

Investigation of the relationship between food consumption and emotions that show psychobiotic characteristics of healthcare professionals: Karabük province example

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ABSTRACT

Aim: The aim of this study was to examine the relationship between psychobiotic food consumption and moods in healthcare professionals.

Material and Method: The research was conducted on healthcare professionals in December 2022. The research sample consists of healthcare workers over the age of 18 and at least secondary school graduates (physician, nurses, midwives, laboratorians, anesthesia technicians, audiologists, radiology technicians, medical secretaries, nurses, civil servants, psychologists and physiotherapists). A questionnaire comprised three parts. In the first part, there are questions containing general information about the demographic characteristics of the participants (age, educational status, profession, etc.). In the second part, the nutritional habits of the participants and the food consumption frequency form including the foods showed psychobiotic properties were used. In the third part, Depression Anxiety Stress Scale (DASS-21) was used. Body Mass Indexes were calculated by measuring the body weight and height of the individuals. Statistical analyses were performed by using SPSS (IBM SPSS Statistics 24.0) package program.

Results: 88 (57.5%) of the participants were female and 65 (42.5%) of them were male. 57 participants (37.3%) were in the age range of 40-49. Negatively, weakly statistically significant relationship was found between the age and anxiety scale ($\rho=-0.208$; $p=0.010$). A negatively significant relationship was found between the anxiety subscale and foods such as cauliflower, cabbage, broccoli and oats/oat bran consumption ($\rho=-0.231$, $p=0.004$; $\rho=-0.387$, $p=0.000$). Fish and fish oil consumption and depression and stress subscales have been positively statistically significant relationship ($\rho=0.166$, $p=0.040$; $\rho=0.200$, $p=0.013$).

Conclusion: The consumption of probiotics and psychobiotics is increasing day by day with the increase in the level of knowledge. Because psychobiotics have effects in alleviating anxiety, depression and psychological problems, it is thought that they may have positive effects, such as reducing the effects of factors that cause obesity, such as emotional eating. In this study, there are relationships between depression, anxiety and stress and consumption of psychobiotic foods, but there is a need for more detailed and large-scale studies as there are many factors that can affect the level of stress and anxiety.

Keywords: Mood, probiotics, prebiotics, psychobiotics, body mass index

INTRODUCTION

According to the World Health Organization, depression affects more than 300 million people around the world (1). Psychological disorders such as depression and anxiety disorders of individuals; It has a negative effect not only on health conditions but also on quality of life. Depression; sad and anxious mood, anxiety, pessimism, irritability, fatigue, changes in sleep patterns and suicide thoughts such as serious symptoms of emotional disorder. Mood disorders reduce productivity in the workplace of individuals and affect the economic welfare of all regions in welfare-health expenditures. Existing research; It shows that the interaction of psychological, environmental, genetic and biological factors and eating habits triggers the

emotions of individuals. There are many multidisciplinary methods to treat these disorders (2,3).

Today, it is common for individuals to have both intestine and mood disorders together. This suggests that there is a strong connection between the central nervous system and the gastrointestinal tract (4). When the complex system between the intestine and the brain is analyzed, the relationship between these two organs goes further than the maintenance of homeostasis; It has been confirmed by studies that there is a relationship between intestinal microbiota and mental health (4-6). Psychobiotics have been defined as "living organisms that, when taken in adequate amounts, create health benefits in patients

suffering from psychiatric illnesses" (7,8). It is therefore thought that all of the substances that affect psychology through the microbiome may be potential psychobiotics (9). The bacteria most commonly used as psychobiotics are probiotics, which show potential effects on psychological and physiological conditions such as improving anxiety, depression and appetite levels. Psychobiotics are probiotic microorganisms that affect the central nervous system and neurological functions of a host and can improve the quality of life of hosts with psychological disorders by balancing gastrointestinal function (10-13).

In recent years, clinical and animal studies have reported that one of the best ways to improve the microbiota is to supplement psychobiotic bacteria. It has been observed that the beneficial effects of psychobiotics are not only in the gut, but also reach the whole microbiota-gut-brain axis (8,9). Psychobiotics, when taken in appropriate formulations and in the right amounts, can have positive psychiatric effects on psychopathology (14,15). In an age where the tendency to eat ready-to-eat foods instead of traditional nutrition is increasing, access to and follow-up of up-to-date information by health professionals on the consumption of foods is an important component for increasing the quality of health (16). Exposure to tension and high stress due to intense work tempo can lead to both physical, behavioral, emotional and psychological problems of employees. The positive or negative emotions that people feel affect their decisions, choices, behaviors as well as their eating behaviors. Therefore, eating is a biological necessity and there is also a psychological dimension (16,20). While there are studies on the level and consumption of probiotic, prebiotic and synbiotic information of healthcare professionals in our country, there are few studies on psychobiotics. The hypothesis of this study is that health workers who consume more foods with psychobiotic properties have lower stress and anxiety levels. Therefore, the aim of this study was to examine the relationship between the consumption of foods showing psychobiotic properties and moods in healthcare professionals.

MATERIAL AND METHOD

The study was carried out with the permission of Karabük University, Non-invasive Clinical Researches Ethics Committee (Date: 19/12/2022, Decision No:1183). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Design and Participants

This research was conducted in December 2022 on individuals who are health workers. This group was preferred because healthcare workers are under higher stress due to their working conditions. The sample size of the study was found to be 134 people by performing power analysis at

95% confidence interval and 0.05 significance level. The research sample consists of health workers over the age of 18 and at least secondary school graduates (physicians, nurses, midwives, laboratorians, anesthesia technicians, audiologists, radiology technicians, medical secretaries, nurses, civil servants, psychologists and physiotherapists). Before the research, the participants were informed about the research and the volunteer individuals who agreed to participate in the research were included in the research by signing the "Informed Consent Form". Those who did not volunteer to participate in the study, those with severe psychiatric illness, and those using regular probiotic supplements were excluded from the study.

Collection and Evaluation of Data

A questionnaire form containing multiple choice and open-ended questions was applied to the participants by the researcher with face-to-face interview technique. This questionnaire consists of three parts. In the first part, there are questions containing general information about the demographic characteristics of the participants (age, educational status, profession, etc.). In the second part, the nutritional habits of the participants and the food consumption frequency form including the foods showing psychobiotic properties were used (consumption of the relevant food for at least 3 months is based on regular consumption). In the third part, Depression Anxiety Stress Scale (DASS-21) was used. Researchers reached out to participants through personal connections. The survey was conducted face-to-face to the health personnel working in the Family Health Centers affiliated to the Safranbolu District Health Directorate of Karabük Province by the researcher. It was completed in about 15 minutes.

The Depression, Anxiety, Stress Scale (DASS-21)

DASS-21 was developed by Lovibond et al. (18) and adapted to Turkish by Sariçam. The scale has 21 items; There are seven items in the sub-dimensions of depression, anxiety and stress. The scale assesses symptoms of depression, anxiety and stress in the last week according to a quadruple rating between (0) never and (3) always. A score between 0 and 21 can be obtained from the sub-factors of the scale. Higher scores indicate higher levels of depression, anxiety and stress. In the clinical sample, Cronbach's alpha internal consistency reliability coefficient was found to be 0.87 for depression subscale, 0.85 for anxiety subscale and 0.81 for stress subscale (17).

Anthropometric Measurements

Anthropometric measurements were made by the researcher with the appropriate technique. Body length and body weight of the individuals included in the research were recorded in the questionnaire form. Body mass index (BMI) of patients was calculated by dividing body weight by square meters of height [body weight (kg)/

height²]. According to World Health Organization (WHO) standards, <18.5-<24.9 kg/m² is defined as normal, ≥25.0-<29.9 kg/m² is overweight, and ≥30.0 kg/m² is defined as obese (19).

Statistical Analysis

Statistical analyses were performed using a package program called SPSS (IBM SPSS Statistics 24.0). Frequency tables and descriptive statistics were used to interpret the results. Non-parametric methods were used for measurement values that were not suitable for normal distribution. In accordance with non-parametric methods, "Mann-Whitney U" test (Z-table value) method was used to compare two independent groups with their measurement values, and "Kruskal-Wallis H" test (χ²-table value) method was used to compare three or more independent groups with measurement values. The relationships between the scales and some variables were determined by correlation analysis. Interpretations of correlation coefficients rho=0; no relationship, rho=0.01-0.29; relationship at a weak level, rho=0.3-0.7; moderate relationship, rho=0.71-0.99; high level of relationship, rho=1; interpreted with excellent relationship levels (21). The results of the analysis were interpreted at the confidence level and 0.05 significance values for the comparison tests and at the significance values of 0.05 and 0.01 for the correlation tests and trust levels.

RESULTS

The demographic characteristics of the participants participating in the study are given in **Table 1**. Out of a total of 153 participants; 88 (57.5%) were female and 65 (42.5%) were male. 57 participants (37.3%) are between the ages of 40-49. 137 (89.5%) are married and 82 (53.6%) are undergraduates. The body mass index of 45.1 % of the participants is in the overweight group. The working time of 35.9 % of the participants is in the range of 10-15 years and 41.2 % are nurse.

Information on nutrition individuals is given in **Table 2**.

Table 3 includes the scores of individuals from the DASS-21 subscales and the relationships between age, body weight (kg) and height (cm) and body mass index. Negatively, weakly statistically significant relationship was found between age and anxiety scale (r=-0.208; p= 0.010). As age increases, the anxiety of individuals increases. A negative, weakly statistically significant relationship was found between height and stress (r=-0.193; p=-0.017). There was a moderate statistically significant positive relationship between anxiety, depression and stress scales (r=0.587; p=-0.000, r=-0.578; p=0.000). A very high degree of statistically significant positive relationship was found between depression and stress scales (r=0.921; p=0.000). Stress and depression scale scores tend to increase or decrease together.

Table 1. Demographic characteristics of individuals

Variable (n=153)	n	%
Gender		
Female	88	57.5
Male	65	42.5
Age (year)		
20-29	30	19.6
30-39	48	31.4
40-49	57	37.3
50 and over	18	11.8
Marital Status		
Married	137	89.5
Single	16	10.5
Education Level		
High School	50	32.7
University	82	53.6
Undergraduate	21	13.7
Body Mass Index (kg/m²)		
<18.5	1	0.65
18.5-24.9	42	27.5
25-29.9	69	45.1
>30	41	26.8
Have been working for		
0-5 years	20	13.1
5-10 years	19	12.4
10-15 years	55	35.9
15-20 years	47	30.7
20 years and over	12	7.8
Occupation		
Nurse	63	41.2
Physician	10	6.5
Midwife	20	13.1
Health officer	44	28.8
Other (Physiotherapist, Psychologist, Audiologist, Medical secretary)	16	10.5

Table 2. Distribution of participants' nutritional status and probiotic and prebiotic information

Variable (n=153)	n	%
Regularly using medication/food supplement		
Is not using	124	81.0
Vitamin B12	2	1.3
Vitamin D	14	9.15
Collagen	6	3.9
Multivitamin	7	4.6
Foods of choice when stressed, nervous or irritable		
Don't want to eat	78	51.0
Chocolate, wafer, biscuit, cake	47	30.7
Salted foods like crackers, snacks	5	3.3
Sugar drinks	23	15.0
Foods of choice when you are happy and cheerful		
Don't want to eat	87	56.9
Chocolate, wafer, biscuit, cake	42	27.5
Salted foods like crackers, snacks	5	3.3
Sugar drinks	19	12.4
Does your emotional state affect nutrition		
Effective	85	55.6
Not effective	68	44.4
Believing that probiotics are useful for health		
Beneficial	106	69.3
Not beneficial	20	13.1
Has no idea	27	17.6
Believing that prebiotics are useful for health		
Beneficial	106	69.3
Not beneficial	20	13.1
Has no idea	27	17.6

Table 3. Test of correlation between anthropometric measurements of individuals and DASS-21 scale scores

Variable (n=153)		Age (year)	Body mass index (kg/m ²)	DASS-21 anxiety subscale	DASS-21 depression subscale	DASS-21 stress subscale
Age (year)	rho	1.000	0.048	-0.208**	-0.104	-0.061
	p		0.554	0.010	0.201	0.454
Body weight (kg)	rho	0.050	.828**	-0.087	0.009	0.029
	p	0.539	0.000	0.285	0.907	0.720
Length (cm)	rho	-0.008	-0.236**	-0.154	-0.145	-0.193*
	p	0.921	0.003	0.057	0.074	0.017
Body mass index (kg/m ²)	rho	0.048	1.000	-0.029	0.093	0.133
	p	0.554		0.720	0.253	0.102
DASS-21 anxiety subscale	rho	-0.208**	-0.029	1.000	0.587**	0.578**
	p	0.010	0.720		0.000	0.000
DASS-21 depression subscale	rho	-0.104	0.093	0.587**	1.000	0.921**
	p	0.201	0.253	0.000		0.000
DASS-21 stress subscale	rho	-0.061	0.133	0.578**	0.921**	1.000
	p	0.454	0.102	0.000	0.000	

*p<0.05. **p<0.01, Spearman Correlation Analyses (rho,p)

In **Table 4**, the results of the analysis of the comparison of the sub-dimensions of the DASS-21 scale and some characteristics of the individuals were included. It was analyzed that there were statistically significant differences between the gender of the individuals and the anxiety scale ($Z=4.360$, $p<0.05$). It was analyzed that there were statistically significant differences between the age groups of the individuals and the stress scale ($\chi^2=7.872$, $p<0.05$).

In **Table 5**, the consumption of foods with psychobiotic characteristics and the correlation of BMI and DASS-21 subscales are given. Negatively, weakly statistically significant relationship was found between dark chocolate consumption and anxiety subscale ($r=-0.291$; $p=-0.000$). Negatively statistically significant relationship between Kombucha tea and water kefir consumption and stress subscale was found to be weakly statistically ($r=-0.193$; $p=-0.017$). A negatively significant relationship was found between the anxiety subscale and foods such as cauliflower, cabbage, broccoli and oats/oat bran consumption ($r=-0.231$, $r=0.040$; $r=-0.387$ $p=0.000$). Fish/fish oil consumption and depression and stress subscales have been positively statistically significant relationship ($r=0.166$, $r=0.040$; $r=0.200$ $p=0.013$).

DISCUSSION

The recent development of the concept of psychobiotics is important in addition to traditional probiotic and prebiotic supplements. Animal and clinical studies in recent years report the potential of microorganisms for psychobiotics that alter the gut microbiota, improve cognitive function, and control anxiety and stress levels. However, due to the complexity of the gut-brain-microbiota axis, the elucidation of the specific mechanisms by which bacterial and yeast strains exert their activity and the identification of a systemic procedure for assessing the psychobiotic effects of a particular strain, formulation, or food product is still

underway (21). In this sense, awareness is still low and there is no consensus in general. In a study conducted on university students, it was determined that 45.2% of the students had knowledge about the concepts of probiotics and prebiotics, but did not have clear information about the concept of psychobiotics (22). In a study aimed at measuring probiotic-prebiotic consumption, it was found that 38.4-46.0% of individuals consumed probiotics (22-24). It has been observed that individuals' knowledge can increase their probiotic-prebiotic food consumption. On the other hand, the low level of knowledge of individuals about psychobiotics did not reduce their consumption of probiotic foods. In our study, 60.1% of the participants knew the concept of probiotics, 69.3% knew the concept of prebiotics, 26.8% knew the concept of psychobiotics. 69.3% of the participants think that probiotics and prebiotics are beneficial for health. Although the number of individuals who have knowledge about probiotic-prebiotics is higher, the number of people who know the concept of psychobiotics in our study is lower. The reason for this is thought to be that the concept of psychobiotics is a relatively new concept and is still being studied.

Made works; It shows that lifestyle changes such as increasing physical activity, healthy nutrition, nutritional supplements when necessary, and the use of probiotic-prebiotic supplements improve the living conditions of individuals and reduce perceived stress. Healthy eating has been proven to successfully reduce symptoms even in non-clinical depression (25-27). Stress not only increases food consumption in some cases, but it can also shift individuals' food choices from lower-fat options to high-fat ones. Socio-demographic factors (gender, age, country) and lifestyle characteristics (nutritional behaviors, quality of life, social support, etc.) affect body perception, the content of food consumed and perceived stress level (28). Although improvements in stress have been observed before through

microbiota-targeted studies (probiotics, fermented drinks); future studies should investigate the hypothesis that the psychobiotic diet leads to a more stable microbiota, resulting in greater changes in perceived stress. Nishida et al. (27) investigated the psychobiotic potential of *Lactobacillus gasseri* CP2305 to improve chronic stress-related symptoms in medical students. As a control and intervention group; each student was given psychobiotic supplementation for 12 weeks; The sleep quality index scores of students who used psychobiotic supplements were low in the Persistent Anxiety Inventory and their stress factors were lower. In this study, the foods preferred by the participants who woke up from sleep at night and ate were; It was analyzed that there were statistically significant differences between the foods preferred when stressed, nervous and irritable, and the rate of eating, the emotional state affecting nutrition and the anxiety subscale. It was determined that the emotional state of the

participants affected their nutrition in general, and when they were stressed, nervous, irritable and happy, cheerful, they generally ate chocolate, wafers, biscuits and cakes.

In clinical and animal studies, it has been observed that psychobiotic supplementation provides similar effects to traditional antidepressant treatments, relieves symptoms and beneficial effects reach the whole microbiota-gut-brain axis, not only in the gut. When animal studies were examined, it was seen that the antidepressant effect of psychobiotics was closely related to the regulation of the microbiota-gut-brain axis (28). Another study found that psychobiotic food consumption can positively affect anxiety, depression, and mood swings (29,30). In our study, it is thought that the reason why the expected effect could not be achieved compared to other studies is due to the low level of knowledge of health professionals about psychobiotic foods.

Table 4. Comparison of Some Characteristics and Nutritional Preference of Individuals with DASS-21 Scale Scores

	DASS-21 Anxiety Subscale					DASS-21 Depression Subscale					DASS-21 Stress Subscale				
	\bar{x}	SD	Median	Analysis	p	\bar{x}	SD	Median	Analysis	p	\bar{x}	SD	Median	Analysis	p
Gender				Z=-4.360	0.000				Z=-1.068	0.285				Z=-0.352	Z=0.725
Female	10.3	2.0	10.0			8.2	2.5	7.0			8.1	2.6	7.0		
Male	8.9	1.9	8.0			8.0	2.4	7.0			8.0	2.4	7.0		
Age (year)				$\chi^2=5.021$	0.170				$\chi^2=7.547$	0.053				$\chi^2=7.872$	0.047
20-29	10.3	1.9	10.0			7.8	2.1	7.0			7.7	2.1	7.0		
30-39	10.0	2.1	10.0			8.8	3.0	7.0			8.8	3.1	7.0		
40-49	9.5	2.0	9.0			7.5	1.8	7.0			7.5	1.8	7.0		
50 and over	9.2	2.3	8.0			8.6	3.0	7.0			8.6	3.0	7.0		
Body Mass Index (kg/m ²)				$\chi^2=3.842^*$	0.146*				$\chi^2=2.638^*$	0.267*				$\chi^2=2.879^*$	0.237*
<18.5	11.0					7.0					7.0				
18.5-24.9	10.2	2.2	10.0			8.2	2.6	7.0			8.2	2.6	7.0		
25-29.9	9.4	1.9	9.0			7.7	2.1	7.0			7.7	2.1	7.0		
>30	9.9	2.2	10.0			8.6	2.9	7.0			8.5	2.9	7.0		
Marital status				Z=-1.661	0.097				Z=-2.692	0.007				Z=-1.912	0.056
Married	9.6	2.0	10.0			7.9	2.4	7.0			7.9	2.4	7.0		
Single	10.6	2.2	10.0			9.3	3.3	7.0			9.2	3.4	7.0		
Foods of choice when stressed, nervous or irritable				$\chi^2=11.182$	0.011				$\chi^2=0.265$	0.966				$\chi^2=0.249$	0.969
Don't want to eat	9.4	2.0	9.0			8.0	2.4	7.0			8.0	2.5	7.0		
Chocolate, wafer, biscuit, cake	10.2	1.9	10.0			8.0	2.5	7.0			8.0	2.5	7.0		
Salted foods like crackers, snacks	8.2	2.2	7.0			8.4	3.1	7.0			8.4	3.1	7.0		
Sugar drinks	10.3	2.1	10.0			8.3	2.7	7.0			8.2	2.7	7.0		
Foods of choice when you are happy and cheerful				$\chi^2=3.009$	0.390				$\chi^2=2.671$	0.445				$\chi^2=3.500$	0.321
Don't want to eat	9.6	2.1	10.0			8.2	2.6	7.0			8.1	2.6	7.0		
Chocolate, wafer, biscuit, cake	10.0	1.8	10.0			7.7	2.1	7.0			7.7	2.1	7.0		
Salted foods like crackers, snacks	8.8	2.5	7.0			9.6	3.6	7.0			9.8	3.8	7.0		
Sugar drinks	10.1	2.1	10.0			8.2	2.6	7.0			8.1	2.6	7.0		
Does your emotional state affect nutrition				Z=-3.076	0.002				Z=-0.227	0.821				Z=-0.555	0.579
Effective	10.2	2.0	10.0			8.2	2.6	7.0			8.2	2.6	7.0		
Not effective	9.2	2.0	9.0			8.0	2.4	7.0			7.9	2.4	7.0		

In the comparison of two independent groups in data that do not have normal distribution with the measurement values, the "Mann-Whitney U" test (Z-Table value); In the comparison of three or more independent groups, "Kruskal-Wallis H" tests (χ^2 -Table value) statistics were used. *One participant with a Body Mass Index <18.5 was not included in the analyses.

Table 5. Correlation of foods with psychobiotic properties with consumption status with BMI and DASS-21 subscales

Foods with Psychobiotic Properties	Correlation	BMI	DASS-21 anxiety subscale	DASS-21 depression subscale	DASS-21 stress subscale
Kefir	rho	-0.037	-0.085	0.070	0.047
	p	0.646	0.298	0.388	0.567
Milk with probiotics	rho	-0.072	0.084	-0.056	-0.003
	p	0.377	0.304	0.494	0.967
Yogurt with probiotics	rho	0.125	0.037	-0.035	-0.035
	p	0.123	0.650	0.667	0.667
Banana	rho	-0.086	-0.102	-0.048	-0.109
	p	0.293	0.208	0.554	0.182
Apple	rho	-0.035	0.100	0.012	0.015
	p	0.668	0.217	0.879	0.852
Dark chocolate	rho	0.084	-0.291**	-0.127	-0.072
	p	0.302	0.000	0.118	0.380
Kombucha tea	rho	0.090	-0.075	-0.148	-0.193*
	p	0.269	0.355	0.069	0.017
Water kefir	rho	0.090	-0.075	-0.148	-0.193*
	p	0.269	0.355	0.069	0.017
Boza	rho	0.092	0.006	-0.070	-0.054
	p	0.257	0.939	0.387	0.505
Tarhana	rho	0.062	-0.045	0.084	0.057
	p	0.448	0.582	0.305	0.486
Fermented pickle	rho	0.071	-0.132	-0.105	-0.148
	p	0.386	0.104	0.197	0.067
Turnip	rho	0.065	0.076	-0.005	-0.008
	p	0.424	0.351	0.950	0.926
Vinegar	rho	-0.067	-0.025	0.092	0.067
	p	0.407	0.758	0.256	0.410
Pomegranate sour sauce	rho	-0.105	0.020	0.078	0.043
	p	0.195	0.804	0.337	0.595
Brine foods	rho	-0.114	0.027	0.110	0.084
	p	0.161	0.743	0.176	0.301
Whole grain products	rho	0.026	0.019	0.002	0.007
	p	0.749	0.817	0.977	0.928
Green leafy vegetables	rho	0.038	-0.036	-0.116	-0.104
	p	0.640	0.656	0.155	0.202
Vegetables such as cauliflower, cabbage, broccoli	rho	0.003	-0.231**	-0.064	-0.100
	p	0.975	0.004	0.434	0.217
Oats/oatmeal	rho	0.148	-0.387**	-0.125	-0.049
	p	0.067	0.000	0.123	0.551
Fish/fish oil	rho	0.002	0.103	0.166*	0.200*
	p	0.977	0.207	0.040	0.013

*p<0.05. **p<0.01, Spearman Correlation analysis (rho,p)

The effects of psychobiotic supplementation on depressive symptoms were investigated in another systematic review. In the seven studies examined; in the intervention group compared to placebo; psychobiotic interventions have been found to be effective in improving the depressive symptoms of diseases such as hypertension and diabetes (31). In interpreting the different results of various studies, the anti-depressant effects of psychobiotics, the types of probiotic strains or prebiotics administered, the dosage and also the duration of supplementation should be taken into account. Some types have been shown to be effective in relieving symptoms. In our study, when the relationships between the scores they received from the DASS-21

subscales and age, body weight (kg) and height (cm), body mass index were examined; negative direction between age and anxiety, negative direction between height and stress; A very high degree of statistically significant relationship was found between anxiety and depression and stress in a positive direction and between depression and stress in a positive direction. As the age increases, the anxiety of individuals increases.

Today, the effects of foods containing psychobiotic organisms on mental health are mentioned. Some psychobiotics have been found to produce neuroactive compounds, showing behavioral effects, especially in stress-related disorders such as depression and anxiety.

Fermented foods such as yogurt, kefir, boza, which are among the fermented milk products, and foods such as bananas, apples and cocoa with prebiotic content have been shown to be related to mental health by supporting the proliferation of beneficial gut bacteria (32). In a randomized double-blind placebo-controlled study, individuals given probiotic yogurt and probiotic capsules showed improvements in their depression status (33). In another study, the relationship between the consumption of probiotic and prebiotic foods and happiness was discussed and a positive relationship was found between the consumption of probiotic milk and yogurt, apple, fermented yogurt and turnip juice and happiness status (34). In our study, a statistically significant relationship was found between the participants' dark chocolate consumption and the anxiety scale, in a negative way between the consumption of kombucha tea and water kefir and the stress subscale and between the anxiety subscale and the consumption of foods such as cauliflower, cabbage, broccoli and oat/oat bran.

In a study, it was found that yoghurt (90.9%), ayran (59.6%) and pickles (55.6%) were consumed from foods with psychobiotic properties (35). In our study, kefir (68.0%), banana (98.0%), apple (100.0%), green leafy vegetables (100.0%) were consumed the most. It was found that boza, water kefir and kombucha tea are the least consumed psychobiotic products. This may be due to the fact that individuals do not like or do not try boza, water kefir and kombucha tea, as well as the lack of knowledge. In a similar study to determine the frequency of probiotic consumption of adult individuals, it was found that probiotic added foods are less frequently consumed in parallel with our study (36). In another study, it was found that 61.8% of the individuals participating in the study did not consume probiotic milk and that the probiotic yogurts were more preferable (37). Probiotic foods and consuming habits they consume according to the cultures and nutritional habits of the countries may vary (36). Probiotic and psychobiotic consumption is increasing day by day with the increase in the level of knowledge. It is thought that psychobiotics have positive effects such as reducing the effects of obesity such as emotional eating because of the effects of anxiety, depression and psychological problems. As far as we know, our study is the first study to investigate the relationship between psychobiotics and mood in health workers in our country. Healthcare workers are a group that is under serious stress. Adding psychobiotic foods to their diet can improve their mood.

CONCLUSION

Our study has some limitations. The study is limited to Safranbolu district of Karabük province. It cannot be attributed to the general. As a result of the literature

review, the researchers determined the foods that are described as psychobiotic. If there is a scale to be developed for this purpose in the future, data will be collected more objectively. In addition to these, it has not been questioned how long the psychobiotic foods have been consumed regularly.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Karabük University, Non-invasive Clinical Researches Ethics Committee (Date: 19/12/2022, Decision No:1183).

Informed Consent: All participants included in the study were informed and their consent was taken before filling the questionnaire.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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REFERENCES

1. Dahiya D, Nigam PS. The gut microbiota influenced by the intake of probiotics and functional foods with prebiotics can sustain wellness and alleviate certain ailments like gut-inflammation and colon-cancer. *Microorganisms* 2022; 10: 665.
2. Dahiya D, Nigam PS. Probiotics, prebiotics, synbiotics, and fermented foods as potential biotics in nutrition improving health via microbiome-gut-brain axis. *Fermentation* 2022; 8: 303.
3. Gibson GR, Scott KP, Rastall RA, et al. Dietary prebiotics: Current status and new definition. *IFIS Functional Foods Bulletin* 2010; 7: 1-19.
4. Lee YK, Salminen S. *Handbook of probiotics and prebiotics*. John Wiley & Sons. 2009.
5. Sarkar A, Lehto SM, Harty S, Dinan TG, Cryan JF, Burnet PWJ. Psychobiotics and the manipulation of bacteria-gut-brain signals. *Trends Neurosci* 2016; 39: 763-81.
6. Dinan TG, Butler MI, Cryan JF. Psychobiotics: evolution of novel antidepressants. *Mod Trends Psychiatry* 2021; 32: 134-43.
7. Mayer EA, Knight R, Mazmanian SK, Cryan JF, Tillisch K. Gut microbes and the brain: paradigm shift in neuroscience. *J Neurosci* 2014; 34: 15490-6.
8. Savignac HM, Corona G, Mills H, et al. Prebiotic feeding elevates central brain derived neurotrophic factor, N-methyl-D-aspartate receptor subunits and D-serine. *Neurochem Int* 2013; 63: 756-64.
9. Macfarlane GT, Macfarlane S, Gibson GR. Validation of a three-stage compound continuous culture system for investigating the effect of retention time on the ecology and metabolism of bacteria in the human colon. *Microb Ecol* 1998; 35: 180-7.

10. Macfarlane GT, Gibson G. Microbiological aspects of short chain fatty acid production in the large bowel 1995; 87-105.
11. Selhub EM, Logan AC, Basted AC. Fermented foods, microbiota, and mental health: ancient practice meets nutritional psychiatry. *J Physiol Anthropol* 2014; 33: 2.
12. Hilimire MR, DeVlyder JE, Forestell CA. Fermented foods, neuroticism, and social anxiety: an interaction model. *Psychiatry Res* 2015; 228: 203-8.
13. Alexander KE, Siegel HI. Perceived hunger mediates the relationship between attachment anxiety and emotional eating. *Eat Behav* 2013; 14(3): 374-7.
14. Logan AC, Katzman M. Major depressive disorder: probiotics may be an adjuvant therapy. *Med Hypotheses* 2005; 64: 533-8.
15. Alexander KE, Siegel HI. Perceived hunger mediates the relationship between attachment anxiety and emotional eating. *Eat Behav* 2013; 14: 374-7.
16. Jadrešin O, Hojsak I, Mišak Z, et al. *Lactobacillus reuteri* DSM 17938 in the treatment of functional abdominal pain in children: RCT study. *J Pediatr Gastroenterol Nutr* 2017; 64: 925-9.
17. Güleç M, Yabancı N, Göçgeldi E, Bakır B. Ankara'da iki kız öğrenci yurdunda kalan öğrencilerin beslenme alışkanlıkları. *Gülhane Tıp Derg* 2008; 50: 102-9.
18. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the Beck depression and anxiety inventories. *Behav Res Ther* 1995; 33: 335-43.
19. Sarıçam H. The psychometric properties of Turkish version of Depression Anxiety Stress Scale-21 (DASS-21) in health control and clinical samples 2018; 7: 19-30.
20. Derin DÖ, Keskin S. Gıda mühendisliği öğrencilerinin probiyotik ürün tüketim durumlarının belirlenmesi: Ege Üniversitesi Örneği. *GIDA* 2013; 38: 215-22.
21. Arpa Zemzemoğlu TE, Uludağ E, Uzun S. Üniversite öğrencilerinin probiyotik bilgi düzeyi ve tüketim durumlarının belirlenmesi. *Gıda* 2019; 44: 118-30.
22. Kaya Cebioğlu İ, Önal AE. İstanbul'da bir ilçede erişkinlerde probiyotik ve prebiyotik tüketimi ile obezite arasındaki ilişkinin incelenmesi. *Geleneksel ve Tamamlayıcı Tıp Derg* 2019; 2: 55-63.
23. Yılmaz F, Yardımcı H. Beden kütle indeksinin infertilite üzerine etkisi. *Hacettepe University Faculty of Health Sciences J* 2015.
24. Evrensel A, Ceylan ME. Bağırsak-beyin eksenini: depresyondaki kayıp halka. *Klinik Psikofarmakoloji ve Nörobilim* 2015; 13: 239.
25. de Souza BL, Magalhães-Guedes KT, Lemos PVF, et al. Development of arrowroot flour fermented by kefir grains. *J Food Sci* 2020; 85: 3722-30.
26. Al-Ansari MM, Sahlah SA, AlHumaid L, Ranjit Singh AJ. Probiotic lactobacilli: Can be a remediating supplement for pandemic COVID-19. A review. *J King Saud Univ Sci* 2021; 33: 101286.
27. Nishida K, Sawada D, Kawai T, Kuwano Y, Fujiwara S, Rokutan K. Para-psychobiotic *Lactobacillus gasseri* CP2305 ameliorates stress-related symptoms and sleep quality. *J Appl Microbiol* 2017; 123: 1561-70.
28. Xu J, Li Y, Yang Z, et al. Yeast probiotics shape the gut microbiome and improve the health of early-weaned piglets. *Front Microbiol* 2018; 9: 2011.
29. Woodhams DC, Rollins-Smith LA, Reinert LK, et al. Probiotics modulate a novel amphibian skin defense peptide that is antifungal and facilitates growth of antifungal bacteria. *Microb Ecol* 2020; 79: 192-202.
30. Mörkl S, Butler MI, Holl A, Cryan JF, Dinan TG. Probiotics and the microbiota-gut-brain axis: focus on psychiatry [published correction appears in *Curr Nutr Rep* 2020 Jun 5; :]. *Curr Nutr Rep* 2020; 9: 171-82.
31. Liu J, Jin Y, Li H, et al. Probiotics exert protective effect against sepsis-induced cognitive impairment by reversing gut microbiota abnormalities. *J Agric Food Chem* 2020; 68: 14874-83.
32. Kuyumcu A, Yıldız M. Sağlık bilimleri fakültesi öğrencilerinin psikobiyotik özellik gösteren besinlerin tüketim durumları ile mutluluk düzeyleri arasındaki ilişkisi. *Namık Kemal Tıp Derg* 2020; 8: 212-8.
33. Mohammadi AA, Jazayeri S, Khosravi-Darani K, et al. The effects of probiotics on mental health and hypothalamic-pituitary-adrenal axis: A randomized, double-blind, placebo-controlled trial in petrochemical workers. *Nutr Neurosci* 2016; 19: 387-95.
34. Yüksel-Bilsel A, Şahin-Yeşilçubuk N. Enkapsüle yapıları lipitler ile güçlendirilmiş probiyotik kefir üretimi ve oksidasyon ve in vitro sindirim çalışmaları ile matriks etkilerinin araştırılması. *Gıda Kimyası* 2019; 296: 17-22.
35. Pehlivan B. Yetişkin bireylerin probiyotik besinleri tüketim sıklıklarının ve bilgi düzeylerinin belirlenmesi. *Bilimsel Tamamlayıcı Tıp Regülasyon ve Nöral Terapi Derg* 2020; 14: 69-79.
36. Horasan B, Sevinç Ö, Çelikyürek NA. Üniversite öğrencilerinin probiyotik bilgi düzeyi ve tüketim durumlarının belirlenmesi. *Avrupa Bilim ve Teknoloji Derg* 2021; 31: 446-53.
37. Özen AE, Bibiloni Mdell M, Pons A, Tur JA. Consumption of functional foods in Europe: a systematic review. *Nutr Hosp* 2014; 29: 470-8.