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Research Article
How Does Nutritional and Energy Intake at Breakfast Differ Among Adults According to the Level of Adherence to the Mediterranean Diet

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Abstract

Background and Objective: The Mediterranean diet is a diet based on the consumption of fruits, vegetables, whole grains and seafood and has reported positive effects on cardiovascular diseases and chronic diseases such as type 2 diabetes and obesity. In addition, breakfast is the most important of the main meals and is also associated with many health effects. In this study, we aimed to evaluate the nutrients and nutritional elements consumed by individuals considering their adherence to the Mediterranean diet. **Materials and Methods:** The study was conducted with healthy volunteers who regularly ate breakfast and who were between 18 and 64 years of age. Data on Mediterranean diet compliance and breakfast consumption were obtained by a questionnaire. According to the scale of compliance with the Mediterranean diet, ≤5 points was considered low, 6-9 points was moderate and ≥10 points was high. Data were analyzed using the One-Way ANOVA test. **Results:** A total of 400 adult individuals with a mean age of 34±13.5 years participated in the study. The majority (60.3%) had moderate adherence to the Mediterranean diet. Those who showed high adherence to the Mediterranean diet consumed more soup and oilseeds at breakfast than participants with other compliance levels ($p<0.001$). Moreover, herbal tea consumption at breakfast was the lowest among those with low compliance ($p<0.001$). The energy and macronutrient intakes at breakfast did not differ according to the level of compliance with the Mediterranean diet ($p>0.05$). **Conclusion:** It was determined that more than half of the participants had a moderate level of compliance with the Mediterranean diet. The data obtained as a result of the study contribute to the literature in terms of interpreting the adherence of the participants to the Mediterranean diet in the context of their nutrient preferences at breakfast. More studies with a larger sample size should be conducted.

Key words: Mediterranean diet, breakfast, energy intake, food consumption, herbal tea

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The Mediterranean diet is a natural diet that reflects the traditional dietary habits of people living on the Mediterranean coast[1]. Studies have shown that despite the high intake of olive oil, the risk of cardiovascular disease is much lower among people across the Mediterranean region and studies on the 'Mediterranean diet' have been conducted[2,3]. The Mediterranean diet is defined as a diet rich in plant-based foods (cereals, fruits, vegetables, legumes, tree nuts, seeds and olives) and the main source of fat is olive oil. The Mediterranean diet is a nutrition model that recommends moderate consumption of fat, fish, seafood, eggs, poultry and dairy products (such as cheese and yogurt), low consumption of red meat and often moderate alcohol intake during meals (especially wine)[2,4-6].

It has been reported that the Mediterranean diet prolongs life, reduces the risk of cardiovascular disease and cancer and may also slow the decline in cognitive capacity with age[7]. In addition to these effects, in the contexts of visceral obesity and type 2 diabetes, the Mediterranean diet may be seen as an anti-inflammatory diet that can prevent and treat chronic inflammation-related diseases such as metabolic syndrome[8].

Another nutritional component that has an impact on chronic diseases such as obesity, type 2 diabetes, hypertension and cognitive performance and weight control is breakfast[9-12]. Some studies have shown that skipping breakfast increases the consumption of high-energy nutrients for the rest of the day[13] and increases the risk of various chronic diseases[9,11].

Today, the importance of breakfast consumption is emphasized in terms of health benefits. However, breakfast preparation, content and what is consumed are also important. Although adequate studies have been conducted on the health impacts of the Mediterranean diet, the contents of breakfast have not been correlated with compliance with the Mediterranean diet. Therefore, the aim of this study, which was determined by considering that the data obtained from the study will be a guide for future research, was to investigate the adherence of adult individuals to the Mediterranean diet and to associate this adherence with breakfast.

MATERIALS AND METHODS

Design, place and time: The study was performed between October 2017 and May 2018 with 400 adults who could communicate clearly, who lived in Ankara or Konya in Turkey, who were between 18 and 64 years old, who voluntarily agreed to participate in the study and who reported eating breakfast regularly (at least 4-5 days a week).The participants who met the inclusion criteria were contacted during the study period. According to the sample size in this period (n = 400), the power of the study was determined to be 0.95 using the G-Power 3.1 program (Universität Dusseldorf, Germany) based on a 0.05 significance level and a 0.2 effect size.

Sociodemographic characteristics of the participants (age, sex, educational status, marital status), a scale of the level of adherence to the Mediterranean diet and breakfast consumption records from the day of data collection were collected by the researchers with a questionnaire form using the face to face interview method.

Body weight (kg) was measured using a portable digital scale and height (cm) was measured and recorded using a nonflexible tape measure and these were the anthropometric measurements. Body mass index (BMI: body weight kg height^{-2} m^2) was calculated from body weight and height measurements and was categorized as follows: <18.5 kg m^{-2} underweight, 18.5-24.9 kg m^{-2} normal and ≥25.0 kg m^{-2} overweight or obese.

Ethical aspects of the study: This study was performed in accordance with the principles of the Declaration of Helsinki. Ethics Committee Approval (Decision no. 10/170 dated 29.05.2017) was obtained from the Ethics Committee of the Rectorate of Ankara University. Informed consent was obtained from each individual who agreed to participate in the study.

Prevention with mediterranean diet (PREDIMED): The PREDIMED scale was applied to the participants and consists of 14 questions. The answers were scored by giving "+1 points" for each "yes" and "0 points" for each "no". After collecting all data, a PREDIMED score of 5 or less was considered "low compliance", a PREDIMED score of 6-9 was considered "moderate compliance" and a PREDIMED score of 10 and more was considered "high compliance[14].

Statistical analysis: Data obtained from the research were analyzed using the SPSS package program (IBM SPSS Statistics 23.0. Armonk, NY, USA: IBM Corp; 2013) and the data of food consumption records were transferred into the SPSS program after being processed using the BEBIS program [The German Food Code and Nutrient Data Base (BLS II.3, 1999)].

The mean ($\bar{X}$), standard deviation (SD) and lower and upper values were calculated for quantitative data. Quantitative data are shown in number percent tables. The chi-square test (Pearson chi-square) was used to compare

categorical variables. One-Way ANOVA (post hoc Tukey's test) was used to compare the means between more than two independent groups. The results were considered statistically significant at $p<0.05$.

RESULTS

A total of 400 adult individuals (63 males (15.7%) and 337 females (84.3%)) with a mean age of 34.0±13.5 years participated in the study. Having evaluated the levels of adherence to the Mediterranean diet, it was found that more than half (60.3%) of the participants had moderate compliance.

As the age of the adults participating in the study increased, compliance with the Mediterranean diet increased ($p<0.001$). Similarly, marital status was found to have a significant impact on compliance with the Mediterranean diet ($p<0.001$) Table 1.

Regarding the data obtained in relation to the nutrient consumption frequency of individuals (Table 2), it was

Table 1: The Distribution of sociodemographic characteristics of participants according to adherence to the mediterranean diet

	Low adherence (n = 130)		Moderate adherence (n = 241)		High adherence (n = 29)		
Sociodemographic characteristics	No.	Percentage	No.	Percentage	No.	Percentage	p-value
Sex							
Male (n = 63)	20	15.3	38	15.7	5	17.2	0.970
Female (n = 337)	110	84.7	203	84.3	24	82.8	
Age (year)							
18-24 (n = 164)	63	48.5	93	38.6	8	27.6	0.038*
25-49 (n = 165)	50	38.5	104	43.1	11	37.9	
50-64 (n = 71)	17	13.0	44	18.3	10	34.5	
X±SD**	30.8±11.8[a]		34.9±13.9[b]		41.3±14.6[c]		0.000*
Marital status							
Married (n = 194)	47	36.2	129	53.5	18	62.1	0.002*
Single (n = 206)	83	63.8	112	46.5	11	37.9	
Education level							
Non literate/elementary (n = 66)	15	11.5	46	19.1	5	17.2	0.436
Secondary school (n = 29)	7	5.5	20	8.3	2	6.9	
High school/gymnasium (n = 99)	38	29.2	55	22.8	6	20.7	
Vocational school of higher Education/university (n = 206)	70	53.8	120	49.8	16	55.2	
Chronic disease status							
No (n = 272)	97	74.6	158	65.5	17	58.6	0.108
Yes (n = 128)	33	25.4	83	34.5	12	41.4	
BMI (kg/m^2)							
Underweight (<18.5)	4	3.1	13	5.5	1	3.5	
Normal (18.5-24.9)	71	54.6	116	48.7	15	51.8	0.747
Overweight or Obese (≥25,0)	55	42.3	109	45.8	13	44.7	

*p<0.05, Chi-square test, **One-way ANOVA test, BMI: Body mass index [abc]Statistically significant difference between application

Table 2: The consumption of food at breakfast of participants according to adherence to the mediterranean diet

	X±SD			
Foods	Low adherence (n = 130)	Moderate adherence (n = 241)	High adherence (n = 29)	p-value
Milk and milk products	58.0±60.4	63.8±64.8	62.6±56.1	0.694
Meat and meat products	5.9±8.8	4.6±7.3	2.9±5.9	0.111
Egg	24.3±21.6	26.5±20.3	23.4±17.5	0.526
White bread, pastries, bagels, donut	75.8±56.6	71.7±57.9	64.4±55.0	0.588
Whole grain bread	5.2±2.3	4.7±2.3	4.1±2.4	0.051
Soups	2.2±10.0[a]	6.2±22.2[ab]	21.6±41.0[c]	0.000*
Freshly squeezed fruit juice	13.9±34.4	17.7±42.3	33.7±62.6	0.071
Vegetables	36.7±56.8	37.3±57.2	51.6±90.2	0.454
Olives and olive oil	18.5±15.0	19.0±15.9	20.9±13.8	0.754
Butter	2.3±4.3	2.0±3.2	1.7±2.8	0.608
Sugar, honey, jam, molasses	7.9±9.6	9.9±13.1	10.7±10.7	0.250
Walnuts, hazelnuts, peanuts, almonds	1.3±5.2[a]	3.5±7.1[b]	7.5±10.0[c]	0.000*
Fried potatoes	15.8±25.5	15.1±25.8	14.0±22.2	0.930
Herbal teas	9.1±29.5[a]	27.5±60.7[b]	49.3±97.0[b]	0.000*
Carbonated drinks	0.6±5.8	0.4±5.6	-	0.851

*p<0.05, One-way ANOVA test, [abc]Statistically significant difference between application

Table 3: Evaluation of energy and macro nutrient intakes of participants in breakfast according to adherence to the mediterranean diet

	X±SD			
Energy and nutrient intakes	Low adherence (n = 130)	Moderate adherence (n = 241)	High adherence (n = 29)	p-value
Energy (kcal)	435.3±240.5	446.4±269.2	495.9±284.3	0.529
Carbohydrate (g)	44.5±28.4	31.8±2.1	30.8±5.7	0,845
Protein (g)	14.0±8.9	15.1±9.0	15.6±9.7	0.454
Vegetable protein (g)	6.0±3.8	6.4±4.5	6.4±3.8	0.593
Oil (g)	22.1±14.6	22.6±16.3	26.5±17.1	0.400
Saturated fat (g)	9.0±6.7	8.8±6.5	9.3±6.4	0.895
Monounsaturated fatty acid (g)	8.2±6.1	8.5±6.6	9.9±8.1	0.479
Polyunsaturated fatty acid (g)	3.3±3.4	3.6±4.5	5.3±4.7	0.073
Oleic Acid (g)	7.4±5.5	7.7±6.1	9.1±7.6	0.374
Linoleic Acid (g)	2.8±3.3	3.1±4.2	4.7±4.1	0.067
Linolenic Acid (g)	0.4±0.4	0.4±0.6	0.5±0.8	0.333
EPA (g)	0.1±0.1	0.1±0.1	0.1±0.1	0.986
Fiber (g)	3.9±2.8	3.9±3.0	4.6±3.5	0.410
Cholesterol (mg)	100.7±118.4	104.5±109.0	109.4±122.6	0.915

*p<0.05, One-way ANOVA test

observed that those who showed high compliance with the Mediterranean diet were more likely to have consumed soup and oilseeds (walnut, hazelnut, peanut, almond) at breakfast than individuals with low or medium compliance (p<0.001). In addition, the consumption of herbal tea varieties at breakfast was lower in those with low compliance (9.1±29.5 mL) than in those with moderate or high compliance (p<0.001). Carbonated drinks were never consumed by individuals with high adherence.

The total energy and macronutrient contents of the food consumed by the participants at breakfast in one day were examined and the results are shown in Table 3. According to the levels of adherence to the Mediterranean diet, the average energy, carbohydrate, protein, fat and fatty acid intakes of individuals at breakfast were similar (p>0.05).

DISCUSSION

The Mediterranean diet, which is accepted as a healthy diet form, has been studied for many years and it has been determined that it is protective against many chronic diseases, positively affects cognitive capacity and increases quality of life[15,16]. One of the important components of a healthy diet is the regular consumption of breakfast[17]. In this study, we attempted to determine how the adherence of adult individuals to a Mediterranean diet affects breakfast consumption in terms of energy and nutrient intake.

In the study conducted by Hu *et al.*[18] to evaluate the relationship between compliance with the Mediterranean diet and some factors, it was found that nonsmokers, those who performed physical activity and individuals with high educational levels showed high compliance with the Mediterranean diet but compliance with the Mediterranean diet was low in obese and single individuals[18]. It was also observed that older males followed the Mediterranean diet more than younger males[18]. Similarly, in this study, it was found that compliance with the Mediterranean diet was lower in single participants and that diet compliance increased significantly with age (p<0.05) (Table 1).

The daily consumption of vegetables and fruits, which are an important component in the Mediterranean diet, is 2-3 servings for vegetables and 4-6 servings for fruits[5,19].The antioxidant, vitamin, mineral and flavonoid contents of fruits and vegetables have anti-inflammatory properties and thus have protective effects against many chronic diseases[2]. In this study, it was determined that the consumption of fruit, freshly squeezed fruit juice and vegetables at breakfast was higher in the group with moderate or high compliance with the Mediterranean diet (p>0.05). In addition, herbal tea consumption at breakfast was higher in the same two groups (p<0.05) (Table 2). However, the average amount of fruit, freshly squeezed juice and vegetables consumed by the participants at breakfast was quite low. Although, only the breakfast meal was evaluated, it was difficult for the participants to consume the total amount of vegetables and fruits recommended in the Mediterranean diet for the rest of the day. In addition, the fact that the habit of consuming fruit and vegetables at breakfast is culturally uncommon may have affected this outcome.

Oilseeds are rich in monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) and are an important component of the Mediterranean diet. Consumption of a handful of oilseeds is recommended each day[5] and oilseeds may have an effect on reducing cardiovascular risk, improving lipid profile and triglyceride levels and reducing the inflammatory response in patients

with hypercholesterolemia[20]. In this study, it was determined that the consumption of oilseeds, such as walnut, hazelnut, peanut and almond, was the highest in the group that had high adherence to the Mediterranean diet ($p<0.05$). In addition, the mono- and polyunsaturated fatty acid intake of the participants in the high adherence group was higher than that in the other two groups (Table 2). Excessive consumption of oilseeds may have contributed to this difference.

The traditional Mediterranean diet recommends eating one or two portions of cereals at meals in the form of bread, pasta, rice, couscous or other cereals. In particular, due to processing, magnesium, phosphorus, iron and vitamins can be lost from foods in the grain group, so the foods in the grain group must be unprocessed[5]. The health effects of whole grains have been associated with their being rich in vitamins, minerals, dietary fiber components (inulin, lignin, beta glucan, etc.), phytosterol and numerous phytochemicals[21]. In this study, it was determined that the consumption of white bread, pastries, bagels and donuts was higher in all groups than the consumption of whole grain bread at breakfast (Table 2). This may result in lower intake of the above mentioned health-contributing nutrients, thereby increasing the risk of nutrition-related diseases.

The recommended foods for breakfast in the Mediterranean diet are oatmeal, fresh fruit, whole grain bread, low-fat yogurt and boiled eggs 3-4 times a week[22].

In a sample Mediterranean diet breakfast, it was suggested to consume 3/4 cup of fresh fruit and 1/4 cup of walnuts with 1 cup of yogurt, 1/4 cup of avocado butter, 2 teaspoons of natural butter, 1 slice of whole grain bread and coffee or tea[23]. Another suggestion for a Mediterranean diet breakfast is muesli, avocado, bananas, almonds, apricots, whole grain toast, hazelnut butter, boiled eggs and a dried fruit and cereal mix (granola)[24].

Considering the importance of breakfast, it is understood that the foods consumed at breakfast are also important in relation to compliance with the Mediterranean diet. However, studies with larger samples in which more detailed food groups are examined will raise awareness on the subject. For this reason, this study is a pioneer for future studies.

CONCLUSION

Based on this study, consuming a small amount of fruits and vegetables at breakfast, which is the most important meal of the day and consuming more cereal products prepared with refined flour, reduces compliance with the Mediterranean diet. Moreover, when the participants were generally considered, the number of people who had moderate or high compliance with the Mediterranean diet was low. Although, this study reflects the foods consumed only at breakfast in relation to adherence to the Mediterranean diet, the participants' choice of food and beverages guided us to assess their compliance. Furthermore, recent studies have indicated that there is no single Mediterranean diet model. According to the general principles of the Mediterranean diet, the pattern of the diet may change according to cultural characteristics. The most important meal of the day is breakfast, which can be characterized by the positive or negative effects of the foods consumed. For this reason, it is advisable to distribute the nutrients contained in the Mediterranean diet throughout each meal in a balanced manner and to consume a Mediterranean diet at breakfast.

SIGNIFICANCE STATEMENT

The adherence to the Mediterranean diet was not significantly different between the body mass index groups. Further studies that include other anthropometric measurements and body analyses are needed.

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