

The Relationship of Willingness to Eat Whole Grains and Fermented Food Consumption with Mental Wellness

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Abstract

This study aimed to examine the relationship between the willingness to consume whole grains, the frequency of fermented food consumption, and mental well-being among university students. This cross-sectional, descriptive-correlational study included 269 volunteer first- and fourth-year health sciences students. Data were collected using a Demographic Information Form, the Willingness to Eat Whole Grains Questionnaire (WEWGQ), a Fermented Foods Consumption Frequency Questionnaire, and the Warwick–Edinburgh Mental Well-Being Scale (WEMWBS). A significant association was observed between the consumption frequency of certain traditional fermented foods (including kefir, pickles, turnip juice, pomegranate molasses, and boza) and WEMWBS scores. However, no significant association was found between WEWGQ total scores and mental well-being ($p > 0.05$). Compared with first-year students, fourth-year students demonstrated greater nutritional knowledge and healthier dietary behaviors. In conclusion, although the willingness to consume whole grains was not significantly associated with mental well-being, the consumption frequency of specific fermented foods was significantly associated with mental well-being scores. Owing to the cross-sectional design, these findings indicate associations rather than causal relationships and should be confirmed by future longitudinal studies.

Keywords: Whole grains, Prebiotics, Probiotics, Mental wellness, University students.

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1. Introduction

Whole grains are an important component of a healthy diet, and enabling consumers to consume high whole grain foods is a crucial step in the prevention of chronic diseases (van der Kamp et al., 2022). Whole grains are also rich in prebiotics necessary for the proliferation of probiotic microorganisms. Probiotics have beneficial effects such as reducing the number of pathogenic bacteria in the gut microbiota, positively changing the microbial metabolism and regulating the immune system. It is known that microorganisms with probiotic properties are found in fermented foods such as yogurt, kefir, boza, pickles (Özer et al., 2019). Prebiotics are selectively fermentable substrates that stimulate the growth and metabolic activity of beneficial microorganisms in the colon, thereby promoting their colonization and conferring health benefits to the host (Gibson et al., 2017).

Mental health is more than the absence of mental disorders such as depression or anxiety. According to the World Health Organization (WHO), mental health is "a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to contribute to his or her community" (World Health Organization, 2024). In this context, mental well-being is associated with a positive self-perception, self-acceptance, the ability to establish warm and trusting interpersonal relationships, and the capacity to adapt to and shape the environment to meet one's needs (van Dierendonck & Lam, 2023).

There is a bidirectional relationship between nutrition and mental state. While the diet of the individual affects his mental state, his mental state also affects his nutrition. Some specific foods consumed and the individual's diet form the chemical composition and function of the brain and affect mental health (Beyhan & Taş, 2019).

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Today, although potential associations between probiotics and mental health are widely documented, studies examining the relationship between the willingness to eat whole grains and consumption of whole grains with mental well-being are insufficient in the literature. Therefore, this study aims to investigate the relationship between the willingness to eat whole grains and the frequency of consumption of some traditional fermented foods with BMI and mental well-being in university students.

2. Material and Methods

2.1. Study Design and Participants

This study was designed as a cross-sectional, descriptive-correlational study to investigate the relationship between dietary factors and mental well-being. The population of the research consisted of students studying in the 1st and 4th grades of the Faculty of Health Sciences of Üsküdar University. The 4th grade students and the 1st grade students formed the comparison groups to evaluate the potential differences based on their academic progression and exposure to health education. The sample size was calculated as 240 with 95% power, 5% error, and 95% confidence. The study was conducted between January and March 2020. At the beginning of the study, all participants were informed about the research and informed consent was obtained from voluntary participants.

Ethical approval of the study was obtained with the permission of Üsküdar University Non-Interventional Clinical Research Ethics Committee, dated 27.12.2019 and numbered 61351342/2019-647. The study was performed in accordance with the Declaration of Helsinki.

All volunteer students who continued active education at the Faculty of Health Sciences during the period when the study was conducted and did not have any mental or physical health problems, history of drug use, or special diet were included in the study. Students other than these were not included in the study.

A questionnaire consisting of questions to determine their sociodemographic characteristics, the Consumption Frequency Questionnaire of Fermented Foods, the Willingness to Eat Whole Grains Questionnaire (WEWGQ) and the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) were administered to the participants.

2.2. Demographic Information Form

The demographic Information Form contains information about students' age, gender, body weight

and height, smoking and alcohol use, diagnosed diseases, number of meals, skipping meals, nutritional supplement use, and whole grain and probiotic concepts. It consists of twenty-eight questions in total.

2.3. Fermented Foods Consumption Frequency Questionnaire

The Fermented Foods Consumption Frequency Questionnaire was used to assess the some traditional fermented foods consumed by the students. In this study, the frequency of consumption of kefir, yogurt, buttermilk (ayran), tarhana, pickles, turnip (şalgam), pomegranate syrup, vinegar and boza was asked to the participants. The consumption-frequencies categories were once a day, 2-3 times a day, once a week, once every 15 days, once a month and never consume. The form evaluated the frequency of consumption over the past months. However, specific portion sizes, duration of consumption habits, and the distinction between commercially manufactured and traditional homemade products were not evaluated. Furthermore, the presence and concentration of viable probiotic microorganisms within the consumed products were not microbiologically quantified. Since a standard validated questionnaire for traditional Turkish fermented foods was not available, this frequency form was developed by the researchers based on relevant dietary literature and checked by expert opinions for content validity.

2.4. Willingness to Eat Whole Grains Questionnaire

The original Willingness to Eat Whole Grains Questionnaire, developed by Tuuri et al. (2016), was adapted into Turkish by Abdurrahmanoğlu (2017). In the Turkish validity and reliability study, 4 more whole grain product options were added by taking expert opinion, and a final questionnaire with a total of 14 items was created. Factor analysis was performed to test the validity of the questionnaire, and Cronbach's Alpha coefficient was calculated for its reliability. As a result of the validity analysis, it was found that the questionnaire had a single-factor structure, and in the Cronbach's Alpha reliability analysis, the Cronbach's Alpha coefficient was 0.81. It was determined that the entire questionnaire was reliable according to the values obtained in the reliability analysis. The questionnaire is in a five-point Likert type and scored as never (1), always reluctant (2), sometimes reluctant (3), sometimes willing (4), always willing (5). While calculating the questionnaire scores, the scores given by the individuals from 1 to 5 for each whole grain were added and divided by 14, and average scores were obtained. Those who were above the average were

accepted as having a high level of willingness to eat whole grains, and those below the average were considered to have a low level of willingness to eat whole grains (Abdurrahmanoğlu, 2017).

2.5. Warwick-Edinburgh Mental Well-Being Scale

The 'Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)' was developed by Tennant et al. (2007) to measure the mental well-being of individuals living in England. The scale consists of 14 positive items and has a five-point Likert-type answer key. Scoring of the scale is strongly disagree (1), disagree (2), somewhat agree (3), agree (4), and completely agree (5). The lowest and highest scores to be obtained from the scale are 14 and 70, respectively. High scores obtained from the scale indicate high mental (psychological) well-being. The validity and reliability study of the Turkish version of the scale was conducted by Keldal (2015). Cronbach's Alpha value of the Turkish version of the Warwick-Edinburgh Mental Well-Being Scale was found to be 0.903, which shows that the scale is reliable.

Statistical analyses of the data obtained from the study were performed in the SPSS 24 program. Numerical variables are shown as mean, standard deviation (SD), median, lower and upper values, and categorical variables are shown as numbers (S) and percentage (%). A confidence interval of 95% was used

in all tests in our study, and a p value of <0.05 was considered statistically significant. BMI was compared using the Mann–Whitney U test; categorical variables were compared using the chi-square test. Pearson's correlation analysis was used to examine the relationships between continuous variables. The Kruskal–Wallis test was used to compare WEMWBS scores across multiple fermented food consumption-frequency categories. Effect size is reported as r for the Mann–Whitney U test and Cramer's V for chi-square analyses.

3. Results

The participants of the study were 210 (78.1%) females and 59 (21.9%) males. Median age was 21 years, and Body Mass Index (BMI) was 21.6 ± 2.96 kg/m². Participants of the study were Nursing (14.9%), Midwifery (14.9%), Language and Speech Therapy (14.9%), Nutrition and Dietetics (14.1%), Health Management (6.7%), Social Services (8.6%), Occupational Health and Safety (0.4%), Child Development (6.3%), Audiology (5.9%) and Occupational Therapy (13.4%) department students. Of the participants, 155 (57.6%) were first-year students and 114 (42.4%) were fourth-year students (Table 1).

Table 1. Sociodemographic Variables

Variables (n=269)		Mean $\pm$ SD	Median	Min-Max
Age (year)		21 $\pm$ 1.71	21	18-30
Weight (kg)		58.66 $\pm$ 10.09	58	40-120
Height (m)		1.64 $\pm$ 0.07	1.64	1.50-1.95
BMI (kg/m ²)		21.6 $\pm$ 2.96	21.28	16.23-35.56
Variables (n=269)		n	%	
Gender	Male	59	21.9	
	Female	210	78.1	
Department	Nursing	40	14.9	
	Midwifery	40	14.9	
	Nutrition and Dietetics	38	14.1	
	Health Management	18	6.7	
	Social Services	23	8.6	
	Occupational Health and Safety	1	0.4	
	Child Development and Education	17	6.3	
	Language and Speech Therapy	40	14.9	
	Audiology	16	5.9	
	Occupational Therapy	36	13.4	
Grade level	1st grade	155	57.6	
	4th grade	114	42.4	

SD: Standard deviation, BMI: Body Mass Index, n: Number of participants

Table 2. Comparison of Sociodemographic Variables between First- and Fourth-Year Students

Variables		1. Grade (n=155)		4. Grade (n=114)		Z	p	Effect size
		Mean ±SD	Min- Max	Mean ±SD	Min- Max			
BMI		21.55 ±3.02	16.23- 31.56	21.66 ±2.89	16.65- 35.56	-0.531	0.595	
		n	%	n	%	χ ²	p	Cramer's V
Smoking	Current smoker	12	63.2	7	36.8	0.309	0.857	0.024
	Quit smoking	16	59.3	11	40.7			
	Never smoked	127	57	96	43			
Alcohol Consumption	Current user	9	56.3	7	43.8	0.114	0.945	0.021
	Former user	14	60.9	9	39.1			
	Never used	131	57.5	97	42.5			
Number of Meals Consumed Per Day	2 meals	36	67.9	17	32.1	5.203	0.158	0.139
	3 meals	76	59.4	52	40.6			
	4-5 meals	30	48.4	32	51.6			
	>5 meals	12	50	12	50			
Meal Skipping	Yes	102	60	68	40	0.822	0.364	0.055
	No	53	53.5	46	46.5			
Use of Dietary Supplements	Yes	14	38.9	22	61.1	5.065	0.024	0.137
	No	139	60.4	91	39.6			
Knowledge of Prebiotics and Probiotics	Yes	64	48.5	68	51.5	8.484	0.004	0.178
	No	89	66.9	44	33.1			
Probiotic Supplement Use	Yes	36	45.6	43	54.4	7.803	0.020	0.170
	No	55	59.1	38	40.9			
	Not sure	60	66.7	30	33.3			
Knowledge of Whole Grains	Yes	136	56	107	44	2.930	0.087	0.104
	No	17	77.3	5	22.7			
Whole Grain Consumption	Yes	91	53.2	80	46.8	12.048	0.002	0.212
	No	36	57.1	27	42.9			
	Not sure	21	91.3	2	8.7			

Z= Mann-Whitney U, χ² = Chi-square p: Statistical significance, V=Effect size (Effect size is presented as r for the Mann–Whitney U test and Cramer's V for chi-square analyses).

Table 3. Distribution of WEWGQ total score average by Grade, BMI and Gender Variables

Willingness to Eat Whole Grains Questionnaire								
Total Score Average								
BMI		r				0.047		
		p				0.445		
		Low		High				Effect size
		N	%	n	%	χ ²	P	Cramer's V
Gender	Male	22	18.3	37	24.8	1.282	0.258	0.069
	Female	98	81.7	112	75.2			
Grade level	1st grade	80	66.7	75	50.3	6.606	0.010	0.157
	4th grade	40	33.3	74	49.7			

BMI: Body Mass Index, r: Pearson's Correlation, χ²: Chi-square, p: Statistical significance, n: Number of participants, V=Effect size (Effect size is presented as r for the Mann–Whitney U test and Cramer's V for chi-square analyses).

There were no significant differences between first- and fourth-year students with respect to BMI, smoking status, alcohol use, daily meal frequency, or meal skipping. All participants were asked about their dietary supplement use, knowledge of prebiotics and probiotics, probiotic supplement use, knowledge of whole grains, and whole grain consumption. The distribution of the responses according to academic year is presented in Table 2. Compared with first-year students, fourth-year students had significantly higher rates of dietary supplement use ($p=0.024$), knowledge of prebiotics and probiotics ($p=0.004$), and probiotic supplement use ($p=0.020$).

While there was a statistically significant difference between the Willingness to Eat Whole Grains Questionnaire (WEWGQ) total score average and the grade level ($p=0.010$), there was no significant difference between WEWGQ total score average and BMI ($p=0.445$), and between WEWGQ total score average and gender ($p=0.258$) (Table 3).

The relationship between the total score of WEWGQ and the total score of WEMWBS was investigated with Pearson's Correlation test and no statistically significant difference was found ($r = -0.048$; $p = 0.433$). In the study, it was found that 52 of the 1st grade students (33.5%) never consumed brown rice, while 36 (31.6%) of the 4th grade students occasionally consume it willingly ($\chi^2 = 11.279$, $p = 0.024$); 55 (35.5%) of the 1st grade students never consume whole wheat pasta, 33 (28.9%) of the 4th grade students occasionally consume it reluctantly ($\chi^2 = 15.810$, $p = 0.003$); 44 (28.4%) of 1st grade students never consume whole grain - whole wheat tortilla/lavash, 43 (37.7%) of 4th grade students occasionally consume it willingly ($\chi^2 = 13.517$, $p = 0.009$); 56 (36.1%) of the 1st grade students never consumed grains such as quinoa, chia, and amaranth, and 40 (35.1%) of the 4th grade students occasionally consumed them willingly ($\chi^2 = 18.753$, $p < 0.001$). In addition, 42 (27.1%) of the 1st grade students never consumed granola bars, while 42 (36.8%) of the 4th grade students occasionally consumed them willingly ($\chi^2 = 12.194$, $p = 0.016$); 42 (27.1%) of the 1st grade students never consumed whole grain-whole wheat hamburger buns/flatbread, while 38 (33.3%) of the 4th grade students occasionally consumed them willingly ($\chi^2 = 10.326$, $p = 0.035$); 33 (21.3%) of the 1st grade students never consumed whole grain crackers, biscuits, and muffins, while 50 (43.9%) of the 4th grade students occasionally consumed them willingly ($\chi^2 = 13.377$, $p = 0.010$); 43 (27.7%) of the 1st grade students never consumed whole grain or bran bagels, while 46 (40.4%) of the 4th grade students occasionally consumed them willingly

($\chi^2 = 23.856$, $p < 0.001$); and 19 (12.3%) of the 1st grade students never consumed popcorn, while 51 (44.7%) of the 4th grade students occasionally consumed it willingly ($\chi^2 = 10.019$, $p = 0.040$). No significant difference was found between grade levels and willingness to eat rye bread, whole grain breakfast cereal/muesli, whole wheat bread, bulgur, or rolled oats (Table 4).

The highest mean WEMWBS scores were observed among participants who consumed kefir once a day (66.2 ± 7.92), pickles once a week (50.42 ± 9.73), turnip once a week (57.68 ± 17.16), pomegranate syrup 2–3 times a day (55.78 ± 8.13), and boza once a week (60.73 ± 10.53). WEMWBS scores differed significantly across the frequency categories of kefir ($p = 0.037$), pickles ($p = 0.032$), turnip ($p = 0.002$), pomegranate syrup ($p = 0.019$), and boza ($p = 0.004$) (Table 5). WEMWBS total scores were not significantly associated with BMI ($p = 0.659$) and did not differ significantly by gender ($p = 0.164$) or grade level ($p = 0.731$).

4. Discussion

It was determined that 90.3% ($n = 243$) of the students participating in our study heard the concept of whole grain, and 63.6% ($n = 171$) consumed whole grain foods. Among students who consumed whole grains, 53.2% were first-year students and 46.8% were fourth-year students. Additionally, 57.1% of those who did not consume whole grain are in the first grade (Table 2). Whole grain consumption responses differed significantly according to grade level ($p = 0.002$). Among students who were not sure whether they consumed whole grains, 91.3% were first-year students and 8.7% were fourth-year students. Furthermore, 51.5% ($n = 68$) of those who had knowledge about the concept of pre-probiotics were 4th grade students, while 66.9% ($n = 89$) of those who had no knowledge of prebiotics and probiotics were first-year students ($p = 0.004$). It was also found that 59.1% ($n = 55$) of 1st grade students did not use probiotic supplements and 54.4% ($n = 43$) of 4th grade students used probiotics ($p = 0.020$). The finding that 4th grade students had more knowledge about both whole grains and pre-probiotics compared to 1st graders suggested a possible positive reflection of their academic progression and health-related coursework, although other confounding factors related to chronological age and life experience cannot be ruled out. Health education students' knowledge about pre-probiotics and their effects on health is important as it may affect their ability to provide accurate and useful nutritional advice to their patients in the future.

Table 4. Comparison of Willingness to Eat Whole Grain Foods by Grade Levels

Grain products		1st grade		4th grade		χ^2	p
		N	%	N	%		
Rye bread	Never eats	29	18.7	12	10.5	3.851	0.427
	Always reluctant	18	11.6	12	10.5		
	Occasionally reluctant	42	27.1	33	28.9		
	Occasionally willing	49	31.6	43	37.7		
	Always willing	17	11.0	14	12.3		
Brown rice	Never eats	52	33.5	19	16.7	11.279	0.024*
	Always reluctant	18	11.6	15	13.2		
	Occasionally reluctant	39	25.2	31	27.2		
	Occasionally willing	37	23.9	36	31.6		
	Always willing	9	5.8	13	11.4		
Whole grain breakfast cereal, muesli	Never eats	28	18.1	14	12.3	2.404	0.662
	Always reluctant	17	11.0	13	11.4		
	Occasionally reluctant	38	24.5	34	29.8		
	Occasionally willing	56	36.1	39	34.2		
	Always willing	16	10.3	14	12.3		
Whole wheat bread	Never eats	21	13.5	9	7.9	5.537	0.237
	Always reluctant	13	8.4	14	12.3		
	Occasionally reluctant	39	25.2	21	18.4		
	Occasionally willing	58	37.4	53	46.5		
	Always willing	24	15.5	17	14.9		
Granola bar	Never eats	42	27.1	12	10.5	12.194	0.016*
	Always reluctant	12	7.7	15	13.2		
	Occasionally reluctant	36	23.2	33	28.9		
	Occasionally willing	50	32.3	42	36.8		
	Always willing	15	9.7	12	10.5		
Whole wheat pasta	Never eats	55	35.5	19	16.7	15.810	0.003*
	Always reluctant	12	7.7	12	10.5		
	Occasionally reluctant	43	27.7	33	28.9		
	Occasionally willing	34	21.9	30	26.3		
	Always willing	11	7.1	20	17.5		
Whole grain/whole wheat tortilla/lavash	Never eats	44	28.4	13	11.4	13.517	0.009*
	Always reluctant	14	9.0	18	15.8		
	Occasionally reluctant	36	23.2	27	23.7		
	Occasionally willing	43	27.7	43	37.7		
	Always willing	18	11.6	13	11.4		
Whole grain/whole wheat hamburger buns/flatbread	Never eats	42	27.1	16	14.0	10.326	0.035*
	Always reluctant	12	7.7	18	15.8		
	Occasionally reluctant	33	21.3	28	24.6		
	Occasionally willing	44	28.4	38	33.3		
	Always willing	24	15.5	14	12.3		
Whole grain crackers, biscuits, muffins	Never eats	33	21.3	8	7.0	13.377	0.010*
	Always reluctant	15	9.7	14	12.3		
	Occasionally reluctant	26	16.8	27	23.7		
	Occasionally willing	53	34.2	50	43.9		
	Always willing	28	18.1	15	13.2		
Whole grain or bran bagel	Never eats	43	27.7	10	8.8	23.856	<0.001*
	Always reluctant	15	9.7	16	14.0		
	Occasionally reluctant	33	21.3	28	24.6		
	Occasionally willing	33	21.3	46	40.4		
	Always willing	31	20.0	14	12.3		
Bulgur	Never eats	8	5.2	1	0.9	8.109	0.088
	Always reluctant	12	7.7	7	6.1		
	Occasionally reluctant	18	11.6	11	9.6		
	Occasionally willing	49	31.6	52	45.6		
	Always willing	68	43.9	43	37.7		
Grains such as quinoa, chia, amaranth	Never eats	56	36.1	16	14.0	18.753	<0.001*
	Always reluctant	18	11.6	15	13.2		
	Occasionally reluctant	32	20.6	24	21.1		
	Occasionally willing	33	21.3	40	35.1		
	Always willing	16	10.3	19	16.7		
Rolled oats	Never eats	36	23.2	12	10.5	8.895	0.064
	Always reluctant	14	9.0	14	12.3		
	Occasionally reluctant	31	20.0	25	21.9		
	Occasionally willing	54	34.8	40	35.1		
	Always willing	20	12.9	23	20.2		
Popcorn	Never eats	19	12.3	5	4.4	10.019	0.040*
	Always reluctant	6	3.9	13	11.4		
	Occasionally reluctant	19	12.3	16	14.0		
	Occasionally willing	71	45.8	51	44.7		
	Always willing	40	25.8	29	25.4		

Data are presented as number (n) and percentage (%). Differences between first- and fourth-grade students were analyzed using the Pearson chi-square test. *Statistical significance was set at $p < 0.05$.

Table 5. Comparison of WEMWBS Total Score Average with BMI, gender, grade levels and Frequency of Consumption of Fermented Foods

		WEMWBS Total Score			
BMI	R		0.027		
	P		0.659		
		N	Mean ± SD		P
Gender [¥]	Male	59	49.81±9.95	Z=-1.392	0.164
	Female	210	48.43±11.5		
Grade level [¥]	1st grade	155	48.49±10.6	Z=-0.344	0.731
	4th grade	114	49.07±11.95		
Kefir Consumption Frequency	Once a day	5	66.2±7.92	H=11.831	0.037
	2-3 times a day	12	51.58±13.68		
	Once a week	12	53.25±6.01		
	Once in 15 days	15	51.29±13.16		
	Once a month	35	47.67±8.95		
	I don't consume	183	47.53±10.46		
Yogurt Consumption Frequency	Once a day	106	49.57±11.17	H=10.322	0.067
	2-3 times a day	39	49.06±10.13		
	Once a week	74	49.51±12.34		
	Once in 15 days	25	45.26±8.50		
	Once a month	8	45.22±4.09		
	I don't consume	15	45.18±13.84		
Ayran Consumption Frequency	Once a day	45	52.69±12.24	H=9.728	0.083
	2-3 times a day	30	49.97±10.41		
	Once a week	118	47.85±10.58		
	Once in 15 days	49	47.48±11.72		
	Once a month	15	47.13±9.43		
	I don't consume	11	46.45±13.36		
Tarhana Consumption Frequency	Once a day	13	51.69±6.47	H=10.388	0.065
	2-3 times a day	5	64.20±7.70		
	Once a week	92	48.21±10.69		
	Once in 15 days	60	46.40±9.67		
	Once a month	54	50.67±12.03		
	I don't consume	39	47.12±10.15		
Pickle Consumption Frequency	Once a day	33	49.70±15.14	H=12.251	0.032
	2-3 times a day	7	47.12±9.91		
	Once a week	87	50.42±9.73		
	Once in 15 days	62	46.43±9.23		
	Once a month	45	49.63±12.74		
	I don't consume	31	45.47±10.95		
Turnip Consumption Frequency	Once a day	-	-	H=15.353	0.002
	2-3 times a day	-	-		
	Once a week	18	57.68±17.16		
	Once in 15 days	20	52.93±9.55		
	Once a month	49	49.00±10.36		
	I don't consume	175	47.15±10.42		
Pomegranate Syrup Consumption Frequency	Once a day	26	49.98±10.37	H=13.573	0.019
	2-3 times a day	9	55.78±8.13		
	Once a week	74	51.00±12.30		
	Once in 15 days	53	47.37±9.69		
	Once a month	49	46.57±13.15		
	I don't consume	53	46.68±8.99		
Vinegar Consumption Frequency	Once a day	22	47.93±12.53	H=4.303	0.507
	2-3 times a day	14	52.00±5.67		
	Once a week	49	48.02±9.39		
	Once in 15 days	45	51.10±16.16		
	Once a month	36	47.90±9.94		
	I don't consume	95	47.55±9.89		
Boza Consumption Frequency	Once a day	1	52	H=15.402	0.004
	2-3 times a day	-	-		
	Once a week	3	60.73±10.53		
	Once in 15 days	10	57.20±8.67		
	Once a month	37	51.72±14.15		
	I don't consume	210	47.33±10.42		

r: Pearson's Correlation, [¥]Z: Mann-Whitney U, H=Kruskal-Wallis

In a study examining the consumption of prebiotic/probiotic sources in university students, it has been found that 15.2% of the participants consumed whole grain/whole wheat bread, 7.9% consumed dried fruits and 5.8% consumed bananas every day, while asparagus, soybeans and artichokes are almost never consumed. In the study, it was determined that the most consumed probiotic sources every day were cheese types, yogurt and ayran, and 95.2% of the participants did not consume boza, 92.8% did not consume vinegar, and 61.6% did not consume kefir (Adıgüzel et al., 2024). A study conducted among students of the School of Health in Saudi Arabia aimed to evaluate their knowledge, attitudes and practices regarding the use of probiotics in various health conditions (Al Hossan et al., 2024). It was reported that 56.0% of health sciences students had moderate knowledge about probiotics, more than one third had positive attitudes and 53.4% had positive practices ($p < 0.001$). Another study conducted with health sciences students found that 80% of their students had adequate knowledge, 52.9% had a positive attitude, and 62.1% had a positive practice towards probiotics (Rahmah et al., 2021).

In our study, 55.4% of the students had a high willingness to eat whole grains. Among students who consumed whole grains, 53.2% were first-year students and 46.8% were fourth-year students ($p = 0.002$). It is thought that the nutrition courses students took as part of their health education may have contributed to this result.

There was no statistically significant difference between the mean total score of the WEWGQ and BMI and gender. Similarly, in a study on adults, 50% of individuals had a high willingness to eat whole grains, but no significant difference was found between their willingness to eat whole grains and gender (Abdurrahmanoğlu, 2017). In our study, no statistically significant relationship was found between the mean total score of the WEWGQ and WEMWBS ($r = -0.048$, $p=0.433$). Similar to the results of our study, no correlation was found between the willingness to eat whole grains and depression in a study examining the relationship between the level of willingness to eat whole grains and depression levels of adults ($r = -0.005$, $p>0.05$). In another study investigating the effect of substituting whole grains instead of refined grains on the risk of developing psychological disorders in Iranian adults, participants with the highest whole grain consumption had lower depression and anxiety rates compared to those with the lowest intake (Sarsangi et al., 2023). A systematic review examining the relationship between whole grain consumption and

measures of cognitive decline, mood, and anxiety found consistent associations between higher whole grain intake and decreased scores for mood disorders, including depression and anxiety. However, there is insufficient evidence that whole grains reduce cognitive decline (Ross et al., 2023).

In the current study, it was determined that 83.1% ($n=98$) of the individuals with a low total score from the WEWGQ and 59% ($n=85$) of those with a high score did not consume kefir ($p=0.001$). A statistically significant difference was not found between the WEMWBS total score average and BMI ($r= 0.027$, $p=0.659$), gender ($Z= -1.392$, $p= 0.164$), and grade levels ($Z= -0.344$, $p= 0.731$). In another study examining the relationship between psychological well-being and BMI, no significant difference was found between BMI and mental well-being ($p>0.05$) (Amık & Şahin, 2020).

In a study examining the relationship of intuitive eating and hedonic hunger with diet quality, mental health and sleep quality, contrary to our study, the WEMWBS scores of the overweight participants were found to be significantly higher than the scores of the obese participants ($p<0.05$) (Ateş, 2021). Since health is defined as healthy body, mind and spirit as a whole, healthy BMI values are expected to be associated with higher mental well-being scores. In our study, it was thought that the inhomogeneity of the number of students falling into BMI groups and the fact that most of them were in the normal BMI range may have caused this result.

In our study, it was determined that 29.4% of all participants knew the concept of probiotic and prebiotic, 34.6% did not know, and 36% left this question unanswered. In a study on the level of probiotic and prebiotic knowledge, it was determined that 51% ($n=100$) of individuals did not know the concept of probiotic-prebiotic (Yücel Şengün et al., 2020). In the study of Pradito et al. (2020), it was determined that the majority of the students (80.6%) knew the basic information about probiotics well. In another study on the determination of probiotic knowledge level and consumption status, it was stated that 55.6% ($n=716$) of university students participating in the research knew the concept of probiotics (Arpa Zemzemoğlu et al., 2019). In the previous studies, it was seen that the grade levels of university students were not taken into account. In our study, 57.6% of the participants were first-year students. It was thought that the lower pre-probiotic knowledge levels of first-year students contributed to our lower results than other studies.

It has been suggested that fermented foods, consisting of microorganisms and molecules with neuroactive potential, may provide potential benefits to the host's mental health through the microbiota-gut-brain axis (Balasubramanian et al., 2024). Fermented foods are rich food sources of bioactive peptides, phytochemicals and vitamins, as well as beneficial microorganisms. It is hypothesized that through these properties, they may modulate the pathways that transmit information from the gut to the brain through their capacity to modulate the composition and/or diversity of the intestinal microbiota or the production of microbial metabolites such as short-chain fatty acids (SCFA), polyphenolic compounds, tryptophan and bile metabolites.

In the current study, 39.4% of the students reported that they consumed yogurt once a day at most, and 43.9% consumed buttermilk at most once a week. It was observed that 68% of the students did not consume kefir very much. In a study investigating the probiotic knowledge level of university students, it was determined that 73.1% of the students did not consume kefir (Arpa Zemzemoğlu et al., 2019). In our study and similar studies, it was seen that yogurt and buttermilk (ayran) were preferred more than kefir. It was thought that this situation was caused by the lack of sufficient information about kefir and the traditional preference for yogurt.

In our study, it was determined that 46.7% of the participants answered the question "What health benefits have you seen from probiotic products?" that probiotics are mostly good for digestive system problems. Previous surveys have consistently reported that gastrointestinal health is the health benefit most frequently associated with probiotics by both university students and adults (Adıgüzel et al., 2024; Mukherjee et al., 2024). In another study investigating fermented food consumption by women, 72.12% of the participants agreed with the statement "foods containing probiotic regulate the digestive system" (Şahin, 2018).

In our study, the WEMWBS total score was found to be higher in those who consumed pickles, boza, turnip once a week, kefir once a day, and pomegranate syrup 2-3 times a day. The findings suggest that the consumption frequency of potentially probiotic fermented foods, such as kefir, pickles, turnip, pomegranate syrup, and boza, was associated with mental well-being scores. In a study conducted on 121 adults aged 21-59 years, the relationship between the consumption of all foods containing probiotics and the WEMWBS total score was examined. As a result of the

study, a significant relationship was found between the consumption of foods containing probiotics in women and the WEMWBS total score (Şahin, 2018).

In a study investigating the effect of probiotic food consumption on anxiety disorder with the participation of 484 students from the Faculty of Health Sciences, no significant difference was found between the frequencies of kefir, ayran, and cheese consumption and generalized anxiety disorder test scores. On the other hand, a statistically significant difference was found between the frequency of yogurt consumption and generalized anxiety disorder test results. As yogurt consumption decreased, anxiety disorder increased significantly (Çatak, 2019).

In a study investigating the relationship between fermented food and food-derived prebiotic consumption and cognitive performance, depressive and anxiety symptoms in psychiatrically healthy medical students under psychological stress, it was reported that no relationship was observed between cognitive performance under stress and fermented food or food-derived prebiotic consumption (Karbownik et al., 2022).

One study of probiotic consumption and prevalence of depression included people aged 19 to 64 years who participated in the Korea National Health and Nutrition Survey. Participants with the highest probiotic food consumption had significantly lower levels of depression severity and self-reported clinical depression. Although there was no significant relationship between probiotic food consumption and clinical depression in women, a significantly lower prevalence of clinical depression was observed in men consuming probiotic foods (Kim & Shin, 2019).

A study that conducted a meta-analysis of published cohort studies to estimate the overall depression risk of fermented dairy intake reported that fermented dairy intake may have a potential beneficial effect on depression via the gut-brain axis. However, it has not been found that excessive intake of fermented dairy products reduces the risk of depression (Luo et al., 2023).

The significant relationship observed between the consumption frequency of certain fermented foods and mental well-being is a finding that aligns with literature suggesting a noteworthy linkage between probiotics and mental health. In addition to the high willingness to eat whole grains in the 4th grades, the fact that their consumption of whole grains and probiotics-containing fermented foods is higher than that of the 1st grade may reflect a possible contribution of health

education to the development of healthy eating behavior.

4.1. Limitations of the Study

Several limitations of the present study should be acknowledged. First, due to its cross-sectional design, causal relationships between fermented food or whole grain consumption and mental well-being cannot be established; the findings indicate only associations. Second, dietary data were based entirely on self-reported consumption frequencies, which may have introduced recall bias. Third, important potential confounding factors, including total daily energy intake, overall dietary patterns, portion sizes, and the duration of these dietary habits, were not assessed in detail. Finally, because the microbiological characteristics of the consumed fermented foods were not analyzed, it could not be confirmed whether all reported fermented foods contained viable probiotic microorganisms or biologically active components.

5. Conclusion

In conclusion, this study demonstrated that while the willingness to consume whole grains was higher among senior students, it was not significantly associated with mental well-being. In contrast, the consumption frequency of certain fermented foods was significantly associated with mental well-being scores, suggesting a potential relationship between fermented food consumption and mental well-being among university students. Furthermore, senior students demonstrated greater knowledge of prebiotics and probiotics and healthier dietary behaviors than first-year students, suggesting that health education may contribute to improved nutritional awareness and dietary habits. Future longitudinal studies involving more diverse populations and comprehensive dietary assessments are warranted to clarify these associations and to determine the optimal consumption levels of prebiotic and probiotic-rich foods for promoting mental well-being.

Declarations

Competing Interest

The authors declare that they have no financial or non-financial competing interests.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author.

Funding

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Ethics Statement

Ethical approval of the study was obtained with the permission of Üsküdar University Non-Interventional Clinical Research Ethics Committee dated 27.12.2019 and numbered 61351342/2019-647. The study was performed in accordance with the Declaration of Helsinki.

AI statement

Generative AI tools were used only in a limited and controlled manner for language editing. All content was reviewed and approved by the authors.

Author's Contributions

A. Özenoğlu : Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing.

İ. Öztürk : Methodology, Writing – review & editing, Validation.

C. Erkul : Formal analysis, Visualization, Writing – original draft, Writing – review & editing.

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