

The Effect of Body Weight on Eating Behavior and Risk for Diabetes, Health Literacy Among Turkish Adults

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Summary. *Aim:* This study was aimed to investigate the effect of body weight on eating behavior, risk for diabetes and health literacy of individuals in a primary healthcare center. *Design:* Body weight, eating behavior, risk for diabetes and health literacy level were evaluated in this cross-sectional descriptive study. A total of 210 individuals with normal weight (Body Mass Index (BMI) of 18.5 to <25), overweight (BMI of 25 to <30 kg/m²) and obese (BMI ≥30 kg/m²) were included in the study. The three-factor eating questionnaire (TFEQ) was used to investigate the eating behaviors of the participants. Turkish Health Literacy Scale-32 (THLS-32) and FINDRISC Type 2 Diabetes Risk Assessment Form was used. *Results:* A significant relationship was determined the total score of TFEQ scale and body mass index categories. The risk of diabetes was higher in obese individuals. The scores obtained from THLS-32 were lower in obese individuals. The chances of obese individuals being in the high-risk group for diabetes are 8.47 times higher compared to individuals with normal weight. According to the results of multivariate analysis, this risk is 9.92 times. *Conclusions:* It was determined that increased the body weight associated TFEQ scale and the risk for diabetes and also Health Literacy. Weight management practices should be conducted by a multidisciplinary team for individuals in risk group with high BMI in healthcare centers.

Key words: Eating behavior, body weight, body mass index, diabetes mellitus, health literacy

Introduction

World Health Organization (WHO) defines overweight and obesity as the accumulation of excessive fat at a level that affects human health negatively. All over the world, the frequency of overweight and obesity has been frequently increasing. In 2016, it was reported that more than 1.9 billion adults aged 18 and older were overweight and 650 million of these were obese. Additionally, 39% of the adults aged 18 and older were overweight while 13% of them were obese (1).

In obese individuals, the morbidity and the mortality risks of chronic diseases vary depending on the

amount and the distribution of fat in the body, affecting the quality of life and lifespan negatively (2). It is not only the amount of fat in the body that determines risks and diseases based on obesity but also the distribution of the fat in the body. The presence of intensive adipose tissue in the abdominal region and around the waist circumference creates more risks for the development of other diseases such as type 2 diabetes related to obesity, hypertension and other cardiovascular and metabolic disorders (3, 4).

Around the world, the prevalence of Type 2 Diabetes has been increasing and according to International Diabetes Federation (IDF) Diabetes Atlas-8th Edition, there are 425 million individuals with diabetes

in the world (5). In The Turkish Epidemiology Survey of Diabetes, Hypertension, Obesity and Endocrine Disease (TURDEP I) study conducted between 1997 and 1998, it was reported that the prevalence of diabetes was 7.2% while obesity was 22% (6). In the TURDEP II study conducted in 2010, the frequency of diabetes in Turkish adult population was 13.7% while obesity was determined as 36% (7). It is clearly seen that diabetes had become a significant public health problem for Turkey in the elapsed time.

Eating behavior affect the development of various chronic diseases such as obesity, cardiovascular diseases, diabetes and cancer (8). The Three-Factor Eating Questionnaire (TFEQ) is one of the most commonly used scales to measure food intake in terms of measuring behavioral and cognitive aspects (9). Three different eating habits were, these are cognitive or restrictive, uncontrolled and emotional eating behavior, derived from three different eating behavior theories which can help in understanding the psychological aspects of eating behavior. Individuals with cognitive eating, which is derived from the restraint theory (10), are inclined to limit food or calorie intake in order to control their self-image or avoid gaining weight (11) while individuals with uncontrolled eating behavior are inclined to overeat when they receive sensory cues or are in presence of food (e.g. "Sometimes, when I start eating, I just can't seem to stop") (12). Individuals with emotional eating, which is derived from the psychosomatic theory (13), are inclined to overeat in the face of negative emotions as a response (14).

Health literacy refers to the social and cognitive skills that influence the abilities and motivation of people to access, understand and use related information to maintain and promote good health (15). The cognitive and social skills included in the concept of healthy literacy determines the motivation and abilities of people to access, understand and process information related to health in a certain approach that enables people to change their lifestyles, improve their quality of life, prevent diseases and maintain good health (16, 17).

In this study, it was aimed to investigate the effect of body weight on eating behavior, risk of diabetes and health literacies of individuals in a primary healthcare center.

Method

Sample

In order to calculate the size of the sample, a power analysis was conducted for the level that can result in statistically significant findings by using the FINDRISC scale (with 95% CIs, 80% power), whose measurement error was believed to be greater. As a result of the analysis, it was calculated that each group should have 70 individuals. In the study, a total of 210 individuals with normal weight, overweight and obese were included in the study. The criteria for participation in the study included participating voluntarily, having no problems in communication and being aged 18 and having normal weight (BMI of 18.5 to 24.9 kg/m²), overweight (BMI of 25.0 to 29.9 kg/m²) or obese (BMI \geq 30.0 kg/m²). The exclusion criterias were not being pregnant, not having any chronic disease (diabetes, metabolic disorder etc.), being underweight (below BMI of <18.5 kg/m²).

The participants were investigated for their demographic variables, which included age, gender, education level, marital status and occupational status. Furthermore, the participants were measured for their heights, weights and waists sizes. All the participants in the study completed the questionnaire conducted by the experts.

The permission for the study was obtained from the provincial directorate of health. Moreover, the participants were informed about the aims of the study, which was followed by the application of the questionnaire.

Lastly, the ethics committee for non-interventional studies at Fırat University approved the study. Additionally, all of the participants provided written consents and the identities of the participants were kept confidential. All procedures of the study were in accordance with the latest version of the Declaration of Helsinki given by World Medical Association.

Design

This study was designed as a cross-sectional study. The study was conducted between September 17, 2018 and November 16, 2018 in a primary healthcare center

located in Turkey. The study included a total of 210 participants, who applied to the healthcare center with various types of weight -70 normal weight, 70 overweight and 70 obese-. All participants who applied to the healthcare center included the study with randomly.

Measurement

Body Composition

A stadiometer was used to measure the heights of the participants while a calibrated scale was used to measure their fasting weights. BMI values of the participants were calculated by dividing weight (kg) by the square of height (m). The BMI values were categorized into three as normal weight (BMI of 18.5 to <25.), overweight (BMI of >25), obese (BMI of >30) (18).

Three-Factor Eating Questionnaire

The three-factor eating questionnaire (TFEQ) was used to investigate the eating behaviors of the participants. The three-factor eating questionnaire was developed by Stunkard et al. in 1985. Furthermore, Karlsson et al. developed a reduced version of the scale. The revised version of the Three-Factor Eating Questionnaire (TFEQ-R18) contains 18 items, which forms three distinct subscales as cognitive restraint, emotional eating and uncontrolled eating (19). The Turkish validation study of the scale was conducted by Kırac et al. in 2015 (20). The scale is a 4-point Likert type scale with 18 items and includes 3 subscales for eating behaviors, which are cognitive restraint, emotional eating and uncontrolled eating. The scores of the questionnaire range between 0 and 100 for each subscale. Higher scores of a subscale further demonstrate the eating patterns of that scale.

Turkish Health Literacy Scale-32

The Health Literacy of the participants was evaluated with the Turkish Health Literacy Scale-32 (THLS-32). The scale consists of 32 items, which were

adapted from the conceptual model of the consortium of HLS-EU by Okyay et al. in 2016 (21). The scale is a 5-point Likert type scale with 32 items. The lowest health literacy in the scale is represented by 0 points while the highest health literacy is represented by 50 points. As the scores obtained in the scale increases, the individual's health literacy level also increases.

Type 2 Diabetes Risk Assessment (FINDRISC) Form

In this study, the "FINDRISC Type 2 Diabetes Risk Assessment Form", which was developed by Lindström and Tuomiletho and referred by Turkish Endocrinology and Metabolism Association in Turkey, was adopted (22). In this test, a total of 8 parameters are investigated. These parameters are age, body mass index, waist circumference, daily physical activity, daily vegetable and fruit consumption, family history, hypertension presence and history of randomly detected high blood sugar, respectively. The answers to these questions are added together to form the risk score. As a result of the measurement, the minimum risks score is 0 while the maximum score is 26. The total obtained scores lower than 7 indicates that the individual has a 1% risk of developing type 2 diabetes in 10 years while scores between 7 and 11 indicates 4% followed by 12-14 points indicating 16% risk, 15-20 points indicating a high risk with 33% and higher points than 20 indicating very high risks with 50%.

Data Analysis

The data collected in the study were analyzed using SPSS 21.0 software (IBM Corp, Armonk, NY USA). Descriptive statistical analyses were conducted to summarize the demographic information of the participants. The relationships between participants' demographic information and BMI were evaluated by using the chi-square test. The distributions of scores of scales by BMI were analyzed using One way ANOVA and Kruskal Wallis Test. To determine the factors that increase the risk for diabetes, logistic regression analysis was conducted. In this analysis, risk for diabetes (low, high) was determined as the dependent variable while the variables of gender, age, education level (≤ 8 years, ≥ 9 years), marital status (married, single), body mass index (BMI) were de-

terminated as independent variables. The level of significance was regarded as $p < 0.05$. P-value of our study was one-tailed since one of our hypotheses was that the body weight increases the risk of diabetes increases.

Results

The demographic information of the participants ($n=210$), normal weight, overweight and obese, were presented in Table 1. Individuals with normal BMI had a mean age of 34.22 ± 13.61 years while those with overweight had 40.44 ± 15.71 years followed by obese individuals with 44.87 ± 12.65 years. The obese group includes 74.3% of females and 25.7% males. The rate of 9 years or more education was 67.1%, 60% and 40% among individuals with normal, overweight and obese, respectively. Married individuals were less overweight and obesity (32.9% and 15.7%, respectively) while single individuals had higher rates of overweight and obesity (67.1% and 84.3%, respectively). Individuals who unemployed had an obesity rate of 64.2% while those who employed 35.7%.

In Table 2, the distributions of the participants according to BMI categories of FINDRISC, Health Literacy and Three-Factor Eating Questionnaire (TFEQ) scale scores were presented. The risk of diabetes was higher in obese individuals ($p=0.001$). The scores obtained from the health literacy scale was higher in individuals with normal weight while the scores were lower in obese individuals ($p=0.003$). A significant relationship was determined the total score of TFEQ scale and BMI categories ($p=0.010$) while no significant relationship was determined between the scores of cognitive restraint, a subscale of TFEQ, and BMI ($p=0.821$). As the scores obtained in the uncontrolled eating and emotional eating subscales of TFEQ scale increase, the BMI levels were also increased, resulting in a statistically significant relationship ($p=0.033$ and $p=0.002$, respectively).

According to the FINDRISC scale, 15.7% of the participants in the study had a high risk for diabetes while 6.2% had very high risks for diabetes. The individuals with risk for diabetes scores 14 and less were classified as low-risk individuals while those with 15 or more were classified as high-risk individuals (Table 3).

Table 1. Demographic Characteristics of the Participants by BMI ($n= 210$)

Characteristics	Normal weight		Overweight		Obese		p
	n	%	n	%	n	%	
Mean age (min-max)	34.22±13.6		40.44±15.71		44.87±12.65		0.004
Gender							0.263
Female	43	61.4	48	68.6	52	74.3	
Male	27	38.6	22	31.4	18	25.7	
Education							0.004
≤8 years	23	32.9	28	40.0	42	60.0	
≥9 years	47	67.1	42	60.0	28	40.0	
Marital status							0.002
Single	40	57.1	47	67.1	59	84.3	
Married	30	42.9	23	32.9	11	15.7	
Occupation							<0.001
Employed		41.4	23	42.9	25	35.7	
Not employed	41	58.6	81	67.2	45	64.2	

Table 2. The distributions of scores of Scales by BMI

	Normal weight Mean±Sd	Overweight Mean±Sd	Obese Mean±Sd	P
Diabetes Risk (FINDRISC)	8.62±3.68	10.12±4.67	14.72±4.28	0.001#
Health Literacy	32.19±7.36	33.54±8.11	28.70±9.94	0.003*
Three Factor Eating Questionnaire (TFEQ)	43.62±5.24	46.11±6.80	46.64±5.64	0.010*
Cognitive Restrain	16.47±3.50	16.71±2.86	16.38±3.35	0.821*
Uncontrolled Eating	20.84±3.73	22.08±5.14	22.62±3.93	0.033*
Emotional Eating	6.31±1.97	7.31±2.43	7.62±2.08	0.002#

*One way ANOVA, # Kruskal Wallis Test

Table 3. Distribution of diabetes risks of participants in our study

Total Score	Level of Risk	10-year risk	% (n)
<7	Very Low	%1	24.3 (51)
7-11	Low	%4	30.5 (64)
12-14	Medium	%16	23.3 (49)
15-19	High	%33	15.7 (33)
≥20	Very High	%50	6.2 (13)

According to the univariate analysis, as the age increases, the risk for diabetes also increased for 1.08 times in addition to multivariate increasing for 1.15 times. The chances of obese individuals being in the high-risk group for diabetes are 8.47 times higher compared to individuals with normal weight. According to the results of multivariate analysis, this risk is 9.92 times. In the univariate analysis for education level, individuals with primary school degree had 2.66 times risks for diabetes compared to those with high school degrees. According to marital status, in the multivariate analysis, single individuals had 11.33 times higher risks for diabetes compared to married individuals. In univariate analysis for TFEQ, a relationship was found between emotional eating and diabetes risk. The risk for diabetes increases for 1.29 times among individuals who have emotional eating behavior. As the health literacy level decrease the risk of diabetes increases in the univariate analysis (Table 4).

Discussion

As the main finding of our study, it was determined that increased the body weight associated TFEQ scale and the risk of diabetes and also Health Literacy.

American Psychiatric Association defines over-eating and characteristic uncontrolled eating behaviors as an inability to control what to eat and how much to eat (23). It was reported that this behavior is observed in overweight or obese individuals (24, 25, 26, 27) and this condition increased comorbidity related to obesity (such as T2DM) (28, 29, 30).

In a study conducted with Swedish adult females and adolescents, it was determined that eating behaviors were related to body weight (31). In a study conducted with a sample consisting of Finnish women, a relationship was discovered between cognitive restraint and emotional eating and body weight

Table 4. Univariate and multivariate logistic regression analysis of several variables predictive of diabetes risk

Variables	Univariate analysis		Multivariate analysis	
	OR (%95 CI)	p	OR (%95 CI)	p
Single	0.48 (0.21 – 1.07)	0.073	11.33 (2.26 – 56.68)	0.003
Age	1.08 (1.05 – 1.12)	<0.001	1.15 (1.09 – 1.21)	<0.001
Education (≤ 8 years)	2.66 (1.35 – 5.24)	0.004	2.11 (1.00 – 4.42)	0.048
BMI (Overweight)	1.57 (0.52 – 4.68)	0.415	0.62 (0.15 – 2.48)	0.508
BMI (Obese)	8.47 (3.24 – 22.15)	<0.001	9.92 (2.75 – 35.78)	<0.001
Cognitive Restrain	1.00 (0.90- 1.10)	0.996	1.01 (0.90 – 1.13)	0.778
Uncontrolled Eating	1.04 (0.97 – 1.12)	0.204	1.01 (0.93 – 1.09)	0.745
Emotional Eating	1.29 (1.10 – 1.50)	0.001	1.28 (1.09 – 1.51)	0.002
Health literacy	0.96 (0.92 – 0.99)	0.046	0.99 (0.93 – 1.04)	0.719

The dependent variable is high diabetes risk (≥ 15 were grouped as high risk individuals)

CI: Confidence Interval

(32). In our study, it was determined that there was a relationship between high scores of uncontrolled and emotional eating and high BMI, which is similar to results in the literature.

Several studies reported that it is possible to prevent type 2 diabetes with a rate of 58% by conducting early interventions for changing high risks groups' lifestyle behaviors (33-37). Investigating the population, the mean BMI values of individuals with high risk were determined higher compared to individuals with low risk (38).

In a previous study conducted with FINDRISC, it was reported that 10.5% of the population had high risks while 80% of the population with diabetes were either overweight or obese (39). Additionally, in another study, it was concluded that the obesity rate (63.8%) was higher in individuals with high risk (40). The conclusions of the TURDEP II study, which was conducted in Turkey, also confirmed that obesity was one of the major factors contributing to the epidemic of diabetes. In our study, it was similarly discovered that overweight and obese individuals had higher risks for diabetes. Of all the participants in our study, 15.7% had high risks for diabetes while 6.2% had very high risks for diabetes.

In a study conducted with a large sample in Turkey, it was determined that the diabetes risk of indi-

viduals who completed formal 8-year education were 1.45 times higher compared to individuals with further education (6). It was reported in previous studies that low levels of education had a positive effect on diabetes development and gaining related risk factors (41, 42). In our study, findings were similar to those in the literature. Additionally, these findings indicated that individuals with low levels of education did not exhibit healthy life behaviors and this situation increased their risks for diabetes (40, 42).

Individuals with high levels of Health Literacy tend to make healthier decisions in their lives. One of the most significant lifestyle behaviors, healthy nutrition, is also affected by health literacy levels (43, 44). In previous studies, it was reported that individuals with satisfactory health literacy levels were more inclined to consume lower amounts of sugar-sweetened beverages and fried meals and more amounts of vegetables and fruit with high healthy eating index and had better food label use (45-47).

By improving knowledge and increasing participation in healthcare, the significance of Health Literacy has increased according to improvements in self-assessed health (48). Low Health Literacy levels lead to higher healthcare costs and increased burdens of disease, poor quality of healthcare, improved risks for poorer health outcomes (49).

It was reported that obesity is observed more frequently in individuals with low levels of health literacy (50-52). In a systematic compilation study conducted by Faruqi et al., it was reported that health literacy might have positive effects on losing weight (52). Many studies in the literature reported relationships between bad/limited health literacy and high BMI values (50-53). In our study, results that were similar to those in the literature were found, concluding that high BMI and bad health literacy were related.

Previous studies indicated that there is an association only between eating behavior and their body weight or a relationship only between body mass index and health literacy. However, there is limited data about effect of the body weight on diabetes risk and health literacy, eating behavior together. The findings of our study make an important contribution to the understanding of the effect of eating behavior and health literacy on diabetes risk and body weight.

Our study had some limitations. The sample of the study consists of individuals who applied to a family healthcare center in the city of Elazığ. Therefore, the results obtained cannot be generalized to other regions in Turkey. The design of the study, it was cross sectional study, was the other limitation of our study. Furthermore, no laboratory test was used for the diabetes risks of individuals and only the answers provided for the FINDRISC scale were taken into account.

Conclusion

Eating behaviors of individuals affect their body weight. As BMI increases, the risk for diabetes also increases. Health literacy, which defines individuals' aspects of protecting and improving their health, is inversely related to BMI. Further researches on weight management practices should be conducted by a multidisciplinary team (dietician, endocrine specialist, physiotherapist, psychologist, nurse and physicians etc.) for individuals in risk group with high BMI (overweight and obese) in healthcare centers. By reducing obesity, which is a risk factor for many diseases as well as diabetes, the incidence of chronic diseases can be reduced. Similarly, within the scope of preventative healthcare services, more attention can be paid to health educa-

tion to increase healthcare literacy. In this way, individuals can gain healthy behaviors such as gaining healthy eating behaviors and decreasing obesity.

Conflict of Interest: The authors declare that they have no conflict of interest.

Informed consent: An informed consent was obtained from all individual participants included in the study.

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