Study

This study was conducted to evaluate the nutritional and food addiction status of individuals with Type 2 diabetes.

Materials and Methods

The study was carried out on individuals aged between 18 and 65 who presented to Başkent University Ankara Hospital Endocrinology Department and accepted to participate in the study voluntarily. A total of 128 individuals, including 64 with a diagnosis of Type 2 diabetes and 64 with no Type 2 diabetes, were recruited among individuals who already had a diagnosis of Type 2 diabetes or presented to the endocrinology outpatient clinic for general control. Individuals who were pregnant, had cancer, had chronic renal failure, or had chronic liver failure were not included in the study. The participants were administered a questionnaire to collect data about their socio-demographic characteristics, general health conditions, diabetes, nutritional habits, exercise levels, and status of smoking and alcohol. The questionnaire form was filled out by the researcher by interviewing the participants face to face. To determine the general nutritional status of the patients, three-day food consumption records were taken. The Yale Food Addiction Scale (YFAS) was employed to assess their food addiction. The YFAS, whose validity and reliability study was conducted by Bayraktar, Erkman, and Kurtuluş (2012), is a scale consisting of 27 items and evaluated on the basis of the individual's self-report. Anthropometric measurements of the patients were taken and detailed body analyses were done with the TANITA BC-418 MA brand bioelectrical impedance analyzer.

Statistical analysis

Data were analyzed using the IBM SPSS v25 software package. Descriptive statistics for categorical variables (demographic characteristics) were shown as frequency and percentage values. The fit of quantitative variables to normal distribution was examined using the "Shapiro-Wilk Test". In the analysis of the significance of quantitative variables according to categorical variables, "Independent Samples T-Test" was used for comparisons between two groups for normally distributed data, and the "Mann-Whitney U" test was used for non-normally distributed data. Analysis of the food groups consumed by individuals was evaluated with the Nutrition Information System Software (BEBIS).

Results

A total of 128 individuals, including 92 females (71.9%) and 36 males (28.1%), were included in the study. Sixty-four of the participants had a diagnosis of Type 2 diabetes. The mean age of the individuals was 47.23 ± 9.95 years. Fifty-nine (92.2%) of the individuals with Type 2 diabetes were married and 52 (81.2%) had children. Considering the education levels, 33 (51.6%) of the individuals diagnosed with Type 2 diabetes had an undergraduate degree and 22 (34.4%) were workers with social insurance. Also, 37 (57.8%) of the individuals with Type 2 diabetes had equal income and expenses. Of the participants who did not have a diagnosis of Type 2 diabetes, 47 (73.4%) were married and 39 (60.9%) had children. Considering the level of education, 44 (68.8%) of the individuals with no diagnosis of Type 2 diabetes had an undergraduate degree, and 20 (31.4%) were civil servants. The income of 30 (46.9%) of individuals without Type 2 diabetes was equal to their expenses (Table 1).

Table 2 presents the comparison of the average values and standard deviations of the daily intake of food groups (%) according to the sex of the individuals with and without Type 2 diabetes. Accordingly, the average daily energy intake of females diagnosed with Type 2 diabetes was 1239.78 ± 314.26 kcal/day. The averages of the percentage of carbohydrate, protein, and fat intakes from total daily energy were 114.63 ± 49.93, 57.63 ± 14.61, and 60.03 ± 15.79, respectively. The average daily energy intake of females with no diagnosis of Type 2 diabetes was 1219.49 ± 217.21 kcal/day. The averages of the percentages of carbohydrate, protein and fat intakes from total daily energy were 115.46 ± 29.42, 57.47 ± 11.87 and 56.76 ± 13.52, respectively. The average daily energy intake of male individuals diagnosed with Type 2 diabetes was 1543.7 ± 474.17 kcal/day. The averages of the percentages of carbohydrate, protein, and fat intakes from the total daily energy were 147.37 ± 61.45, 75.08 ± 22.45 and 71.13 ± 23.53, respectively. The average daily energy intake of males who were not diagnosed with Type 2 diabetes was 1741.33 ± 234.95 kcal/day. The averages of the percentage of carbohydrate, protein, and fat intakes from total daily energy were 153.98 ± 47.48, 83.90 ± 15.97, and 84.34 ± 14.2, respectively. There was no statistically significant relationship between the groups ($p > 0.05$).

The distribution of individuals with and without Type 2 diabetes according to their food addiction status is shown in table 3.

		With Type 2 diabetes		With no Type 2 diabetes		Total	
		$\bar{X} \pm SS$		$\bar{X} \pm SS$		$\bar{X} \pm SS$	
Age (Year)		51.367.62		43.099.35		47.239.95	
		N	**%**	**N**	**%**	**N**	**%**
Age groups	≤ 36	3	4.6	13	20.3	16	12.5
	37 - 46	17	26.6	32	50.0	49	38.3
	47 - 56	19	29.7	13	20.3	32	25.0
	≥ 57	25	39.1	6	9.4	31	24.2
Sex	Female	34	53.1	58	90.6	92	71.9
	Male	30	46.9	6	9.4	36	28.1
Marital status	Married	59	92.2	47	73.4	106	82.8
	Single	5	7.8	17	26.6	22	17.2
Status of having children	Yes	52	81.2	39	60.9	91	71.1
	No	12	18.8	25	39.1	37	28.9
Level of education	Elementary	5	7.8	1	1.5	6	4.6
	Middle	6	9.3	3	4.7	9	7.0
	High school	17	26.6	11	17.2	28	21.9
	Undergraduate	33	51.6	44	68.8	77	60.2
	Graduate	3	4.7	5	7.8	8	6.3
Job	Student	-	-	5	7.7	5	3.9
	Retired	11	17.2	5	7.7	16	12.5
	Housewife	15	23.4	16	25.0	31	24.2
	Civil servant	8	12.5	20	31.4	28	21.9
	Worker with social insurance	22	34.4	17	26.6	39	30.5
	Trade/self-employed	8	12.5	1	1.6	9	7.0
Status of income	Income < expenses	5	7.8	6	9.3	11	8.6
	Income = expenses	37	57.8	30	46.9	67	52.3
	Income > expenses	22	34.4	28	43.8	50	39.1

Table 1: Summary statistics of the participants' demographic characteristics.

	With Type 2 DM		With no Type 2 DM		P [1]	P[2]
	Female	Male	Female	Male		
	$\bar{X} \pm SS$	$\bar{X} \pm SS$	$\bar{X} \pm SS$	$\bar{X} \pm SS$		
Energy (kcal)	1239.78314.26	1543.7474.17	1219.49217.21	1741.33234.95	0.790[a]	0.123[a]
Carbohydrates (%)	37.069.04	38.778.94	38.847.23	36.179.33	0.301[b]	0.520[a]
Protein (%)	19.263.75	20.173.75	19.503.14	20.174.83	0.523[a]	1.000[b]
Fat (%)	43.687.61	41.136.55	41.596.1	43.505.54	0.152[b]	0.415[b]

Table 2: The comparison of the average values and standard deviations of the daily energy, carbohydrate, protein, and fat intakes of the individuals with and without Type 2 diabetes according to their sex.

*p < 0.05; **p < 0.01; [a]: The difference between the two groups was evaluated using the Mann-Whitney U Test. [b]: The difference between the two groups was evaluated with the Independent Samples T-Test.

P[1]: Comparison of women with and without Type 2 diabetes. P[2]: Comparison of male individuals with and without Type 2 diabetes.

Accordingly, 25 (39.1%) of the individuals diagnosed with Type 2 diabetes had a food addiction, but 39 (60.9%) did not. Also, 19 (29.7%) of the individuals who were not diagnosed with Type 2 diabetes had a food addiction, while 45 (70.3%) did not.

S		With Type 2 Diabetes		With no Type 2 Diabetes		Total	
		%	S	%	S	%	
Food addiction status	No*	39	60.9	45	70.3	84	65.63
	Yes**	25	39.1	19	29.7	44	34.37

Table 3: The distribution of the individuals with and without Type 2 diabetes according to their food addiction status. *Symptom count < 3, **Symptom count 3 and receiving 1 point from the 15th or 16th question *p < 0.05; **p < 0.01.

Considering the relationship between participants with and without Type 2 diabetes in terms of food addiction, there was a very weak positive correlation (9.9%) between individuals with and without Type 2 diabetes and the status of food addiction, which was not statistically significant (p > 0.05) (Table 4).

		Correlation coefficients	p Value
Spearman's rho	Status of food addiction	0.099	0.268[a]

Table 4: The relationship between participants with and without Type 2 diabetes in terms of food addiction.

*p < 0.05; **p < 0.01; [a]: The relationship between the two groups was evaluated with Spearman's Rho Rank Differences Correlation Coefficient.

The comparison of the average values and standard deviations of the daily intake of food groups (%) according to the food addiction status of individuals with and without Type 2 diabetes is presented in table 5. Accordingly, the average daily energy intake of individuals who did not have food addiction but had a diagnosis of Type 2 diabetes was 1252.04 ± 293.01 kcal/day. The averages of the percentages of carbohydrate, protein, and fat intakes from total daily energy were 36.97 ± 9.42, 20.03 ± 3.81, and 43.03 ± 7.79, respectively. The average daily energy intake of individuals who did not have a food addiction and who had not been diagnosed with Type 2 diabetes was 1280.45 ± 275.91 kcal/day. The averages of

the percentages of carbohydrate, protein, and fat intakes from total daily energy were 37.64 ± 6.79, 19.82 ± 3.64, and 42.49 ± 5.38, respectively. The average daily energy intake of individuals with food addiction and a diagnosis of Type 2 diabetes was 1585.36 ± 512.2 kcal/day. The averages of the percentages of carbohydrate, protein, and fat intakes from total daily energy were 39.24 ± 8.2, 19.16 ± 3.67, and 41.64 ± 6.21, respectively. The average daily energy intake of individuals who had food addiction but had not been diagnosed with Type 2 diabetes was 1239.92 ± 244.31 kcal/day. The averages of the percentages of carbohydrate, protein, and fat intakes from total daily energy were 40.84 ± 8.47, 18.95 ± 2.2, and 40.05 ± 7.23, respectively. The average daily energy intake of individuals who had food addiction was found to be statistically significantly higher in those who had been diagnosed with Type 2 diabetes than those without Type 2 diabetes ($p < 0.05$).

	With Type 2 DM		With no Type 2 DM			
	No food addiction	Food addiction	No food addiction	Food addiction		
	$\bar{X} \pm SS$	$\bar{X} \pm SS$	$\bar{X} \pm SS$	$\bar{X} \pm SS$	P [1]	P[2]
Energy (kcal)	1252.04293.01	1585.36512.2	1280.45275.91	1239.92244.31	0.527[a]	0.005**[b]
Carbohydrates (%)	36.979.42	39.248.2	37.646.79	40.848.47	0.713[b]	0.530[b]
Protein (%)	20.033.81	19.163.67	19.823.64	18.952.2	0.665[a]	0.824[b]
Fat (%)	43.037.79	41.646.21	42.495.38	40.057.23	0.719[b]	0.438[b]

Table 5: The comparison of the average values and standard deviations of the daily energy, carbohydrate, protein, and fat intakes of the individuals with and without Type 2 diabetes according to their food addiction status.

*p < 0.05; **p < 0.01; [a]: The difference between the two groups was evaluated using the Mann-Whitney U Test. [b] The difference between the two groups was evaluated with the Independent Samples T-Test.

P[1]: Comparison of individuals with no food addiction by the status of Type 2 diabetes, P[2]: Comparison of individuals with a food addiction by the status of Type 2 diabetes.

Discussion

Diabetes is an important chronic disease whose prevalence worldwide has increased over the years. Similarly, the prevalence of obesity, one of the most important risk factors of Type 2 diabetes, is also at an alarming level. The most effective method has been discussed by evaluating the treatment options of diabetes and obesity within the framework of these results. At this point, environmental factors, dietary habits, psychological conditions, and genetic factors should be taken into account. Eating disorders should be considered in the evaluation of nutritional habits, and a treatment plan should be made accordingly. Eating disorders are a condition in which individuals experience serious disturbance due to their eating behaviors and related thoughts and feelings. They usually occur depending on the psychological state and can also bring serious physical problems. In food addiction, individuals are unable to resist foods containing sugar, fat, or salt, which they describe as extremely delicious, and they feel a desire to eat that they cannot control. There are many studies in the literature comparing food addiction and obesity [7,10]. However, there are not enough studies comparing food addiction and diabetes.

According to the 9th edition of the IDF Diabetes Atlas, there were 351.7 million individuals with diabetes aged between 20 and 64 in 2019. The report pointed to the increasing prevalence of diabetes in the working-age range (20 - 64). The age ranges in which the prevalence of diabetes was lower were reported as 20 - 24 (1.4% in 2019) and 75 - 79 (19.9% in 2019) [3]. In this study, it was determined that the majority of individuals with Type 2 diabetes (39.1%) were aged between 57 and 64. In a study investigating the demographic and clinical characteristics of patients with Type 2 diabetes, the mean age of 4556 individuals with Type 2 diabetes was 47.0 ± 10.82 years [18]. In the present study, the mean age of individuals with Type 2 diabetes was found as 51.36 ± 7.62 years. Also, in the study mentioned above, 2549 (56%) of the individuals

with Type 2 diabetes were female and 2007 (44%) were male. According to IDF (2019), the number of males with diabetes (9.6%) was higher than women (9.0%) in individuals aged between 20 and 79. However, it was determined that 34 (53.1%) of individuals with Type 2 diabetes were female and 30 (46.9%) were male in this study.

When the relationship between Type 2 diabetes and education level was evaluated, it was determined that 51.6% of the individuals with Type 2 diabetes who participated in the study had an undergraduate degree and that 26.6% were high school graduates. In a study, it was determined that 10% of 60 people with diabetes had an undergraduate degree and that 33.3% were high school graduates [19]. Besides, it was found in another study that only 9.66% of 1001 individuals with diabetes had an undergraduate degree [20]. With the increase in education level, it can be thought that individuals are more conscious about healthy life (healthy and balanced diet, high physical activity level, etc.). Accordingly, diseases such as Type 2 diabetes, on which lifestyle has a significant impact, can be seen less frequently among these individuals.

Risk factors of Type 2 diabetes include genetic factors, unhealthy eating habits, obesity, and sedentary life. Obesity, one of the most important one among these risk factors, both increases the risk of diabetes and worsens glycemic control in patients with diabetes [21,22] The increasing prevalence of obesity over the years is at an alarming level. In this context, many factors show up when evaluating cause and effect relationships. Food addiction, which has been frequently emphasized in recent years, is one of them. In a study, it was determined that 39 (4.5%) of 878 participants were diagnosed with food addiction [23]. In a study conducted on university students, it was reported that 24.0% of the students had food addiction [24]. In another study, it was found that 15.2% of 178 individuals were diagnosed with food addiction [25]. The number of studies investigating the relationship between Type 2 diabetes and food addiction is quite limited. In a study conducted on individuals with Type 2 diabetes, 70% of 334 participants were found to have food addiction [26]. In the present study, food addiction was detected in 25 (39.1%) of the individuals with Type 2 diabetes, while it was not observed in 39 (60.9%). Regarding the individuals with no Type 2 diabetes in the study, it was found in 19 (29.7%) of the participants, but 45 (70.3%) of them did not have it.

Independent of the presence of diabetes, it can be thought that the increase in energy-rich food consumption together with food addiction and the increase in daily energy intake can be considered to be important factors leading to obesity. Although food addiction is not always associated with obesity, it is seen 2 - 3 times more frequently in individuals with obesity [27].

To achieve glycemic control and prevent complications in Type 2 diabetes, medical treatment should be accompanied by ideal nutrition. Although various studies have been conducted for many years to determine the ideal diet pattern, a clear result has not yet emerged. In general, there are results that low carbohydrate consumption, low glycemic index food choices, and the Mediterranean type diet improve glycemic control [28,29]. In Type 2 diabetes, in which healthy and balanced nutrition is taken as a base, the most emphasized issue is that nutrition should be customized to the person. Although the energy ranges that should come from carbohydrates, protein, and fat are specified in the guidelines, it is also emphasized that they may differ from person to person [30]. In meta-analysis studies, it has been stated that a diet poor in carbohydrates can improve clinical outcomes in Type 2 diabetes [31,32]. In this study, no statistically significant difference was found between individuals with and without Type 2 diabetes in terms of their daily average energy, carbohydrate, protein, and fat consumption.

It is known that foods associated with food addiction include foods that contain high energy and low nutritional properties and are fattier and saltier. Therefore, it is estimated that the dietary profile of individuals with food addiction may include foods rich in carbohydrates, especially simple carbohydrates [14]. The number of studies evaluating the relationship between food addiction and daily food groups is quite limited. In a study, it was found that the energy from fat and protein in the diet of individuals diagnosed with food addiction was higher than the control group [33]. In another study, most of the total daily energy intake in individuals diagnosed with food addiction was determined to come from foods with high energy content and low nutritional value (such as sugar and sugar-containing foods), while more nutritious foods (such as whole-grain products) were consumed less. While there was no statistically significant difference between the two groups in terms of daily energy, carbohydrate, and protein intake, it was determined that fat intake was significantly higher in the group diagnosed with food addiction [34]. In another study, it was determined that the

percentage of daily fat and carbohydrate from total energy intake was higher in individuals with food addiction than those who were not diagnosed with this addiction. Individuals diagnosed with food addiction were found to have higher intakes of sugar, sodium, potassium, calcium and selenium minerals, saturated fatty acids, monounsaturated fatty acids, and trans fats compared to the group without a diagnosis of food addiction [35]. In the present study, the highest daily carbohydrate consumption (%) was determined in the group with food addiction and with no Type 2 diabetes. However, this finding was not statistically significant. Individuals who had a food addiction and Type 2 diabetes had a daily total energy intake of 1585.36 ± 512.2, while the total daily energy intake of individuals with food addiction but not diagnosed with Type 2 diabetes was 1239.92 ± 244.31. The difference between the groups was found to be statistically significant. In this study, the difference in terms of the consumption of other food groups (carbohydrates, protein, and fat) was not statistically significant between the groups.

Conclusion

Similar to previous studies, it was observed in this study that food addiction was quite common among groups with and without Type 2 diabetes. Besides, when the daily energy, carbohydrate, protein, and fat consumption of individuals with and without Type 2 diabetes were evaluated, it was determined that there was no statistically significant difference between the two groups. When evaluated together with the food addiction factor, it was found that the daily energy intake of patients who had Type 2 diabetes and food addiction was significantly higher than individuals who had food addiction but had not been diagnosed with Type 2 diabetes. Although the number of studies on food addiction is quite high, research into evaluating food addiction in individuals with diabetes is quite limited. More studies are needed to clarify the mechanisms that can explain the relationship between diabetes and food addiction and to explain the effect of food addiction on the intake of nutrients more clearly.

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