Original Article

Factors in bread preference: A cross-sectional study of the comparison of anthropometric measurements and macronutrient differences according to bread type preferences

Havvanur Yoldas Ilktac[1*], Muazzez Garipagaoglu[2]

Abstract

Background: Bread is one of the most consumed foods by humankind throughout history. It is important to evaluate the factors affecting the food preferences of individuals and to examine the effect of frequently consumed food on anthropometric measurements and daily energy and macronutrient intake in order to improve public health and develop nutrition policies of society.

Objective: The aim of the current study was two-fold: (1) to determine the factors affecting the bread type preferences of individuals (2) to compare anthropometric measurements and macronutrient differences according to bread type preferences.

Methods: The study was conducted cross-sectional from January to October 2018 with randomly selected 1554 volunteer individuals aged between 18-65 years in Istanbul Province of Turkey. The data of the study were collected through a questionnaire form applied by the face-to-face interview method. Demographic information, anthropometric measurements, the most consumed bread types, and dietary records were examined in the questionnaire form.

Results: It was determined that the preference for white bread was high (%66.3). White bread and whole-grain bread were consumed 159.4±94 g/day and 131.2±89.2 g/day, respectively. BMI and waist circumference were lower, while the difference was not significant. It was determined that the group who preferred whole-grain bread had fewer carbohydrates, higher fiber, higher protein, higher fat, higher saturated fat, and higher cholesterol intakes in their daily diets. Women, having high education status and old-age popularity increased the preference of whole-grain bread 1.73, 3.39, and 1.03 times compared to the preference of white bread (p<0.001).

Conclusion: It has been determined that white bread is preferred more in society. Bread type preference was not associated with anthropometric measurements. It has been determined that the distribution of daily macronutrients of individuals who prefer whole-grain bread is more unbalanced. It was found that gender, educational status, and age were the factors affecting the preference of bread type. [*Ethiop. J. Health Dev*. 2022; 36(4):000-000]

Keywords: Bread; white bread; nutrition; body mass index; waist circumferences

Introduction

Obesity and obesity-related type 2 diabetes (T2D), hypertension, and dyslipidemia are important public health problems in the world. Healthy dietary guidelines and models continue to be created in the prevention of obesity and related diseases (1). These guidelines cover the food groups recommended for daily consumption for healthy eating habits. These are meat, milk, vegetables, and fruits as well as the grain group. In dietary guidelines published in many countries of the world, the food group that should be consumed the most is specified as grains. Being included in the grain group, bread is a nutritionally important dietary component (2). Bread is one of the most consumed foods by humankind throughout history. Bread is cheap, filling, and easy to supply makes it the main nutrient. Being included in a healthy and balanced diet, bread has global importance in nutrition (3). The common belief that bread is fattening causes it to be excluded from and/or limited in daily nutrition (4,5). Studies have reported that the consumption of bread has decreased over the years, whereas the incidence of obesity continues to increase (2). Although the published nutritional guidelines increase the awareness of society about the consumption of whole-grains and whole-grain bread types, it is reported that white bread is still the most consumed bread type in studies (4). In the literature review, it was seen that white bread was not evaluated as a separate group, but was evaluated in the group of refined grains such as cookies, croissants, cakes, and donuts (6,7). This is a research gap for the evaluation of bread, as a separate group, which is frequently consumed in society. In addition, is the daily diet of individuals consuming whole-grain bread adequate and balanced? Or, on the contrary, is the daily diet of those who consume white bread bad? Or is this a prejudice? These are research questions that need to be answered. It is important to determine the relationship of the frequently consumed food with anthropometric measurements and daily energy and macronutrient intakes of individuals living in the society. There is limited information on whether bread type preference differs among consumers with different sociodemographic characteristics (8). The aim of the current study was two-fold: (1) to determine the factors affecting the bread type preferences of individuals (2) to compare anthropometric measurements and

[1] Department of Nutrition and Dietetics, Faculty of Health Sciences, Istanbul Medeniyet University, Atalar Mh. Şehit Hakan Kurban Cd. 34862. Kartal- Cevizli / Istanbul
[2] Department of Nutrition and Dietetics, Faculty of Health Sciences, Fenerbahçe University, Ataşehir Blv., 34758 Ataşehir/İstanbul
    *Corresponding Author e-mail: havvanur.yoldas@medeniyet.edu.tr

macronutrient differences according to bread type preferences.

Research questions:
1. Is there a relationship between bread type preference and anthropometric measurements of individuals?
2. What are the daily energy and macronutrient distribution of individuals who prefer whole-grain bread?
3. What are the daily energy and macronutrient distribution of individuals who prefer white bread?
4. Which sociodemographic characteristics affect the preference of bread type?

Materials and Methods
Individuals and study area
This study was carried out in the Beykoz District of Istanbul Province of Turkey with volunteer individuals aged between 18-65 years. Individuals with chronic diseases and pregnant women were excluded from the study.

Study design and sample size
The study was conducted at a cross-sectional from January to October 2018 with randomly selected 1554 volunteer individuals aged between 18-65 years in Beykoz District of Istanbul Province of Turkey. The data of the study were collected through a questionnaire form applied by the face-to-face interview method. Demographic information, anthropometric measurements, the most consumed bread types, and dietary records were examined in the questionnaire form. The sample size was calculated as 1084 individuals by power analysis in order to have a 95% confidence interval, 5% sampling error, effect size d: 0.2 and allocation ratio 1 (1:1) (G Power 3.1.9.7 software, Germany). In order to protect the study from possible losses, adding 40% of the sample size gave us 1517 potential individuals.

Data Collection
The data of the study were collected through a questionnaire form applied by the face-to-face interview method. Demographic information, anthropometric measurements, and the most consumed bread types were examined in the questionnaire form. Body weight measurements of individuals were measured with a Tanita UM-07 brand device, while their height, waist, and neck circumferences were measured with a non-stretching measuring tape. While measuring the individuals' height, attention was paid to placing feet together in parallel to each other and placing the head in the Frankfurt Plane position. The body weight matching the height was determined by Body Mass Index (BMI). BMI: Weight (kg)/height (m²) formula was used (9). To measure waist circumference, attention was paid to placing the arms relaxed at the sides, feet together in parallel to each other and the circumference passing through the midpoint between the lower rib and the iliac crest was measured using a non-stretching measuring tape. Neck circumference (cm) was measured using non-stretchable plastic tape to the nearest 1 mm and was

measured from the level just below the laryngeal prominence perpendicular to the long axis of the neck with the head positioned in Frankfurt horizontal plane.

In order to determine the nutritional status, 2-day food consumption records (1 day on weekdays and 1 day on weekends) were kept. The individuals were informed about the portion sizes (tea glass, water glass, tablespoon, dessert spoon, bowl, ladle, etc.) to accurately record the types and amounts of foods consumed. In addition, bread consumption levels and bread types were recorded. The document named 'Photograph catalog of food and dishes: portion sizes and amounts' was used in determining the type and amount of bread consumed (10). Images of bread in the document were taken and bread cards were created. Individuals were asked to show the type and amount of bread they consumed on the prepared card, and this information was recorded in the questionnaire form. In the food consumption records, individuals who showed that the bread made of white flour in the bread catalog and indicate that they consume white bread were included in the "white bread" group, and the individuals who indicate that they consume bread made of whole-grain flour were included in the "whole-grain bread" group.

Data Analysis
The classification of WHO was taken as a basis for evaluating the Body Mass Index (9). The recommended sex-specific cut-off points for waist circumferences are ≥94 cm (men) and ≥80 cm (women) for increased risk, and ≥102 cm (men) and ≥88 cm (women) for a substantially increased risk (11). Neck circumferences cut-off points (≥37 cm for men and ≥34 cm for women) were used (12). The waist-to-height ratio was calculated by dividing the waist circumference by the height. The cut-off point of the waist-to-height ratio was taken as 0.5 (13). The Nutrition Information System (BeBIS) was used to determine daily energy, and nutrient consumption (14). Factors affecting the preference of bread type were determined and anthropometric measurements, daily energy, and macronutrients intakes of individuals were compared between the groups (white bread group or whole-grain bread group).

Statistical Analysis
The quantitative variables were expressed in mean and standard deviation (SD); the categorical variables were expressed in number (n) and percentage (%) values. The conformity of quantitative data distribution to the normal was analyzed by the Kolmogorov-Smirnov test. The Chi-Square test was used to determine relationships between categorical variables. In the quantitative comparison of the two groups, the normally distributed variables were evaluated with the Independent Sample t-Test. The relationship between bread type preferences and sociodemographic factors was calculated with logistic regression. Binary dependent variable encodings bread type '0' for white bread, '1' for whole-grain bread; gender; '0' for men and '1' for women; educational level '0' for primary school, '1' for junior high school, '2' for high school, and '3' for university was made. Associations were

presented in odds ratios (OR) and adjusted odds ratios (AOR) with 95% confidence intervals (95% CI). The data analysis was performed with SPSS 22.0 software and statistical significance was defined as a p-value <0.05.

Ethical approval
The Ethics Committee Approval was obtained from the Non-Interventional Clinical Research Ethics Committee at Istanbul Medipol University, confirming that it conforms to the provisions of the Declaration of Helsinki in 1975 (as revised in Edinburgh, 2013). All individuals signed an informed consent statement at the time of their participation in the study.

Results
sociodemographic characteristics and bread type preferences of individuals:
The mean age of the participants was 39.4±12.4 years and about half of them were in the age range of 31-50 years. Of the participants, 31.9% were high school and 16.7% were university graduates. It was found that the most preferred bread in men and women was white bread. White bread was found to be consumed 159.4±94 g/day, while whole-grain bread was 131.2±89.2 g/day. The daily consumed white bread and whole-grain bread amounts in men were 189.6±99.5 g, and 166.6±105.4 g, respectively, while 133.5±81.4 g, and 109.7±69.7 g in women (see Table 1).

Table 1. socio-demographic characteristics and bread type preferences of individuals

	Men (n=673)		Women (n=881)		Total (n=1554)	
	n	%	n	%	n	%
Age (year)						
19-30	200	29.2	238	27	438	28.2
31-50	289	42.9	470	53.3	759	48.8
51-65	184	27.3	173	19.6	357	23
Education						
Primary school	176	26.2	387	43.9	563	36.2
Junior high school	119	17.7	116	13.2	235	15.1
High School	244	36.3	252	28.6	496	31.9
University	134	19.9	126	14.3	260	16.7
Type of Bread						
White	476	70.7	555	63	1031	66.3
whole-grain	197	29.3	326	37	523	33.7
Age (year) (Mean±SD)	40.0±13.1		38.9±11.7		39.4±12.4	
Amount of Bread (g/d) (Mean±SD)						
White	189.6±99.5		133.5±81.4		159.4±94.4	
whole-grain	166.6±105.4		109.7±69.7		131.2±89.2	

n= number of people in this group; SD: standard deviation; g: gram; d: day

Anthropometric measurements of individuals according to bread type preferences:
Body mass index and waist circumference of individuals who consumed white bread were found to be 26.3±4.0 kg/m^2 and 92.8±12.3 cm, respectively. BMI and waist circumference were lower, and neck circumference and waist/height ratio were higher in those who consumed white bread. However, the difference between groups was not statistically significant (p>0.05) (see Table 2).

Table 2. Comparison of anthropometric measurements of individuals according to bread type preferences

Anthropometric measurements	White Bread (Mean±SD)			whole-grain bread (Mean±SD)			p	95% CI of the difference	
	Men (n= 476)	Women (n= 555)	Total (n= 1031)	Men (n= 197)	Women (n= 326)	Total (n= 523)		Lower	Upper
BMI (kg/m^2)	26.1±3.4	26.4±4.4	26.3±4.05	26.5±3.2	26.7±4.6	26.6±4.2	0.120	-7.77	0.08
Waist circumference (cm)	95.1±10.9	90.8±13.1	92.8±12.3	97.4±10.6	91.5±13.2	93.8±12.6	0.141	-2.29	0.32
Neck circumference (cm)	39.2±3.1	34.9±3.1	36.9±3.7	39.4±3.1	35.0±3.2	36.7±3.8	0.295	-0.18	0.61
Waist/Height ratio	0.54±0.06	0.56±0.08	0.55±0.07	0.55±0.06	0.56±0.06	0.56±0.07	0.089	-0.01	0.00

BMI: body mass index, CI: confidence interval, SD: standard deviation

Daily energy and macronutrient intakes of individuals according to bread type preferences:
It was determined that those who consumed whole-grain bread consumed less carbohydrate, higher fiber, higher protein, higher fat, higher saturated fat, and higher cholesterol in their daily diet compared to those consuming white bread ($p<0.05$) (see Table 3).

Table 3. Comparison of daily energy and macronutrient intakes of individuals according to bread type preferences

Energy and macronutrients	White Bread n= 1031 (Mean±SD)	whole-grain bread n= 523 (Mean±SD)	p	95% Confidence Interval of the difference	
				Lower	Upper
Energy (kcal)	1686.3±345.4	1588.0±337.4	0.000	62.21	134.4
CHO (%)	51.2±24.5	46.3±19.4	0.000	2.5	7.33
Fiber (g)	17.6±5.9	20.0±7.3	0.000	-3.0	-1.64
Protein (%)	16.3±8.0	17.2±8.5	0.043	-1.77	-0.04
Fat (%)	36.8±9.7	40.3±9.1	0.000	-4.49	-2.48
Saturated Fat (%)	13.1±4.1	14.3±4.2	0.000	-1.64	-0.76
Cholesterol (mg)	251.6±130.4	270±142.4	0.010	-32.79	-4.44

CI: confidence interval, SD: standard deviation; kcal: kilocalories; CHO: carbohydrates

Factors associated with the type of bread preferences:
Results of this study showed that the preference of whole-grain bread was 1,73 times higher in females (being female vs. male AOR: 1.73 (1.38-2.18), p: 0<001). In addition, high education status (vs. low education) and old age (vs. young age) were 3,39 (2 .40 -4.80, p<0.001) and 1,03 (1.02-1.04, p<0.001) times increased the preference for whole-grain bread respectively. The number of family members did not affect the preference of bread type. (AOR: 1.03 (0.95-1.12), p: 0.417).

Table 4. Crude and adjusted odds ratios for preference of whole-grain bread

Variables	COR (%95 CI)	p	AOR (%95 CI)	p
Women gender	1.41 (1.14-1.76)	0.001	1.73 (1.38-2.18)	0.000
Education (categorized by education year)	1.99 (1.47-2.71)	0.000	3.39 (2.40-4.80)	0.000
Age per unit	1.01 (1.00-1.02)	0.001	1.03 (1.02-1.04)	0.000
Number of family members	1.00(0.93-1.09)	0.845	1.03 (0.95-1.12)	0.417

COR: crude odds ratios, AOR: adjusted odds ratios, CI: confidence interval

Discussion
There are many types of bread made of white flour and whole wheat flour that are preferred locally and regionally in every region of Turkey. In this study, the rate of individuals to prefer white bread was 66.3%. In two different studies carried out in Turkey, it was determined that the most consumed bread type was bread made of white flour (15,16). It has been reported that the most consumed bread types in Iran were those made of white flour (lavash, taftoon bread, barbari bread and sangak bread) (17,18). In a national study conducted in Sweden, the most consumed bread types were found to be whole-grain bread and white bread with 37% and 36%, respectively (19). According to Turkey Nutrition and Health Research, it was identified that the consumption of white bread types was 85.4%, whereas the consumption of whole-grain bread was quite low (20). According to studies conducted in Turkey, it was observed that in this study, individuals preferred white bread at a higher rate. Today, there are many different types of bread made with whole-grain flour. Although large markets offer more choices in terms of bread types, individuals generally prefer local/neighborhood bakeries when purchasing bread. Bread types may be limited in local bakeries, which may explain why white bread is the most consumed bread. Bread consumption amounts in countries are quite variable. Turkey ranks first in the world with an annual consumption of 150 kg of bread per capita. Iran is the second largest bread consumer in the world with 117 kg per capita per year and 320 g per day, and this value corresponds to 4.5 times the world average (17,21). The average bread consumption in Sweden is 86 g/day (17,19). In Lebanon, men consumed 282 grams of bread per day, while women consumed 126 grams of bread (22). In this study, it was determined that 159.4±94 g/day of white bread and 131.2±89.2 g/day of whole-grain bread were consumed. While the daily bread consumption per capita in Turkey was 400 grams in 1993, it was determined as 236.61 grams and 143.15 grams in the adult group in men and women, respectively, in 2010 (20). It is observed that bread consumption in Turkey has decreased by half in about 20 years. In recent years, there is a belief in the world that bread makes you gain weight. For this reason, people try to reduce their daily bread consumption. In the nutrition studies conducted in Turkey over various years, it has been stated that bread consumption has decreased over the years too. Despite the decrease in bread consumption in the world, the increase in the prevalence of obesity is thought-provoking.

Body Mass Index, an index based on height and body weight, is frequently used in medical screenings of

societies (20). The waist circumference, waist-height ratio, and the measurement of neck circumference positively correlate with obesity status and visceral adiposity (23,24). In this study, it was determined that the individuals were overweight. In the evaluation of waist circumference, it was determined that men were in the risky group and women were in the high-risk group. Waist-height ratio and neck circumference values were high in both men and women. When evaluated according to the preferred bread types, the mean BMI, waist circumference, neck circumference and waist-to-height ratio were higher in whole-grain bread group compared to the white bread group, but the difference was not statistically significant. (Table 2). In a study, it was stated that no meta-analysis was conducted on the relationship between refined grain intake and body weight or body fat measurements and there was no consistent relationship between refined grain intake and BMI and other anthropometric measurements. (6). However, it was revealed that the consumption of refined grains consumed above the recommendation was associated with an increased risk of weight gain or higher BMI (25). At this point, attention should be paid to how grains are classified. In studies showing a positive relationship between refined grain intake and obesity parameters; White bread, which is the main food source in society, was evaluated in the same group with foods high in energy and sugar (such as cookies, cakes, muffins, muffins, croissants). (26). In most epidemiological studies, white bread is evaluated in the refined food group, and whole-grain bread is evaluated in the grain group recommended for health (25). This situation may create a prejudice that the consumption of white bread causes obesity. White bread is refined food, it is true, but it should not be evaluated in the same group as other refined foods that are not included in daily consumption. It is thought that when bread is not evaluated as a separate group, it will give contradictory results in revealing its direct effects on health. Because bread is a kind of main food in daily consumption in society. Regardless of its type, bread should be considered a separate group. Thus, the positive or negative effects of bread can be evaluated independently.

Recommended daily energy should consist of carbohydrates, proteins, and fat in the ratios of 45-60%, 12-20%, and 20-35%, respectively. While the daily fiber intake is recommended to be 25g, the rate of saturated fat should not exceed 10% of the daily energy and cholesterol intake should not exceed 300mg/day (27). In this study, the group that preferred whole-grain bread had lower daily carbohydrate intake and higher fiber, fat, and saturated fat intake (p<0.001) (Table 3). This result reveals that individuals who prefer healthier bread have a more unbalanced diet. Balanced diet models in the literature (such as the Mediterranean diet, MyPlate, and Dietary Approaches to Stop Hypertension (DASH)) report that diet plans containing 50% CHO have more balanced and more positive effects on health (28,29). Besides, it was also stated in the studies that the mixed consumption of refined and whole-grains is associated with more positive health outcomes (30,31). In order to increase dietary fiber, it is important to prefer bread made from

whole wheat flour instead of bread made from white flour. In this study, the daily fiber intake of individuals who preferred whole-grain bread was higher than the white bread group, and the difference was statistically significant (p<0.001). The low carbohydrate intake of the group that preferred whole-grain bread aroused curiosity about which foods they substituted for their carbohydrate sources. It was determined that the group that preferred whole-grain bread consumed approximately 1 slice (25 g) less bread than the white bread group and they increased their meat consumption instead of bread. In parallel with this result, it was observed that the group that preferred whole-grain bread had a higher daily fat intake (above the recommended value (20-35%)). Similar to this study, one study showed that decreasing carbohydrate intake increased fat intake (19). Undoubtedly, consuming whole-grain bread instead of white bread is very supportive in terms of health. Although there is a healthier preference of bread, it was determined that individuals (whole-grain bread group) who limit carbohydrates in their daily diets (who consume less than 1 slice of bread) have a more unbalanced diet. This result shows that the idea that individuals who consume healthy bread eat healthier or that individuals who consume white bread have an unhealthy diet is wrong. These are prejudices. An individual's unhealthy food preference does not mean that the total diet is unhealthy, and a healthy food preference does not mean that the total diet is healthy. Studies generally reveal the health-promoting effects of whole-grains and whole-grain bread. Long-term nutrition studies are needed to evaluate the bread group separately and to evaluate its direct effects on health.

According to this study, the effect of gender on bread type preference is high (p<0.005). Women preferred whole-grain bread 1.73 times more than men (see Table 4). Similar to this study, it was stated in the studies that men preferred white bread more (4,32–34). Muhihi et al. 2013 (35) also report that the perception of foods containing whole-grains tends to be better in women compared to men. These results show that women are more sensitive compared to men in terms of preference of healthy bread. In this study, there was a significant difference between bread type preference and education level (p<0.001). Being a university graduate increased the preference for whole-grain bread 3.39 times compared to being a primary school graduate. Similar to our study, it has been reported that those who prefer white bread are more likely to be less educated (34,36,37). In a study conducted in Poland, people less educated were more likely to declare an intention to eat plain wheat bread rather than fiber-rich bread (38). The low level of education was seen as a barrier to the preference of healthy bread among individuals. So, it is thought that education level was an important factor affecting bread type preferences. According to this study, the effect of being old on whole-grain bread preference is high (p<0.005). In other words, being young increased the consumption of white bread. In studies, it was stated that younger people preferred white bread more (4,34,36). Similar to the study by Sandvik et al., it was determined that the preference of whole-grain bread increases significantly

with age (19). According to this result, it was thought that the increase in age made individuals more conscious about the health benefits of consuming whole-grain products. No relationship was found between the number of family members and bread type preference.

Limitations

This study has potential limitations. Dietary records are affected by errors and have limitations, mainly due to the tendency of individuals to report their food consumption close to what is socially desirable. In addition, some people may have difficulty writing down the foods and drinks consumed or describing the portions. The portion sizes expressed in the food consumption recording method based on the statements of the individuals limit the accuracy of the method due to personal perception differences. Turkey is an upper-middle-income country in terms of gross domestic product per capita. However, there are regional income differences in the country. The fact that the income level was not questioned in the study and that the study was conducted in a single region was an important limitation. The purchasing power of individuals can be effective in the selection of bread types. Therefore, in future studies, it is recommended to associate bread type preference with income level in order to generalize to society.

Strengths

Bread has an important place in human nutrition because it is a source of energy and nutrients. Most people living in the world get a significant part of their daily dietary energy from bread. Bread is often associated with obesity. Although the amount of bread consumption has decreased compared to the past, the obesity rate continues to increase. This suggests that there is a prejudice against bread. There is limited information on whether bread type preference differs among consumers with different socio demographic characteristics and studies revealing the relationship of bread alone with obesity seem to be limited too. Studies generally reveal the health-promoting effects of whole-grain bread. This study reveals the differences between anthropometric measurements and the nutritional status of individuals consuming different types of bread and refutes the idea that individuals consuming healthy bread have a healthier nutritional profile or that individuals consuming white bread have more unhealthy nutritional profiles. In fact, it has been determined that the distribution of daily macronutrients of individuals who prefer whole-grain bread is more unbalanced. In addition, gender, educational status, and age factors were found to be effective in the preference of bread type.

Conclusion

It was determined that white bread is preferred more in society. Bread type preference was not associated with anthropometric measurements. It was determined that the distribution of daily macronutrients of individuals who prefer whole-grain bread is more unbalanced. It was found that gender, educational status, and age were the factors affecting the preference of bread type. Although it is thought that those who prefer healthier

bread are more conscious about nutrition, have a more balanced diet, and their anthropometric measurements will be more optimal, this study has revealed that nutrition is a whole and some stereotypes can mislead us. Perceiving the only scapegoat and the only unhealthy eating habit that needs to be changed is that white bread and the thought that consuming whole-grain bread will not lead to obesity does not reflect the truth. In further studies, in order for revealing the singular health effects of nutrients; to consider the socioeconomic and sociocultural characteristics of the countries when categorizing grains, and to single out the essential grain nutrients consumed in their diets but not to evaluate them in the same class as ready-to-eat/packaged products that took place in the Western diet would be a more accurate approach. In addition, it is recommended that all individuals in society should be screened in terms of bread type preferences, especially those who are young, male, and with low educational status, and the society should be educated on healthy carbohydrate sources. It is believed that providing education on healthy eating and healthy bread consumption in public places, especially in schools for the young population, through public service announcements published in national and local media, can significantly change the diet and bread consumption habits of society.

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