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Vegetable and Fruit Consumption and Its Relationship with Body Mass Index in Adults: A Cross-Sectional and Seasonal Research from Türkiye

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ABSTRACT

This study examines the relationship between fruit and vegetable consumption and the BMI in Türkiye. In this cross-sectional study, which 6332 adults were included, fruit and vegetable consumption, and preferences were collected. The quantities of vegetables and fruits were classified based on the WHO and the national recommendations. Of the adults (33.39 ± 12.59 years), 52.9% of men and 39.7% of women had an above-normal BMI. Based on WHO recommendations, overweight and obese people consumed less vegetables and fruits compared to their counterparts (ORs for women, overweight: 1.2, obese: 1.3; ORs for men, overweight: 1.3, obese: 1.5; 95% CI). The regression analysis revealed that the quantities of vegetable and fruit intake were higher in young individuals, men, and married people. Although the majority consume more than 400 g/day of vegetables and fruits, the intake is inadequate in people with obesity.

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KEYWORDS

BMI; vegetable; fruit; adult; obesity

Introduction

The rise in obesity and related comorbidities in the population continues to be an important global public health problem (Barata Cavalcanti et al. 2022). Türkiye is among the countries with the highest obesity rates in adults. It has been reported that, of individuals in the 19–64 age group in Türkiye, 36.9% are overweight and 28.4% are obese. In men and women, the rates of obesity are 23.8% and 33.1%, and the rates of being overweight are 42.0 and 28.5%, respectively (Turkish Ministry of Health 2014). According to the Organization for Economic Co-operation and Development (OECD) Obesity Update 2017 report, Türkiye ranks 6th after America, Chile, Mexico, New Zealand, and Hungary regarding the obesity rate in adults (Organisation for Economic Co-operation and Development (operation and Development OECD 2017). All these data show that the rates of overweight and obesity rates are increasing year by year in Türkiye.

The United Nations (UN) has declared the year 2021 as the International Year of Fruits and Vegetables, aiming to raise awareness of the nutritional and health benefits of consuming more fruits and vegetables as part of a diversified, balanced, and healthy diet, as well as, to direct attention to minimizing the loss and waste of these highly perishable products. Beyond nutritional benefits, it is

important to address the fruit and vegetable intake holistically as an integral part of the food system, including the social, economic, and environmental benefits (Food and Agriculture Organization (Food and Agriculture Organization FAO 2020).

Inadequate fruit and vegetable intake is associated with unfavorable effects on well-being and an increased risk of chronic non-communicable diseases. In 2017, an estimated 3.9 million deaths worldwide were reported to be associated with the inadequate intake of fruits and vegetables (Food and Agriculture Organization WHO/World Health Organization FAO Expert Consultation 2003). Also, it has been shown that fruit and vegetable intake, when combined with a healthy diet, prevents weight gain, reducing the risk of obesity (Boeing et al. 2012). A diet rich in fruits and vegetables is associated with positive health outcomes as reflected in the body mass index (BMI) and the reduced risk of obesity-related comorbidities. Because vegetables and fruits are low in energy density and contain some bioactive components (carotenoids, folate, vitamin C, vitamin E, quercetin, pyridoxine, and selenium), they prevent the development of diabetes and some types of cancer and reduce the risk of cardiovascular diseases and stroke (Rock and Demark-Wahnefried 2002; Tohill et al. 2004; Frank et al. 2019). For the promotion of general health and the prevention of certain chronic diseases, WHO recommends that more than 400 grams of fruits and vegetables per day should be eaten as part of a healthy diet low in fat, sugar, and sodium (World Health Organisation (2021). Our country's current national nutrition guidelines, Türkiye Dietary Guidelines (TUBER), recommend that 5 servings or more of vegetables and fruits should be eaten per day (Turkish Ministry of Health 2022).

The latest national research has demonstrated that the daily intake of vegetables and fruits in adults in Türkiye occurs at rates of 46.9–50.7% and 44.6%–48.4% in men and 56.7%–60.2% and 57.1%–60.6% in women, respectively (Turkish Ministry of Health 2019). The relationship between BMI and the intake of fruits and vegetables was established in previous studies (Azagba and Sharaf 2012; Machado et al. 2016; Arnotti and Bamber 2020). An inverse relationship is usually reported between BMI and the intake of fruits and vegetables (Yu et al. 2018). The studies about whether vegetable and fruit intake differs by BMI are inadequate in the literature. Therefore, the aim of this study was twofold: 1) to determine fruit and vegetable intake by gender and 2) to compare fruit and vegetable intake by BMI.

Methods

Study design and sample

This cross-sectional study was conducted with 6332 individuals, who were in the age range of 18–65 years and who were selected by random sampling method from different geographical regions of Türkiye.

Based on the Turkish Statistical Institute's Population Report 2016 (Turkish Statistical Institute 2016), covering 12 statistical regions in our country, the required minimum sample size was calculated as 4147 people, with a margin of error of 1% and deviation of 2%. At the end of the study, 7693 people were reached. Consequent to data evaluation and the exclusion of ineligible individuals, the study was completed with 6332 people.

The inclusion criteria were as follows: to be between the ages of 18 and 65 years, to be a Turkish citizen residing in Türkiye, and not to have any chronic diseases. Only one adult from the same family was included in the study. Individuals younger than 18 or older than 65 years old, non-Turkish citizens, individuals not residing in Türkiye, pregnant or lactating women, and individuals with chronic diseases were not included in the study.

Data collection and evaluation

Research data were obtained through a questionnaire in the period between June and September 2017. The questionnaire was administered by the trained staff members through face-

to-face interviews in the home environment of participants. The questionnaire form consisted of two parts. In the first part of the questionnaire, demographic information including age, gender, marital status, educational status were asked and the data collected from participants were recorded. In the second part, participants were asked about the quantities, the frequency, and the preferred ways of daily fruit and vegetable intake.

The height was measured without shoes and with the head of the participant in the Frankfurt plane. The body weight was measured using a scale while the participant had only light clothes on. The waist circumference was measured at the narrowest region of the waist and the hip circumference was measured at the widest part of the hip, using a non-stretchable measuring tape. BMI was calculated by dividing the weight (kg) by the square of the height (m²). The values obtained were classified as underweight, normal, overweight, and obese according to the BMI categories of WHO (World Health Organization (World Health Organization WHO 2015)).

The types and quantities of vegetables and fruits eaten in a day were captured using the 24-hour dietary recall method, which was based on listing the types and quantities of food and beverages consumed by the individual throughout the day. The 24-hour diet recall method was applied to include only vegetable and fruit consumption. A photographic food atlas was used to determine the types and quantities (Rakıcıoğlu et al. 2012). Different sizes of both raw and cooked images of food in the photographic food atlas were shown to individuals to determine the total daily quantities in grams. Then, these quantities were converted into serving sizes of vegetables and fruits as specified in TUBER, the national dietary Guideline of Türkiye. Thus, the quantities of vegetable and fruit servings consumed by the individual were determined. According to TUBER, one serving size for vegetables is 150 g for raw and cooked vegetables, 75 g for salads, cold cuts, and greens; 30 g for dried fruits, 100 g for bananas, and 150 g for all other fresh fruits. Potatoes and corn are excluded (Turkish Ministry of Health 2016).

For comparison with recommended amounts of consumption, daily fruit and vegetable intake quantities advised for adults by WHO and TUBER were taken as the basis. WHO considers a fruit and vegetable intake of at least 400 g/day adequate (World Health Organization WHO/Food and Agriculture Organization FAO Expert Consultation 2003). For the total consumption of vegetables and fruits, a quantity of at least 5 servings was taken as the basis. TUBER considers women's intake of at least 2.5 servings of vegetables and 2 servings of fruits and men's intake of at least 3.5 servings of vegetables and 2.5 servings of fruits adequate. In the study, reported intakes of more than 7 servings per day were considered excessive and probably misinformation, therefore, they were excluded. Fruit and vegetable juices were not included in the study.

Statistical analysis

The data collected for the study were analyzed using the SPSS (Statistical Package for Social Sciences) software 21.1 for Windows. Mean (\bar{X}), standard deviation (SD), and the highest and lowest values of the range were used in descriptive statistics. The normality of the distribution was tested with the Kolmogorov-Smirnov test. The significance of the intergroup distribution in descriptive statistics was tested by Fisher's chi-square test. Paired samples t-test and Wilcoxon's ranked sum test were used for normally distributed data and for data that did not conform to a normal distribution, respectively. Relationships between vegetable and fruit consumption independent variables were analyzed by linear regression analysis. The relationship of continuous variables was examined by correlation analysis. The Forest Plot method was used in the graphics. Relationships were presented as odds ratios (OR) and adjusted odds ratios (adjusted OR) with 95% confidence intervals (95% CI). The results were examined in the 95% confidence interval at the $p < 0.05$ significance level.

Table 1. Descriptive information.

	Men (n = 2139)		Women (n = 4193)		Total (n = 6332)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	33.82	12.80	33.18	12.48	33.39	12.59
Body weight (kg)	79.70	12.78	64.83	15.48	69.85	16.23
Height (cm)	176.40	7.75	162.74	6.29	167.35	9.39
Waist circumference (cm)	91.65	12.17	80.38	13.46	84.18	14.08
Waist – hip ratio	0.89	0.08	0.78	0.07	0.82	0.09
BMI (kg/m ²)	25.60	3.86	24.46	5.08	24.84	4.73
	n	%	n	%	n	%
Marital status						
Married	1114	52.10	2199	52.40	3313	52.30
Single	1025	47.90	1994	47.60	3019	47.70
Educational status						
Elementary school	380	17.80	1090	26.00	1470	23.20
High school	957	44.70	1766	42.10	2723	43.00
University and above	802	37.50	1337	31.90	2139	33.80
BMI Classification						
Underweight	39	1.80	310	7.40	349	5.50
Normal	968	45.30	2217	52.90	3185	50.30
Overweight	852	39.80	1071	25.50	1923	30.40
Obese	280	13.10	595	14.20	875	13.80

Values are mean-SD or *n*-%.

BMI, Body mass index.

Results

Major of the participants, predominantly female group (66.2%), were married (52.3%), and were graduates of high school or higher education (76.8%) (Table 1). The mean BMI values of men and women were 25.60 ± 3.86 kg/m² and 24.46 ± 5.08 kg/m², respectively. Of the participants, 39.7% of women and 52.9% of men were in the overweight and obese categories. Consistent with this finding, the waist circumference and the waist-hip ratio of men were higher than those of women (in men, the waist circumference was 91.65 ± 12.17 cm and the waist/hip ratio was 0.89 ± 0.08 cm).

Table 2 shows fruit and vegetable consumption preferences and frequencies in adults. Vegetables are mostly consumed raw and every day by both women and men (total 62.0%, men 52.1%, and women 66.8%). Deep frying and baking were the preferred methods of cooking for the weekly consumption of vegetables in both men and women, whereas boiling and steaming were among the rarely preferred methods (49.5%). Fresh consumption was the most commonly preferred method of fruit intake in both men and women (57.4% in total, 51.0% for men, and 60.7% for women). Consumption of dried fruits and compote was rare (44.6% and 62.8%, respectively).

Table 3 shows the average daily amounts of vegetable and fruit intake by gender and in comparison with TUBER and WHO recommendations. Accordingly, men's average daily consumption of vegetables and fruits was significantly higher than the daily intake of women ($p < 0.05$). The consumed amounts of vegetables and fruits were statistically different between men and women ($p < 0.05$). The number of men consuming more than two servings of fruits and three servings of vegetables was higher than the number of women. However, the comparison based on the WHO recommendation of a minimum of 400 g/d revealed that there was not a significant difference between men and women ($p = 0.62$).

Vegetable and fruit consumption of men and women by BMI categories is shown in Figures 1 and 2. Based on WHO recommendations, inadequate vegetable and fruit intake was 0.90 (0.72–1.20) times lower in underweight women compared to individuals with normal BMI. Inadequate vegetable and fruit intake was 1.24 and 1.25 times higher in overweight and

Table 2. Vegetable and fruit consumption preferences.

			Men		Women		Total		
			n	%	n	%	n	%	
For vegetables	Raw	Every day	1071	52.10	2769	66.80	3840	62.00	
		Several times a week	843	41.1	1244	30.0	2087	33.6	
		Semimonthly	43	2.10	36	0.90	79	1.30	
	With meat	Rarely	97	4.70	95	2.30	192	3.10	
		Every day	249	12.10	296	7.10	545	8.80	
		Several times a week	1474	71.8	2972	71.8	4446	71.7	
	Without meat	Semimonthly	104	5.10	308	7.40	412	6.60	
		Rarely	227	11.10	568	13.70	795	12.80	
		Every day	262	12.70	703	17.00	965	15.60	
	Boiling, steaming	Several times a week	1346	65.6	2943	71.1	4289	69.2	
		Semimonthly	137	6.70	201	4.90	338	5.50	
		Rarely	310	15.10	297	7.20	607	9.80	
	Frying	Every day	30	1.50	59	1.40	89	1.40	
		Several times a week	633	30.9	1379	33.3	2012	32.5	
		Semimonthly	315	15.30	714	17.20	1029	16.60	
	In the oven	Rarely	1076	52.40	1992	48.10	3068	49.50	
		Every day	97	4.70	192	4.60	289	4.70	
		Several times a week	1212	59.0	2234	53.9	3446	55.6	
	For fruits	Fresh	Semimonthly	331	16.10	788	19.00	1119	18.10
			Rarely	415	20.20	930	22.40	1345	21.70
			Every day	21	1.00	51	1.20	72	1.20
Dried	Several times a week	1105	53.9	2335	56.3	3440	55.4		
	Semimonthly	411	20.00	877	21.20	1288	20.80		
	Rarely	517	25.20	881	21.30	1398	22.60		
Compote	Every day	1076	51.00	2509	60.70	3585	57.40		
	Several times a week	959	45.4	1487	36.0	2446	39.2		
	Semimonthly	36	1.70	54	1.30	90	1.40		
For fruits	Dried	Rarely	38	1.80	83	2.00	121	1.90	
		Every day	97	4.60	257	6.20	354	5.70	
		Several times a week	695	32.9	1481	35.8	2176	34.9	
Compote	Semimonthly	322	15.30	602	14.60	924	14.80		
	Rarely	994	47.20	1788	43.30	2782	44.60		
	Every day	42	2.00	83	2.00	125	2.00		
For fruits	Compote	Several times a week	377	17.9	733	17.8	1110	17.8	
		Semimonthly	379	18.00	705	17.10	1084	17.40	
		Rarely	1310	62.10	2607	63.20	3917	62.80	

obese women, respectively. However, the difference increased when the defined quantity of 5 servings per day was taken as the basis of comparison, with 1.57 and 1.58 times higher inadequate fruit and vegetable consumption rates in the overweight and obese categories, respectively (Figure 1).

For men, findings were similar with WHO recommendations. Men in the underweight category had inadequate vegetable and fruit intake 1.23 (0.61–2.48) times more compared to individuals with normal BMI. The inadequate intake of fruits and vegetables was 1.38 and 1.54 times higher in overweight and obese men, respectively. When the basis of consumption was taken as 5 servings a day, unlike women, the inadequate intake of vegetables and fruits was 0.77 times lower in underweight men. However, the inadequate vegetable and fruit intake was notable as 1.75 times higher, especially in obese men (Figure 2).

Table 4 shows the variables affecting the consumption of vegetables and fruits as analyzed by regression analysis. In the regression analysis model, the relationship of the vegetable and fruit intake with age, gender, and marital status was statistically significant ($B = 2.32$, $B = -67.47$, and $B = -54.05$, $p < 0.001$, respectively).

Table 3. Average daily consumption of vegetables and fruits by gender and the status of meeting the recommendations.

	Men		Women		Total		p ¹
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	
Vegetables (g)	308.89 ± 172.36	275	289.60 ± 164.48	255	294.66 ± 178.25	260	<0.001
Fruits (g)	419.23 ± 245.73	374	373.89 ± 227.89	324	427.52 ± 406.59	344	<0.001
	Men		Women		Total		p ²
	n	%	n	%	n	%	
Vegetable and fruit consumption ^a	666	34.20	1379	34.80	2045	34.60	0.625
Inadequate (<400 g/d)	1281	65.80	2578	65.20	3859	65.40	
Adequate (≥400 g/d)	1255	82.00	2851	84.80	4106	83.90	0.015
Vegetable consumption ^b	275	18.00	512	15.20	787	16.10	
<3 portion	676	41.00	1656	47.60	2332	45.50	<0.001
≥3 portion	973	59.00	1820	52.40	2793	54.50	

¹Mann-Whitney test, p<0.05; ²Chi-square test, p<0.05.

^aAccording to WHO, ^bAccording to TUBER.

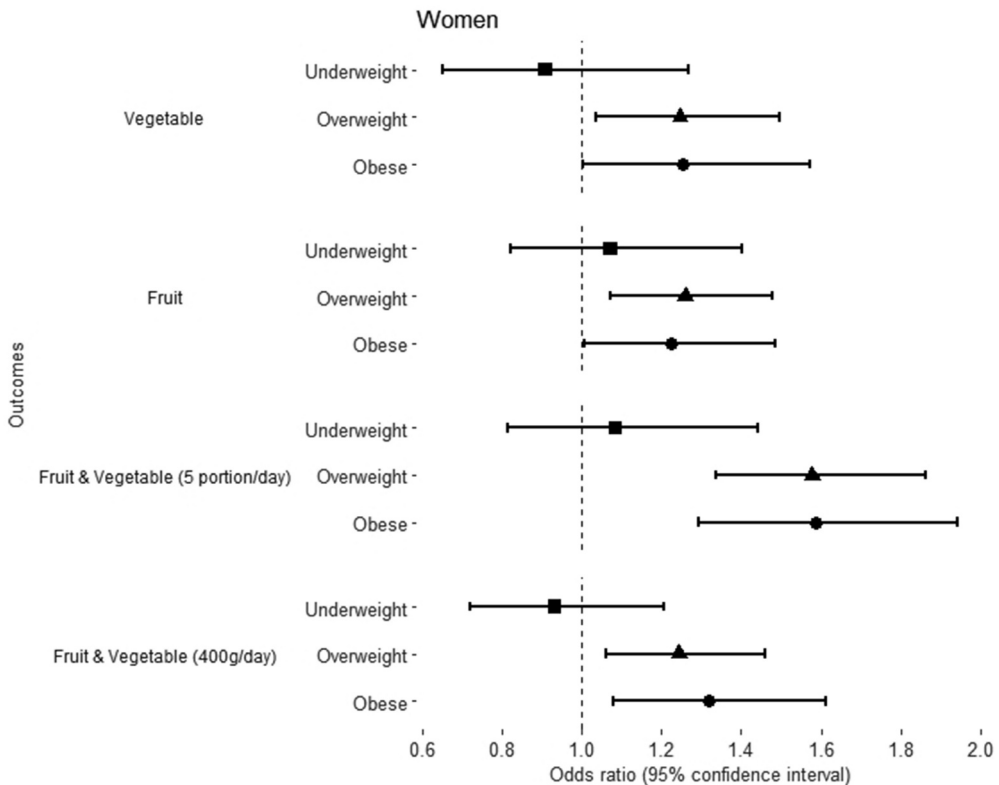


Figure 1. Forest plot graphs (95% CI) of fruit and vegetable consumption of women according to BMI. Inadequate consumption of vegetables only and inadequate consumption of vegetables and fruits in total (400 g/d) in the underweight population were 0.90 and 0.93 times less, respectively, whereas inadequate consumption of fruits and vegetables was higher in all categories in the overweight and obese groups.

Discussion

Besides the use of fresh vegetables and fruits (raw and cooked), vegetables and fruits processed in various ways at home or by the food industry (canned, dried, flash-frozen, etc.) are used. The Turkey Nutrition and Health Survey (TNHS) 2017 study reported the consumption frequency of dried vegetables among adults as follows: 27.0% consumed 1–3 times a month, 16.5% less than once a month, and 44.1% did not consume dried vegetables at all. The same study reported the consumption frequency of dried fruits as follows: 35.6% did not consume dried fruits at all, 22.3% consumed dried fruits 1–3 times a month, and 14.5% consumed them less than once a month. The rate of individuals consuming fresh fruits every day was 33.1% (Turkish Ministry of Health 2019). Similarly, in our study, the most common way of consumption of fruits is eating fresh fruits every day, vegetables are consumed twice a week with or without meat, and the consumption of dried vegetables is rare.

In a study investigating fruit and vegetable consumption among university students in Türkiye, the average daily intake was reported as 3.67 ± 1.81 servings of fruit and vegetables. Compared to male students, the rate of fruit and vegetable consumption of female students was higher (Unusan 2006). In a meta-analysis, which included 3719 adults, it was determined that low socioeconomic status, high BMI, and long-term intervention factors were negatively associated with fruit and vegetable consumption and being overweight and obese (Arnotti and Bamber 2020). In our study, when the average daily consumption of vegetables and fruits was compared using the recommended amounts by TUBER and WHO, it was observed that vegetable and fruit intake was significantly

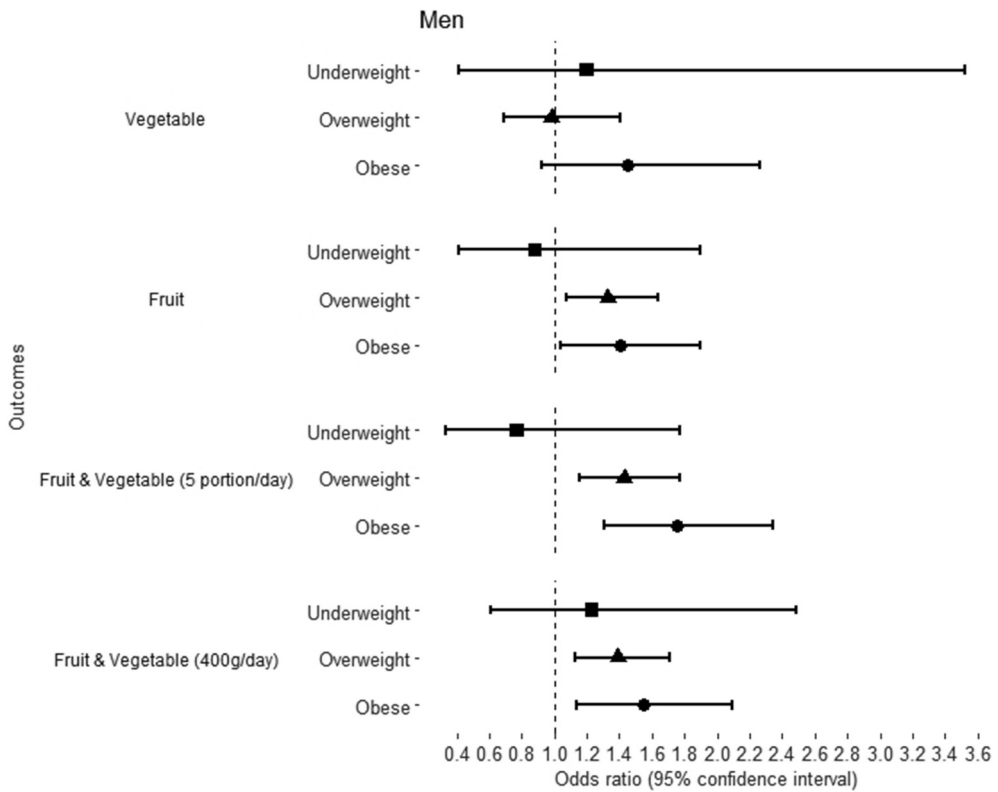


Figure 2. Forest plot graphs (95% CI) of fruit and vegetable consumption of men according to BMI. Although the inadequate consumption of fruits only and the inadequate consumption of vegetables and fruits (compared to 5 portions/d) were 0.88 and 0.77 times less in the underweight group, respectively, individuals in the obese group had more inadequate consumption of vegetables and fruits than normal-weight individuals in all categories.

Table 4. Regression analysis for vegetable and fruit consumption (gr).

R	R ²	Adjusted R ²	Std. Error of the Estimate	Δ R ²	F Change
0.149	0.02	0.02	466.68	0.02	32.74
Vegetable and fruit consumption	B	SD	Beta	t	p-value
Age	2.32	0.60	0.06	3.86	<0.001
Gender	-67.47	11.91	-0.06	-5.66	<0.001
BMI	1.94	1.31	0.02	1.48	0.139
Marital status	-54.05	14.83	-0.05	-3.64	<0.001
Education status	-8.76	5.42	-0.02	-1.61	0.106

different between genders. The average daily consumption of vegetables and fruits was significantly higher in men. In parallel with the higher energy expenditure of men, the fact that their food consumption is generally higher than that of women can be shown as one of the reasons for this situation. At the same time, factors such as the ease of access to food and the excess of financial means may also affect this situation. In our study, the majority of the participants consumed less than 3 servings of vegetables, while more than half of them consumed 2 servings or more of fruits. This shows that fruit consumption is above but vegetable consumption is below the minimum intake level. When the results of our study were compared with those of previous studies in the literature, it was thought that factors such as age, gender, marital status, education level, seasonal factors, and BMI could affect fruit and vegetable consumption. The results of the regression analysis

revealed that age, gender, and marital status affected the consumption of vegetables and fruits at recommended levels. However, a diet that includes food groups other than fruits and vegetables, or a lack of physical activity combined with the intake of high-density foods, has been thought to be other contributing factors.

In a study investigating the amount of fruit and vegetable consumption among young adults in Australia, 56% and 93% of the participants reported eating fruits and vegetables, respectively. The intake levels were reported to be equivalent to 1.2 servings of fruits and 2.1 servings of vegetables according to Australian reference intake levels. When compared by gender, a significantly greater proportion of women consumed fruits compared to men (men, 40.6%; women, 53.8%; $p < 0.001$) (Nour et al. 2017). According to another study conducted in Australia, only 5.5% of Australian adults had an adequate daily intake of 2 servings of fruits and 5 servings of vegetables (Charlton et al. 2014). Contrary to this study, men were more likely to meet the recommended quantities of both fruit and vegetable consumption compared to women (65.8% and 65.2%, respectively) in our study. The fact that the amount of food consumption of men is higher increases the daily intake of these food groups above the women, causing them to meet the recommended daily intakes more easily.

Various studies revealed that, especially, young adults had poor diet quality (Aljadani et al. 2013; Hiza et al. 2013; Chapman et al. 2016). In their study in Australia to investigate fruit and vegetable consumption, Nour et al. found that adults in the age range of 18–34 years had an average consumption of 128 g (0.9 servings) of fruits. Furthermore, the average amount of vegetable intake was 205 g (2.7 servings), which was below the recommended minimum daily intake of 375 g (5 servings) (Nour et al. 2017). In another study, from Saudi Arabia, the examination of the fruit and vegetable consumption status of adults revealed that the majority of the participants consumed less than two servings of fruits and vegetables a day. When these data were compared against Centers for Disease Control and Prevention (CDC) guidelines, it was observed that only 2.6% of Saudis aged 15 years and over had the recommended daily amounts of fruit and vegetable intake (Mokdad et al. 2015). The average daily consumption of fresh vegetables and fruits in adults in Türkiye was reported as 461.5 g, 537.3 g, and 603.9 g in men and 484.5 g, 541.4 g, and 581.3 g in women, in the following age groups of 19–30, 31–50, and 51–64 years, respectively (Turkish Ministry of Health 2019). In our study, being young was a favorable factor for fruit and vegetable intake. Therefore, it can be argued that the consumption of vegetables and fruits decreased with age in our study. The decrease in fruit and vegetable consumption with increasing age suggests that the diet quality of older individuals may be poor. This is also may be related to the higher education level and awareness of young individuals.

In the United States Behavioral Risk Factor Surveillance Survey, an inverse relationship was found between BMI and fruit and vegetable intake (Heo et al. 2011). Another study conducted with middle-aged individuals in Australia examined the relationship between BMI and fruit and vegetable consumption. The study reported that overweight and obese women (OR 1.09; 95% CI 1.04–1.14 and OR 1.18; 95% CI 1.12–1.24, respectively) consumed higher quantities of vegetables compared to underweight women (OR 0.84; 95% CI 0.73–0.97). An inverse relationship was found for fruit consumption. Being in the highest intake quartile was 25% less likely for obese women and 15% less likely for morbidly obese women (OR 0.75; 95% CI 0.69–0.80 and OR 0.85; 95% CI 0.80–0.90, respectively). In terms of the total intake of fruits and vegetables, obese women were more likely to be in the highest intake quartile (Charlton et al. 2014). In another study by Nour et al., a significant relationship of total fruit and vegetable consumption with BMI categories could not be established but fruit consumption levels of obese individuals were significantly lower, similar to our study ($p = 0.02$) (Nour et al. 2017). In a systematic review, performed by the same researcher, Nour et al., reported that increased vegetable consumption was associated with less weight gain and lower obesity risk (ORs 0.18 to 0.88) (Nour et al. 2018). In a study conducted in China, investigating the relationship between fruit and vegetable consumption and body weight and BMI in adults, an inverse relationship was found between the change in fruit and vegetable consumption in men and the change in body weight and BMI. Increased fruit and vegetable consumption in men was associated with decreased changes in

weight and BMI but, in women, decreased fruit and vegetable consumption was associated with a lower increase in BMI. The same trend was not observed for body weight (Yuan et al. 2018). According to Heo et al., in the USA, overweight (23.9%) and obese (21.9%) individuals consumed significantly less fruits and vegetables compared to normal-weight individuals (27.4%) (Heo et al. 2011). The study by Aljadani et al., similar to other studies, reported that diet quality, as well as the frequency and variety of fruit and vegetable consumption, might play a role in estimating body weight in young women in the long term (Aljadani et al. 2013). Similar to our study, in a cross-sectional study by Yu et al., the relationship between fruit and vegetable consumption and body adiposity was investigated and a positive relationship was found between fruit consumption and increased body adiposity (Yu et al. 2018). In our study, an inverse relationship was found between BMI and fruit and vegetable consumption. As per the recommendations of WHO of a total intake of 400 g per day, inadequate fruit and vegetable consumption was observed in overweight and obese women and men compared to individuals with normal BMI. However, limitations exist with respect to the interpretation of our data because a comprehensive dietary assessment was not performed and information was not collected about the intake of other food groups.

The major strength of this study is that it is one of the few studies, which was conducted with a large number of participants and demonstrated the fruit and vegetable consumption preferences of adults in Türkiye. The evaluation of the relationship between fruit and vegetable consumption and BMI on a national scale is another strength of the study. However, a limitation is that it is a cross-sectional study, covering only the summer season. Moreover, access to fruits and vegetables at the time of data collection and the effects of price increases on vegetable and fruit consumption should be further examined by future studies. Another limitation is that, because the study was conducted with healthy adults, the results cannot be generalized to the whole population.

Conclusion

This is one of the largest cross-sectional population-based studies evaluating the relationship between fruit and vegetable consumption and BMI among adults in Türkiye. Our findings support the relationship between high fruit and vegetable consumption and low BMI. The results of this study show that the consumption of vegetables is inadequate but the consumption of fruits is adequate in our country. It was determined that the majority of the participants met the WHO recommendation of an intake of at least 400 g of fruits and vegetables per day. When examined according to BMI categories, it was determined that overweight and obese men and women consumed inadequate quantities of fruits and vegetables compared to individuals with normal BMI. Age, gender, and marital status are the variables that significantly affect fruit and vegetable consumption. We found that being woman, single, and older, and having a high BMI were associated with a low intake of fruits and vegetables. Therefore, nutritional strategies should be developed to increase the intake of vegetables and fruits, especially for overweight and obese persons, women, singles, and middle-aged and older population, and health professionals should spend efforts to promote fruit and vegetable consumption.

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Authorship

HHG conceptualized the research with inputs from MG and GE. HHG, NS, FES, HYI and CA collected and analyzed the data and drafted the manuscript. NS, FES and HYI reviewed the manuscript and made inputs. Finally, all authors read and approved the final version.

Data availability statement

The data that support the findings of this study are available from the corresponding author [HHG], upon reasonable request. For access to the files, please send an e-mail request to hilalhizliguldemir@anadolu.edu.tr.

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