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Determination of consumers' knowledge levels and consumption status on probiotic and prebiotic products

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ABSTRACT

Between March 2022 and May 2022, this study was conducted to determine adult consumers' knowledge and consumption habits of probiotic and prebiotic products. Adults aged 18 to 65 were included in the cross-sectional study using an online questionnaire. Data were collected on participants' knowledge of the terms probiotics and prebiotics, patterns of consumption, frequency of consumption and variables affecting consumption, and diseases treated as a result of their usage. The study involved 447 volunteers, of whom 31.3% were men (n=140) and 68.7% were women (n=307). According to research data, 87.0% of consumers know about probiotics, and 62.2% know about prebiotics. There were statistically significant differences in knowledge of probiotics and prebiotics by sex ($p<0.001$ and $p<0.001$, respectively). When analyzed according to education level, probiotic knowledge improved as education level rose ($p<0.001$). Prebiotic knowledge and education level were statistically significant ($p<0.05$). Although probiotic and prebiotic knowledge is statistically significant according to education level, more research should be done on products, and individuals should be made aware of this issue.

Keywords: Probiotic, Prebiotic, Level of knowledge, Consumption status

Introduction

Awareness of the effect of nutrition on health is increasing daily (Yücel Şengün et al., 2020). It is argued that functional foods should be consumed in addition to nutrition during the day to provide additional benefits to help prevent or deal with diseases. (Pulido et al., 2021). Today, with the growing awareness of healthy nutrition, in addition to meeting the nutritional elements required by the person, the components in its structure are thought to improve current health by lowering the risk of diseases (such as cardiovascular disease, infections, cancer, diarrhea, constipation, and osteoporosis) and have a positive effect on consumer health. Functional foods are foods that improve one's quality of life. In recent years, functional foods have received much attention (Arduzlar Kağan et al., 2019; Demir and Aktaş, 2018; Pradito et al., 2020; Yabancı and Şimşek, 2007; Yücel Şengün et al., 2020). Foods containing probiotics and prebiotics are at the forefront of functional foods (Arduzlar Kağan et al., 2019; Yücel Şengün et al., 2020).

Probiotics are beneficial live microorganisms that provide various health functions to the host by improving the intestinal microbial balance (Pradito et al., 2020). Probiotic bacteria should have a minimum of 10^6 colony-forming units per gram (cfu/g) when they reach the intestines to provide these advantages. Various stress conditions during manufacture, storage, and transit through the gastrointestinal system endanger probiotic bacteria's survival. They must resist gastric juice and bile salts to keep the intestinal environment intact and exhibit their therapeutic functions on the host body (Baş, 2019). Many health benefits, such as overcoming the problem of intestinal infections, controlling pathogenic bacteria in the digestive system, stimulating the immune system, and lowering cholesterol and low-density lipoprotein level,s have been provided by probiotics (Pradito et al., 2020). However, the effect of probiotics varies according to the type of probiotic, the strain used, the dose, and the mode of administration. As a result, the predicted effects do not apply to all probiotic microorganisms. Probiotics are safe and well tolerated when taken orally. Furthermore, probiotic foods should be ingested regularly (Horasan et al., 2021). Fermented dairy products, kefir, boza, tarhana, pickles, soy products, hardly, turnip, table olives, wine, and beer are fermented items that contain probiotic microorganisms (Arpa Zemzem-oğlu et al., 2019a; Demirel, 2018; Özgül et al., 2020).

Prebiotics, on the other hand, are non-microorganic organic components that positively affect the host's health by stimulating the development and activity of one or a limited number of microorganisms in the colon and that cannot be digested in the upper gastrointestinal tract but can be fermented by microorganisms (*Bifidobacterium* and *Lactobacillus* species) in the colon (Yabancı and Şimşek, 2007; Yücel Şengün et al., 2020). It has been determined that prebiotics contribute to the probiotic effect and positively affect the host's health by providing the proliferation of one or more beneficial microorganisms (Taşdemir, 2017). Prebiotics are nutrients not hydrolyzed or absorbed in the stomach or small intestine. It should be selective for beneficial bacteria in the colon microflora and capable of stimulating their proliferation. It should alter the flora to a healthier composition and have positive local and systemic effects on the host (Baş, 2019). In this context, evidence supports the possible positive benefits of some nutrients, such as inulin and fructooligosaccharides (FOS) synthesized from oligofructose, sucrose, and oligosaccharides (xylooligosaccharides) containing galactose and xylose, began to emerge in the 1980s and early 1990s. The consumption of FOS and galactooligosaccharides in human milk has been shown to promote the proliferation of intestinal bifidobacteria (Precup et al., 2022). Microorganisms in the colon, prebiotics, which are taken with food and cannot be digested in the stomach and small intestine, are fermented by the colon microflora. The metabolites are released to form an energy source for the microflora. Prebiotics creates a healthy environment for the host in the intestinal flora, making it possible to use them to treat patients and prevent diseases (Yılmaz, 2004). The health benefits of prebiotics in the gastrointestinal tract have been linked to inhibiting the growth potential of pathogenic microorganisms that produce short-chain fatty acids like acetate, propionate, and butyrate, stimulating the immune system, lowering intestinal pH, and promoting mineral absorption. (Pehlivan, 2020; Precup et al., 2022). Recent studies have shown that prebiotic consumption potentially benefits human and animal health, gastrointestinal tract, obesity, type 2 diabetes mellitus, inflammatory bowel disease, cardiovascular diseases, bones, and neurological disorders. Also, prebiotics and probiotics can be combined into "synbiotics" to achieve synergistic effects. Probiotic strains will stimulate growth by fermenting the prebiotic (Precup et al., 2022).

There needs to be more clarity in society about probiotics and prebiotics. These concepts either need to be discovered or understood. This study aimed to determine consumers' knowledge levels and consumption status about probiotic and prebiotic products when the tendency toward ready-to-eat foods increases. In addition, it evaluated how gender, age,

and health conditions affect the consumption of probiotic and prebiotic products.

Materials and Methods

The study was approved by Afyonkarahisar Health Sciences University Non-Interventional Clinical Research Ethics Committee at the meeting numbered 2022/2 on 04.02.2022. This study was conducted in March-May 2022 with adults aged 18-65, using convenience sampling. According to TUIK (Turkish Statistical Institute) data, in February 2022, 67.9% (57.497.905) of Türkiye's population was between the ages of 18-65 (TUIK, 2022). With a 95% confidence level and a 5% acceptable error, the research was designed to include at least 384 participants (SSC, 2022). An online questionnaire was sent to 447 participants who agreed to participate in the study, and their consent was obtained. Living in the Republic of Türkiye, being willing to participate in the study, and being between 18 and 65 are the inclusion requirements.

The data were collected using a questionnaire form prepared by the researchers using the relevant literature (Horasan et al., 2021; Özgül et al., 2020; Yücel Şengül, 2020; Arpa Zemzemoğlu et al., 2019b) and using the online method. The questionnaire form consists of three parts and 28 questions. In the first part, the demographic information of the participants (age, gender, height, body weight, marital status, education status, income status); in the second part, the knowledge levels, preferences, attitudes, and behaviors of the participants about probiotics and prebiotics, and in the last part, the frequency of consumption of probiotic and prebiotic products. The consumption frequency table in the previous section was questioned as "I never consume" "daily", "2-3 times a week", "once a week", "fortnightly", "monthly" and "yearly".

The gathered data were analyzed in a computer setting using SPSS 26 descriptive statistics tools. The number and percentage frequency tables were used to provide introductory information on the study's participants, and the chi-square test was used to assess the relationship between the variables. The statistical significance threshold was set at $p<0.05$.

Results and Discussion

A total of 447 people participated in the research. The mean age of the participants was 24.3 ±7.66 years, and the mean body mass index calculated body weight/(height)^2 was 23.2 ±4.36 kg/m^2, 68.7% (n=307) of the research group were female and 31.3% (n=140) were male. According to their educational status, 83.0% (n=371) were university graduates, while only 0.4% (n=2) of the participants were primary school graduates. While 90.2% of the participants had no chronic disease, 9.8% reported a chronic disease (Table 1).

Table 1. Socio-demographic Characteristics of Participants

Gender	**n (447)**	**% (100)**
Male	140	31.3
Female	307	68.7
Educational Level	**n (447)**	**% (100)**
Primary School	2	0.4
Middle School	8	1.8
High School	56	12.5
University	371	83.0
Graduate	10	2.2
Diagnosed Disease Status	**n (447)**	**% (100)**
Yes	44	9.8
No	403	90.2
Diagnosed Diseases	**n (44)**	**% (100)**
Asthma - COPD	10	22.8
Celiac	1	2.3
Diabetes	6	13.6
Hypertension	6	13.6
Thyroid	6	13.6
Heart	9	20.5
Migraine	3	6.8
Rheumatic diseases	3	6.8
Level of income	**n (447)**	**% (100)**
Income less than expenses	156	34.9
Same as income	217	48.5
Income more than the expense	74	16.6

Table 2 shows the distribution table of the participants according to their knowledge, usage, and preferences for probiotic-prebiotic. Of 447 people participating in the research, 87% (n=389) stated that they knew the term probiotic and 45.8% (n=178) of the 389 people who knew the term probiotic said that they used probiotics. It was observed that 83.7% (n=149) of the individuals using probiotics preferred probiotics with food/as food, and 16.3% (n=29) preferred it as supplements (capsules, powder, pills, etc.). While only 6.5% of the participants in the study chose supplemental probiotics, only 2.8% (n=5) of them were determined to take probiotic supplements regularly every day. While the most important reason for preferring probiotics is the thought that it is beneficial for digestion (64.7%, n=115), the reasons for not choosing it are that they do not need it (41.2%, n=87).

Again, as indicated in Table 2, while those who knowledge the term prebiotic were 62.2% (n=278), 37.8% did not knowledge the term prebiotic. Prebiotics were found to be effective by 41.0% of the 278 participants who knowledge the term, partially effective by 44.6%, and ineffective by 14.4%.

Statistically significant differences were found both in probiotic and prebiotic knowledge and in the usage of probiotics according to gender ($p<0.001$, $p<0.001$, $p<0.05$, respectively).

Table 4, probiotic knowledge ($p<0.001$), prebiotic knowledge ($p<0.05$), and probiotic usage ($p<0.05$) were found to be statistically significant according to education level (Table 4).

When the research participants' frequency of using probiotics and prebiotics-containing goods was assessed, it was discovered that most did not consume other foods besides banana, tarhana, or garlic. Consumption of probiotic yogurt, kefir, tarhana, vinegar, garlic, banana, leek, rye, and oat are 18.1% (n=81), 18.3% (n=82), 48.1% (n=215), 25.1% (n=112), 38.7% (n=173), 39.6% (n=177), % 25.5 (n=109), 12.8% (n=57), 19.5% (n=87) respectively, consumption once a week was found to be higher, while consumption of Boza, Jerusalem artichoke and artichoke (14.8% (n=66), 17.7% (n=79), 15.0% (n=67) respectively) was determined to be higher once a year.

When 447 people who volunteered for the study were asked if they had heard of the probiotics and prebiotics, 87% (n=389) said they knew the probiotics, while 62.2% (n=278) said they knew the prebiotics. In a similar study of Izmir Province, Yücel Şengün et al. (2020) when asked if the consumers participating in the study were aware of the concept of probiotics and prebiotics, 49% said yes and 51% said they did not know. In a survey conducted for adults, 64.5% of the participants stated that they knew the concept of probiotic food (Arduzlar Kağan et al., 2019). Another study conducted for adults determined that 73.3% knew the term probiotic (Zeren, 2015). In another study conducted for working people, 96% of the participants stated that they knew the term probiotic (Özgül et al., 2020). Arpa Zemzemoğlu et al. (2019b), in their study for university students, 55.6% of the participants stated that they knew what probiotics were.

While 45.8% (n=178) of 389 study participants who were aware of the term "probiotic" reported using them in our study, the percentage for adults was reported as 73.6% (Arduzlar Kağan et al., 2019). In one study, the rate was determined to be 73.5% (n=446), and in another, the rate was determined to be 82.4% (n=593) (Horasan et al., 2021; Arpa Zemzemoğlu et al., 2019b). Özgül et al. (2020) stated that the probiotic consumption rate was 96% (n=24). In another study conducted with university students, a high probiotic consumption rate (99.6%, n=258) was found (Demirel, 2018). This high rate may be because the study was conducted on students who received nutrition education. The most significant factor in the participants' preference for probiotics was their thought that it was beneficial to their digestion (64.7%, n=115). In contrast, the main reason for not choosing was their thought that they did not require it (41.2%, n=87). These results were similar to studies by Horasan et al. (2021), Yücel Şengün et al. (2020), and Özgül et al. (2021), where the benefits of probiotics for digestion were cited by 73.8% (n=329), 63.9% (n=108), and 83.3% (n=20) of participants, respectively. With rates of 62.1% (n=100), and 55.6% (n=15), Horasan et al. (2021) and Yücel Şengül et al. (2020) stated that the reason for not preferring in their study was because they did not know what probiotic products were. (Yücel Şengün et al., 2020; Horasan et al., 2021; Özgül et al., 2020).

Table 2. Distribution of the participants according to the probiotic-prebiotic knowledge, usage, and preference status

Probiotic knowledge	**n (447)**	**% (100)**
Yes	389	87.0
No	58	13.0
Probiotic usage	**n (389)**	**% (100)**
Yes	178	45.8
No	211	54.2
Type of preference in probiotic usage	**n (178)**	**% (100)**
With/As food	149	83.7
With supplements (capsules, powder, pills, etc.)	29	16.3
Frequency of usage of Probiotic Supplements (capsule, powder, pill, etc.)	**n (178)**	**% (100)**
None	149	83.7
Daily	5	2.8
Once a week	3	1.7
2-3 times a week	6	3.4
Fortnightly	5	2.8
Monthly	3	1.7
Yearly	7	3.9
Reason for the usage of probiotics	**n (178)**	**% (100)**
Beneficial for the digestive system	115	64.7
I think it protects against cancer	4	2.2
I find it delicious	4	2.2
It strengthens the immune system	55	30.9
Why don't usage probiotics	**n (211)**	**% (100)**
I don’t know what it is	74	35.1
I do not find it natural	18	8.5
I do not need	87	41.2
I find it expensive	24	11.4
I do not distrust content	8	3.8
Prebiotic knowledge	**n (447)**	**% (100)**
Yes	278	62.2
No	169	37.8
Effectiveness of prebiotics	**n (278)**	**% (100)**
Yes	114	41.0
No	40	14.4
Partially	124	44.6

Table 3. Distribution of Probiotic-Prebiotic knowledge and usage of participants by gender

	Yes		No		Total	p-value /χ^2
Probiotic knowledge	**n**	**%**	**n**	**%**		
Female	281	91.5	26	8.5	307	p=0.001
Male	108	77.1	32	22.9	140	χ^2 =17.6
Probiotic usage						
Female	135	44.0	172	56.0	307	p=0.008
Male	43	30.7	97	69.3	140	χ^2 =7.05
Prebiotic knowledge	**n**	**%**	**n**	**%**		
Female	214	69.7	93	30.3	307	p=0.001
Male	64	45.7	76	54.3	140	χ^2 =23.5

Table 4: Probiotic-Prebiotic knowledge and usage distribution table according to the education level of the participants

	Yes		No		Total	p-value /χ^2
Probiotic knowledge	**n**	**%**	**n**	**%**		
Primary School	0	0.0	2	3.4	2	
Middle School	2	0.5	6	10.4	8	
High School	38	9.8	18	31.0	56	p=0.001
University	340	87.4	31	53.5	371	χ^2 =66.0
Graduate	9	2.3	1	1.7	10	
Probiotic usage						
Primary School	0	0.0	2	0.7	2	
Middle School	0	0.0	8	3.0	8	
High School	22	12.4	34	12.6	56	p=0.034
University	149	83.7	222	82.5	371	χ^2 =10.4
Graduate	7	3.9	3	1.2	10	
Prebiotic knowledge	**n**	**%**	**n**	**%**		
Primary School	2	0.7	0	0.0	2	
Middle School	1	0.4	7	4.1	8	
High School	29	10.4	27	16.0	56	p=0.010
University	239	86.0	132	78.1	371	χ^2 =13.2
Graduate	7	2.5	3	1.8	10	

Table 5. The frequency of usage of Probiotic-Prebiotic products by the participants

Foods	Never		Daily		2-3 times a week		Once a week		Once a month		Once a year	
	n	%	n	%	n	%	n	%	n	%	n	%
Probiotic yogurt	222	50.8	17	3.8	45	10.1	81	18.1	46	10.3	31	6.9
Kefir	219	49.0	4	0.9	30	6.7	82	18.3	71	15.9	41	9.2
Boza	341	76.3	6	1.3	7	1.6	15	3.4	12	2.7	66	14.8
Tarhana	92	20.6	15	3.4	39	8.7	215	48.1	73	16.3	13	2.9
Vinegar	155	34.7	17	3.8	76	17.0	112	25.1	60	13.4	27	6.0
Garlic	94	21.0	26	5.8	102	22.8	173	38.7	46	10.3	6	1.3
Jerusalem artichoke	276	61.7	10	2.2	12	2.7	40	8.9	30	6.7	79	17.7
Artichoke	255	57.0	13	2.9	7	1.6	56	12.5	49	11.0	67	15.0
Banana	60	13.4	34	7.6	130	29.1	177	39.6	43	9.6	3	0.7
Leek	170	38.0	4	0.9	6	1.3	114	25.5	109	24.4	44	9.8
Rye	250	55.9	26	5.8	29	6.5	57	12.8	50	11.2	35	7.8
Oat	186	41.6	25	5.6	66	14.8	87	19.5	61	13.6	22	4.9

It was observed that 83.7% (n=149) of the individuals using probiotics preferred probiotics with food/as food, and 16.3% (n=29) preferred it as supplements (capsules, powder, pills, etc.). Although only 6.5% of our study participants preferred probiotic supplementation, Özgül et al. (2020) stated that 20% (n=5) of participants indicated that they consumed dietary supplements (capsules, powders, pills, etc.).

In the study, it was determined that 91.5% of women (n=281) and 77.1% (n=108) of men knew the terms probiotic and prebiotic ($p<0.001$). In a similar study, when probiotic and prebiotic knowledge was evaluated according to gender, it was determined that 65.3% of women and 31.6% of men knew the concepts of probiotic and prebiotic ($p<0.05$) (Yücel Şengün et al., 2020). Arduzlar Kağan et al. (2019) it was determined that women knew the concept of probiotics at a higher rate (75.8%) in their study on adults. In the study of Zeren (2015) for adults, it was determined that women knew the concept of probiotics at a higher rate (80.0%). Similarly, in a study on individuals who do sports, 52.4% of women declared that they knew the term probiotic (Koç, 2020). The fact that women have a high level of knowledge about probiotic and prebiotic products in studies may be associated with paying more attention to nutrition and health than men. For this reason, women's knowledge level and higher consumption of these products make it meaningful.

In the study, a statistically significant difference was found in the usage of probiotics by gender ($p<0.001$); Arduzlar Kağan et al. (2019) also found no statistically significant difference ($p>0.05$). Horasan et al. (2021) found that probiotic food consumption was higher in women (77.4%), and this difference was found to be statistically significant ($p<0.001$).

Knowledge of the term probiotic according to education level was found to be statistically significant ($p<0.001$), and it was determined that the group with the highest knowledge about probiotics was the group at the university level (87.4%, n=340). No statistically significant difference ($p>0.05$) between knowledge of the term prebiotic according to education level. Yücel Şengün et al. (2020), when assessing the level of knowledge of these concepts by educational level, found that the group with the highest level of knowledge (66.7%) consisted of those at the master's level.

When the frequency of usage of probiotics and prebiotics-containing products of the individuals in the study was evaluated, it was determined that most of them did not consume other foods except bananas, tarhana, and garlic. Yücel Şengün et al. (2020) found that 51% (n=100) kefir and 77.9% (n=152) onion and garlic consumption accounted for the majority.

Conclusion

The demand for probiotic and prebiotic products is increasing rapidly worldwide and in Türkiye. However, it is important to understand consumers' attitudes toward probiotic and prebiotic products and to increase consumer acceptance. With a rise in research and publications demonstrating the benefits of probiotics and prebiotics on health, probiotic and prebiotic awareness and usage rates have been observed. Although

there is a high degree of understanding of probiotics and prebiotics, the utilization percentage has been discovered to be as low as 45.8%. Despite having adequate knowledge, there remains skepticism about using such items. The study found that the people who drank probiotics and prebiotic products consumed tarhana the most frequently, with 48.1% ingesting it once a week. The predicted effect of using probiotic products depends on their frequent usage. More research on probiotics and prebiotic products should be conducted, and individuals should be made aware of the issue.

Compliance with Ethical Standards

Conflict of interests: The author declares that for this article, they have no actual, potential, or perceived conflict of interest.

Ethics committee approval: Ethics approval was obtained with the meeting of Afyonkarahisar Health Sciences University Non-Interventional Clinical Research Ethics Committee dated 04.02.2022 and numbered 2022/2.

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