

A CROSS-SECTIONAL SURVEY TO DETERMINE TURKISH DENTAL PATIENTS' PROBIOTIC KNOWLEDGE, ATTITUDE, AND CONSUMPTION STATUS

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ABSTRACT

INTRODUCTION: Probiotics play a significant role in improving oral and dental health.

OBJECTIVES: This study aimed to determine the probiotic knowledge, attitude, and consumption status of Turkish adult patients, who underwent dental treatment at a dentistry faculty.

MATERIAL AND METHODS: This cross-sectional study included 509 participants, 281 females, and 228 males, who were 18 years of age or older. A printed face-to-face survey consisting of 18 questions was administered to patients. For statistical analyses, Kolmogorov-Smirnov, Shapiro-Wilk, Mann-Whitney *U*, and Kruskal-Wallis tests were used. *P*-values < 0.05 were considered statistically significant at a 95% confidence interval.

RESULTS: 78.4% of the participants were familiar with probiotics, but only 45.6% of them correctly knew its definition. Females had more probiotic awareness than males. The most common source of information about probiotics was the Internet. 23.8% of all participants were probiotic consumers, and 47.1% of participants who consumed probiotics were university graduates. 43.8% of female participants and 29.8% of males stated to use probiotics for gastrointestinal diseases, but only 11.4% of females and 8.3% of males claimed to use probiotics to support oral flora. Most of the participants consumed homemade yogurt/ ayran as a naturally fermented food. According to the participants, the most beneficial form of probiotics for oral and dental health was using it in the form of sachets or drops and natural foods, such as yogurt.

CONCLUSIONS: More public education is required concerning the awareness and benefits for oral and dental health as well as consumption of probiotics to improve the general health of individuals, especially oral and dental health.

KEY WORDS: awareness, knowledge, attitude, oral health, probiotics.

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INTRODUCTION

Currently, various studies are being conducted on the development and improvement of health in all aspects. The relationship between nutrition and health is well-known [1]. Antibiotic resistance, cancer, and allergic diseases are becoming more prevalent in adults, and require a search for alternative treatments and preven-

tion methods. Functional foods have an important role in these prevention methods and alternative treatments, and probiotics are one of these functional foods [2].

Gastrointestinal tract has the most intense colonization of the number of micro-organisms living within human bodies. The presence of micro-organisms that colonize and live in the human gastrointestinal tract is important for health [3].

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Probiotics are 'live micro-organisms, that when administered in sufficient amounts, provide a health benefit to the host'. Probiotics affect health positively by improving physiological functions and suppress the proliferation of pathogenic micro-organisms. Probiotics are useful in the treatment of various gastrointestinal systemic diseases, effective in delaying the onset of allergic reactions in children, and useful in the treatment and prevention of vaginal and urinary tracts infections in women. Several studies have shown positive effects of probiotics on acute diarrhea, lactose intolerance, lowering serum cholesterol level, regulating immune system, and various diseases, including helicobacter pylori infection and cancer [4-6].

Additionally, probiotics play a significant role in improving oral and dental health. By adhering to the mucosa and hard tissues of the teeth, oral probiotics compete with pathogens that cause plaque formation and can alter acid environment that leads to caries by regulating pH. Probiotics have also been demonstrated to possess positive effects by controlling the immune response of the host. According to studies, using mouthwash with beneficial bacteria, reduces dental plaque by 20%. Another study found that probiotics can kill the bacteria that cause halitosis by secreting sulfur compounds. Probiotics may even help to prevent oral cancer, according to studies in the field of cancer prevention [7-12].

The term 'probiotic' is not well-known or understood. Many studies have focused on the mechanism, by which probiotics demonstrate protective and therapeutic effects on diseases, but only few studies on probiotic awareness and consumption status among adults have been found in the literature.

OBJECTIVES

This study aimed to determine the probiotic knowledge, attitude, and consumption status of Turkish adult patients, who underwent dental treatment at a dentistry faculty.

MATERIAL AND METHODS

POPULATION AND STUDY DESIGN

In this cross-sectional study, participants were the patients who applied for dental treatment at the Altınbaş University Faculty of Dentistry between January and June 2022. Inclusion criteria were male and female patients aged 18 years or older, who were admitted to the dentistry faculty, and able to consent. Patients under the age of 18 and those who did not complete the survey were excluded from the study.

For power calculation of the present study, we performed an analysis using G*Power (v. 3.1.9) software

with $\alpha = 0.05$ and power $(1 - \beta) = 0.95$, to determine the sample size of data. As a result, 210 participants (105 each for males and females) were required for a significance level of 0.05 and a power of 95% CI. The effect size was calculated and determined to be 1.971. The study was conducted with 509 participants, who fit into the power analysis. All procedures were carried out in line with the Helsinki Declaration of 1975, as revised in 2000, and subsequent ethical standards of the institutional and national responsible committee on human experimentation. Ethics approval was obtained through the Clinical Research Ethical Committee of Altınbaş University (approval number: 2022/108).

The present study included 509 Turkish adults, 281 females and 228 males, who were 18 years of age or older. Age categories were 18-24 years, 25-30, 31-40, 41-50, 51-60, and over 60 years. A printed face-to-face survey was administered to the patients to determine their level of knowledge, attitude, and consumption status of probiotics.

SURVEY INSTRUMENT

The survey was anonymous and voluntary. After explaining the purpose of the study, each individual provided written informed consent. Patients who agreed to participate were asked to complete the questions on their own; study staff collected the completed surveys, and then reviewed them with participants, clarifying answers to avoid missing data.

After conducting an extensive literature review, the survey was modelled and modified based on those used in previously published studies on the knowledge of probiotics [3-6, 13-15]. This survey consisted of 18 questions, including multiple-choice, Likert scale, and response-free questions. The survey was composed of three parts. The first section consisted of demographic status of the participants (3 items), including gender, age, and education level. In section 2 (5 items), the respondents were first asked to grade their knowledge on probiotics on a 4-point Likert scale with the following grades: no knowledge (1), little knowledge (2), medium knowledge (3), and very good knowledge (4). Then, they were asked about the definition of probiotics, main source of probiotic information, perception of probiotic health benefits and medical condition(s) they knew probiotics have benefits. The third section of the survey (10 items) consisted of the participants' probiotic consumption experiences.

STATISTICAL ANALYSIS

Data were analyzed using IBM SPSS version 25 software and Microsoft Excel. A p -value of less than 0.05 ($p < 0.05$) was considered statistically significant. Descriptive statistics (mean, standard deviation [SD],

and percentages) were applied to describe quantitative and categorical study and outcome variables. In the study, Kolmogorov-Smirnov and Shapiro-Wilk normality tests were used. Since $p < 0.05$, normal distribution was not provided, and non-parametric tests were applied. Mann-Whitney U test was used for difference analysis for two groups, and Kruskal-Wallis test was used for groups of three or more. P -values < 0.05 were considered statistically significant at a 95% confidence interval.

RESULTS

DEMOGRAPHICS

The study included a total of 509 participants, 281 females (55.2%) and 228 males (44.8%). Most participants were between the ages of 31-40 (22.8%) and 41-50 (21.8%) years. In terms of educational status, most people were university (42.8%) and high school (30.3%) graduates (Table 1).

PARTICIPANTS' SELF-ASSESSMENT OF PROBIOTIC KNOWLEDGE

Using a 4-point Likert scale, the participants graded their level of probiotics knowledge on a four-point scale, with (1) meaning no knowledge, (2) little knowledge, (3) medium knowledge, and (4) very good knowledge. The majority of 509 participants, (37.3%; $n = 190$) stated

that they had a medium knowledge of what probiotics are. Of those, 58.9% ($n = 112$) were females and 41.1% ($n = 78$) were males, between the age group of 41-50 years (23.7%; $n = 45$), with an educational status of university graduate (51.6%; $n = 98$). There was a statistically significant difference between the knowledge of probiotics by gender and the education level ($p < 0.001$). Some participants rated their knowledge as very good (15.1%), others as little (25.9%), and the remaining (21.6%) had no knowledge of probiotics at all (Tables 2 and 3).

TABLE 2. Participants' probiotic knowledge parameters

Parameters	<i>n</i>	%	
Level of probiotics knowledge	No knowledge	110	21.6
	Little knowledge	132	25.9
	Medium knowledge	190	37.3
	Very good knowledge	77	15.1
Knowledge on the correct definition of probiotics	Yes	232	45.6
	No	277	54.4
Source of information on probiotics	Internet	252	49.5
	Medical journals/ books	75	14.7
	Pharmaceutical representative/ pharmacist	44	8.6
	Doctor/ dietician	60	11.8
	Conferences	19	3.7
	TV/ radio/ newspaper	97	19.1
	Magazine/ advertisement/ pamphlet	32	6.3
	Friend/ family member	126	24.8
	Other	5	1.0
	No idea	94	18.5
Perception of probiotics health benefits	Yes	363	71.3
	No	18	3.5
	No idea	128	25.2
Perceptions of medical condition(s), which probiotics are beneficial for	Allergic conditions	108	21.2
	Obesity	110	21.6
	Diabetes	99	19.4
	Cancer	91	17.9
	Viral upper respiratory infections	62	12.2
	Gastrointestinal diseases	200	39.3
	Oral hygiene/dental caries	120	23.6
	Depression/anxiety	55	10.8
	Autism	20	3.9
	Other	16	3.1
	No idea	122	24.0

TABLE 1. Descriptive analysis of demographics

Demographic data	<i>n</i>	%	
Gender	Female	281	55.2
	Male	228	44.8
	Total	509	100.0
Age group	18-24	103	20.2
	25-30	77	15.1
	31-40	116	22.8
	41-50	111	21.8
	51-60	72	14.1
	≥ 60	30	5.9
	Total	509	100.0
Educational status	Uneducated	9	1.8
	Primary school	48	9.4
	Secondary school	52	10.2
	High school	154	30.3
	University	218	42.8
	Master/ PhD	28	5.5
	Total	509	100.0

TABLE 3. Comparison of the level of probiotic knowledge by demographic data

Demographics		Do you know what a probiotic is?				p-value ^a
		No knowledge, n (%)	Little knowledge, n (%)	Medium knowledge, n (%)	Very good knowledge, n (%)	
Gender	Female	42 (38.2)	75 (56.8)	112 (58.9)	52 (67.5)	0.000*
	Male	68 (61.8)	57 (43.2)	78 (41.1)	25 (32.5)	
Total		110 (100.0)	132 (100.0)	190 (100.0)	77 (100.0)	
Age group	18-24	29 (26.4)	27 (20.5)	36 (18.9)	11 (14.3)	0.231
	25-30	14 (12.7)	23 (17.4)	27 (14.2)	13 (16.9)	
	31-40	26 (23.6)	32 (24.2)	42 (22.1)	16 (20.8)	
	41-50	21 (19.1)	29 (22.0)	45 (23.7)	16 (20.8)	
	51-60	12 (10.9)	14 (10.6)	27 (14.2)	19 (24.7)	
	≥ 60	8 (7.3)	7 (5.3)	13 (6.8)	2 (2.6)	
Total		110 (100.0)	132 (100.0)	190 (100.0)	77 (100.0)	
Educational status	Uneducated	3 (2.7)	3 (2.3)	3 (1.6)	-	0.000*
	Primary school	16 (14.5)	19 (14.4)	7 (3.7)	6 (7.8)	
	Secondary school	21 (19.1)	14 (10.6)	13 (6.8)	4 (5.2)	
	High school	35 (31.8)	42 (31.8)	56 (29.5)	21 (27.3)	
	University	34 (30.9)	49 (37.1)	98 (51.6)	37 (48.1)	
	Master/ PhD	1 (0.9)	5 (3.8)	13 (6.9)	9 (11.7)	
Total		110 (100.0)	132 (100.0)	190 (100.0)	77 (100.0)	

*p < 0.001; ^aKruskal-Wallis test

PARTICIPANTS' KNOWLEDGE OF THE CORRECT DEFINITION OF PROBIOTICS

The respondents then selected one of the following five definitions of probiotics: (1) Probiotics are dead micro-organisms that, when administered in sufficient amounts, provide health benefits to the host; (2) Probiotics are live micro-organisms, that when administered in sufficient amounts, provide a health benefit to the host; (3) Probiotics are all micro-organisms consumed with foods and dietary supplements; (4) Probiotics are all micro-organisms that adhere to intestinal

epithelial mucosa; (5) I do not know the definition of probiotics.

Only 45.6% ($n = 232$) of the participants correctly identified probiotics as answer 2: 'Probiotics are live micro-organisms that, when administered in sufficient amounts, provide a health benefit to the host' (Table 2).

SOURCES OF INFORMATION OF PROBIOTICS

The Internet was the most common source of information among the participants (49.5%; $n = 252$), followed by friend/ family member (24.8%) and TV/radio/

TABLE 4. The relationship between participants' probiotic awareness, probiotic definition knowledge, and probiotic consumption status

		Do you know what a probiotic is? (n)				Total	p-value ^a
		No	Little	Medium	Very good		
Participants' probiotic consumption status	Yes	6	19	63	33	121	0.000*
	No	104	113	127	44		
Total		110	132	190	77	509	
Participants' probiotic definition knowledge	No	98	83	71	25	277	0.000*
	Yes	12	49	119	52		
Total		110	132	190	77	509	

*p < 0.001; ^aKruskal-Wallis test

newspaper (19.1%) as the most frequently used sources of probiotics information (Table 3).

KNOWLEDGE AND PERCEPTION OF PARTICIPANTS OF PROBIOTICS HEALTH BENEFITS

Over half of the participants (71.3%; $n = 363$) stated that probiotics had beneficial effects on health. Most participants (39.3%; $n = 200$) claimed that probiotics had beneficial effect on gastrointestinal diseases. Probiotics support oral hygiene and prevent dental caries, according to only 23.6% ($n = 23.6$) of the participants (Table 3).

THE RELATIONSHIP BETWEEN PARTICIPANTS' PROBIOTIC AWARENESS, PROBIOTIC CONSUMPTION, AND KNOWLEDGE OF PROBIOTIC DEFINITION

While 78.4% ($n = 399$) of the 509 participants stated that they present varying levels of probiotics knowledge, only 28.8% ($n = 115$) mentioned that they consumed probiotics. There was a significant relationship between the groups of participants who were familiar with probiotics and the groups who consumed ($p < 0.001$). Only 220 (55.1%) of 399 participants who were familiar with probiotics correctly defined the term 'probiotic'. There was a significant relationship between the groups of participants who were familiar with probiotics and the groups who knew the correct definition of probiotics ($p < 0.001$) (Table 4).

PARTICIPANTS' EXPERIENCE OF PROBIOTICS CONSUMPTION

Of those consuming probiotics (23.8%; $n = 121$), 69.4% ($n = 84$) were females and 30.6% ($n = 37$) were males. The highest percentages of participants were those who were in the age group of 31-40 years with 24.8% ($n = 30$) and had a university degree, with 47.1% ($n = 57$). There was a statistically significant difference between probiotics consumption by gender and different educational level groups ($p < 0.05$) (Table 5).

Table 6 displays the evaluation of participants' probiotic consumption status and preferences by gender. 29.9% ($n = 84$) of the female and 16.2% ($n = 37$) of male participants responded, 'Yes' to the question 'Do/ did you consume probiotic drugs or supplements?'. The responses to the question show significant differences between gender groups ($p < 0.001$). The majority of the female (42%; $n = 42$) and male participants (33.9%; $n = 19$) responded, 'Health problems' to the question 'If yes, what factors affect your probiotics consumption?'. The responses to the question show no significant differences between gender groups ($p > 0.05$).

Most of the female (87.7%; $n = 93$) and male (74.6%; $n = 44$) participants responded, 'Yes' to the question 'If yes, were probiotics beneficial to you?'. The responses to the question show significant differences between gender groups ($p < 0.05$).

Females (44.5%; $n = 125$) and males (27.2%; $n = 62$) mostly responded, 'Improve immune function' to the question 'In which of the following medical condition(s) do/did you take probiotics?'. The responses to the question show significant differences between gender groups ($p < 0.001$). Of the participants who used probiotics to support oral flora, 11.4% ($n = 32$) were females and 8.3% ($n = 19$) were males. There was no statistically significant difference between gender and the answers ($p > 0.05$).

The female (37%; $n = 104$) and male (53.1%; $n = 121$) participants mostly responded, 'Never' to the question 'How often do you consume probiotics?'. There was a statistically significant difference between gender and the answers ($p < 0.001$).

45.2% ($n = 127$) of the female and 32.9% ($n = 75$) of male participants responded, 'Naturally fermented foods' to the question 'Which kind of probiotic would you prefer to use?'. Females (73.3%; $n = 206$) and males (55.3%; $n = 126$) mostly responded, 'Home-made yogurt/ ayran' to the question 'Which naturally fermented food(s) do you consume?'. Females (43.1%; $n = 121$) and males (31.1%; $n = 71$) mostly responded, 'Branded yogurt/

TABLE 5. Evaluation of participants' probiotic consumption according to demographic data

Demographic data		Do you consume probiotics?		
		Yes <i>n</i> (%)	No <i>n</i> (%)	<i>p</i> -value ^b
Gender	Female	84 (69.4)	197 (50.8)	0.000*
	Male	37 (30.6)	191 (49.2)	
Total		121 (100.0)	388 (100.0)	
Age group	18-24	18 (14.9)	85 (21.9)	0.196
	25-30	20 (16.5)	57 (14.7)	
	31-40	30 (24.8)	86 (22.2)	
	41-50	24 (19.8)	87 (22.4)	
	51-60	21 (17.4)	51 (13.1)	
	≥ 60	8 (6.6)	22 (5.7)	
Total		121 (100.0)	388 (100.0)	
Educational status	Uneducated	1 (0.8)	8 (2.1)	0.015*
	Primary school	7 (5.8)	41 (10.6)	
	Secondary school	9 (7.4)	43 (11.1)	
	High school	37 (30.6)	117 (30.2)	
	University	57 (47.1)	161 (41.5)	
	Master/ PhD	10 (8.3)	18 (4.7)	
Total		121 (100.0)	388 (100.0)	

* $p < 0.05$; ^bMann-Whitney *U* test; *n* - number of participants

TABLE 6. Evaluation of participants' responses to probiotic consumption status and preferences by gender

Parameters		Female		Male		p-value ^b
		n	%	n	%	
Participants' consumption of probiotics	Yes	84	29.9	37	16.2	0.000*
	No	197	70.1	191	83.8	
Factors affecting participants' consumption of probiotics	Advertisement	10	10.0	13	23.2	0.489
	Health problem	42	42.0	19	33.9	
	Recommendation	36	36.0	12	21.4	
	Other	12	12.0	12	21.4	
Participants' probiotics benefit status	Yes	93	87.7	44	74.6	0.031*
	No	13	12.3	15	25.4	
Participants' reasons for taking probiotics	Gastrointestinal disease	123	43.8	68	29.8	0.001*
	Preventing during antibiotic treatment	30	10.7	9	3.9	0.005*
	Improve immune function	125	44.5	62	27.2	0.000*
	Reduce allergic conditions	30	10.7	16	7.0	0.153
	Maintain a good gastrointestinal system	106	37.7	56	24.6	0.002*
	Weight loss or management	46	16.4	21	9.2	0.018*
	Cancer prevention	30	10.7	18	7.9	0.236
	Support oral flora	32	11.4	19	8.3	0.254
	Viral upper respiratory infections prevention	16	5.7	8	3.5	0.248
	Cardiovascular diseases prevention	8	2.8	8	3.5	0.671
	Other reasons	8	2.8	5	2.2	0.642
	No idea	32	11.4	40	17.5	0.048*
	Refused	54	19.2	54	23.7	0.221
	Participants' probiotic consumption frequency	Daily	38	13.5	11	4.8
Once a week		26	9.3	18	7.9	
A few times a month		24	8.5	14	6.1	
After using antibiotics		7	2.5	-	-	
If necessary		82	29.2	64	28.1	
Never		104	37.0	121	53.1	
Participants' probiotic preference	Naturally fermented foods	127	45.2	75	32.9	0.005*
	Food supplements	81	28.8	50	21.9	0.077
	Refused	98	34.9	98	43.0	0.062
Natural fermented foods preference of participants	Home-made yogurt/ ayran	206	73.3	126	55.3	0.000*
	Kefir	124	44.1	85	37.3	0.119
	Home-made pickle	154	54.8	85	37.3	0.000*
	Vinegar	108	38.4	50	21.9	0.000*
	Turnip	108	38.4	50	21.9	0.842
	Bread made with sourdough	108	38.4	50	21.9	0.103
	Turkish boza	44	15.7	29	12.7	0.347
	Bitter chocolate	44	15.7	29	12.7	0.016*
	Other	3	1.1	2	0.9	0.829
	None	7	2.5	10	4.4	0.237
	Refused	28	10.0	39	17.1	0.018*

TABLE 6. Cont.

Parameters		Female		Male		p-value ^b
		n	%	n	%	
Participants' food supplement preferences	Sachets/ powder	36	12.8	10	4.4	0.001*
	Capsules/ tablets	41	14.6	24	10.5	0.172
	Lozenge	24	8.5	16	7.0	0.526
	Branded yogurt/ kefir	121	43.1	71	31.1	0.006*
	Drops/ liquid	13	4.6	7	3.1	0.369
	Vitamin/ incorporated into food	45	16.0	34	14.9	0.733
	Other	3	1.1	4	1.8	0.509
	Refused	77	27.4	81	35.5	0.049*
Physician's recommendation of probiotics with antibiotics	Yes	40	14.2	30	13.2	0.726
	No	241	85.8	198	86.8	

* $p < 0.05$; ^bMann-Whitney U test; n - number of participants

kefir' to the question 'If you were to use probiotics, which kind of food supplement(s) would you prefer?'. There was a statistically significant difference between gender and the answers ($p < 0.05$).

Most of the female (85.8%; $n = 241$) and male (86.8%; $n = 198$) participants responded, 'No' to the question 'Did a physician recommend you personally to take probiotics with antibiotics?'. There was no statistically significant difference between gender and the answer ($p > 0.05$).

PARTICIPANTS' CONSUMPTION STATUS OF USING PROBIOTICS TO SUPPORT ORAL FLORA

Only 51 (12.8%) of the 399 participants who consumed probiotics stated that they took probiotics to support oral flora, with 62.7% ($n = 32$) females and 37.3% ($n = 19$) males. There was no statistically significant difference between the response groups by gender ($p > 0.05$) (Table 6).

In terms of distribution of the participants by age groups, there were 10 participants in each of the age groups: 18-24 years (19.6%), 25-30 (19.6%), 31-40 (19.6%), and 41-50 (19.6%). There were only seven participants between the ages of 51 and 60 (13.7%), and four over the age of 60 (7.8%). In terms of educational status, most people were university (45.1%; $n = 23$) and high school (33.3%; $n = 17$) graduates (Table 7).

While most of the participants (35.8%; $n = 182$) responded, 'No idea' to the question 'Which form of probiotics can be more beneficial for oral and dental health?', other participants' responses to this question were as follows: 24.8% ($n = 126$) 'Incorporated into natural foods, such as yogurt in the form of sachets or drops'; 14.3% ($n = 73$) 'Lozenge/ pastille'; 13.4% ($n = 68$) 'Incorporated into toothpaste'; 8.6% ($n = 44$) 'Incorporated into mouth rinse solution'; 2.0% ($n = 20$) 'Incorporated into natural oils'; 1.2% ($n = 6$) 'Other' (Table 8).

DISCUSSION

In studies investigating individual's awareness of probiotics, those who claimed they know about probiotics constituted the awareness incidence. These studies, however, do not reveal how many individuals who claimed to be familiar with probiotics knew the correct definition. Therefore, in our study, we investigated how many of the adult patients were familiar with probiotics' correct definition.

The sample size of the study was 509 participants. While 78.4% ($n = 399$) of all participants of our study

TABLE 7. Demographic data of participants using probiotics to support oral flora

Demographic data		n	%
Gender	Female	32	62.7
	Male	19	37.3
	Total	51	100.0
Age group	18-24	10	19.6
	25-30	10	19.6
	31-40	10	19.6
	41-50	10	19.6
	51-60	7	13.7
	≥ 60	4	7.8
	Total	51	100.0
	Educational status	Uneducated	1
Primary school		1	2.0
Secondary school		5	9.8
High school		17	33.3
University		23	45.1
Master/ PhD		4	7.8
Total		51	100.0

TABLE 8. Participants' opinions on which forms of probiotics are the most effective for improving oral and dental health

Probiotic form	n	%
Lozenge/ pastille	73	14.3
Incorporated into toothpaste	68	13.4
Incorporated into mouth rinse solution	44	8.6
Incorporated into natural foods, such as yogurt in the form of sachets or drops	126	24.8
Incorporated into natural oils (avocado and coconut oil, etc.)	10	2.0
Other	6	1.2
No idea	182	35.8

were familiar with probiotics at varying levels, only 45.6% ($n = 232$) of them correctly defined probiotics (Table 2). In addition, only 55.1% ($n = 220$) of 399 participants, who had varying levels of knowledge about probiotics knew its definition correctly. There was a statistically significant correlation between those who claimed to be familiar with probiotics and those who knew the correct definition (Table 4).

The results of the studies on individuals' knowledge of the probiotics vary. Stanczak and Heuburger [1] reported that 38.5% of 335 American adults had heard of probiotics before, but only 27.2% knew what probiotics are. Babajimopoulos *et al.* [16] observed that only 24% of participants in their study were familiar with the term 'probiotic'. There are also studies on probiotic knowledge showing high awareness results. Payahoo *et al.* [17] reported that 83% of medical sciences students correctly defined the term 'probiotic'. Also, Oliver *et al.* [18] observed that 88% of participants were aware of the term 'probiotic'. Our findings on probiotic awareness were consistent with the studies of Payahoo *et al.* [17] and Oliver *et al.* [18].

In the present study, 47% ($n = 239$) of 399 individuals with probiotic knowledge were females, while 31.4% ($n = 160$) were males. Females had more probiotic awareness than males. There were significant differences in probiotic awareness levels in terms of gender (Table 3). Al-Nabulsi *et al.* [19] reported that female students presented higher levels of knowledge about probiotics than male students, which is similar to our findings.

According to Al-Nabulsi *et al.* [19], there were no statistically significant differences between age groups, education levels, and students' probiotic knowledge. Babajimopoulos *et al.* [16] and Al-Muammar *et al.* [20] reported that individuals with higher education levels had a significantly higher level of probiotic knowledge than those with lower education levels. Similar findings were obtained by Schultz and Lindstroem [21].

Source of information also has an impact on the participants' probiotic awareness and consumption. In our study, it was determined that the most common source

of information about probiotics was the Internet (49.5%) (Table 2). For this reason, social media should be used more effectively when informing about probiotics and their positive effects on human health. In a study of Al-Muammar *et al.* [20], it was found that 54% of individuals had their information from advertisements, and about 20% from newspapers and magazines. Only 9% of participants had their information from the Internet.

In our study, health problems (39.1%) were found to be the main factor affecting participants' consumption of probiotics (Table 6). Advertisements, recommendations, and other factors had an impact on consumers' behavior. We can conclude that the mainstays of probiotic consumption are the increase in studies on how probiotics maintain intestinal microbial balance and recurring mention of their effects on the digestive system in probiotic products' advertisements. According to a recent study by Schultz *et al.* [22], most consumers had received probiotic supplement recommendations from friends, doctors, and the media, with 80% of non-users saying they would use probiotics under physician's recommendation.

While 78.4% ($n = 399$) of the participants in our study stated they had some knowledge about probiotics, only 28.8% ($n = 115$) revealed they were probiotic consumers. A statistically significant relationship was observed between those who had knowledge on probiotics and consumed probiotics (Table 4). When we compared probiotic consumption in similar studies, we noticed that the results vary. In a Stanczak and Heuburger [1] survey, only 43.9% of consumers defined probiotics correctly. According to Babajimopoulos *et al.* [16] and Schultz *et al.* [22], probiotics were consumed by 60.2%, and 25.4% of study participants, respectively. Moreover, in Babajimopoulos *et al.* [16] study, about 76% of consumers were not familiar with the term 'probiotic'.

In the present study, probiotics consumption rates were 16.2% ($n = 37$) for males and 29.9% ($n = 84$) for females (Tables 5 and 6). Females show greater importance of their health, nutrition, and physical appearance than males, which may explain why they consume probiotic products more and at higher rates than males. There were no age-related differences in the consumption of probiotics.

However, 47.1% ($n = 57$) of the participants, who consumed probiotics ($n = 121$) were university graduates (Table 5). We concluded that higher education levels significantly increase probiotics consumptions of the individuals.

When the participants' perceptions about the effects of probiotics on health were evaluated, 71.3% ($n = 363$) stated probiotics were had a good effect on health, while 39.3% ($n = 200$) assumed probiotics were effective in gastrointestinal diseases (Table 2). Participants in our study also stated that they primarily used probiotics to improve their gastrointestinal health (37.5%; $n = 191$) (Table 6). The most common reason for consuming probiotics was that participants agreed it was beneficial

to the gastrointestinal system, which is consistent with findings of related studies [22].

Probiotics have beneficial effects on the digestive system by regulating microbial balance of the gastrointestinal tract. Studies show a strong correlation between diet, lifestyle, and changes in gut microbiota composition and colon cancer. Although it is unclear how the intestinal microbiota influences the development of colon cancer, it is reported that inflammation caused by imbalance in the microbiota increases the risk of colon cancer [23].

Probiotic micro-organisms have been shown in studies to have an impact on several diseases. According to Schultz *et al.* [22], 5.9% of individuals with immune system diseases and 45.1% with gastrointestinal disorders benefited from consuming probiotics. Another study reported that 29.05% of those who consumed probiotics had lower cholesterol levels, and 28.33% showed relief of diarrhea [24].

Probiotics have traditionally been associated with gut health, and most clinical interest has been focused on their use for the prevention or treatment of gastrointestinal infections and diseases. However, in the last decade, several scientists have suggested the use of probiotics for oral and dental health. Probiotics protect the mouth and teeth by forming a biofilm barrier that acts as a barrier against germs and bacteria, which damage oral and dental health and cause infections. Moreover, probiotics prevent the spread of dangerous bacteria. In our study, 23.6% ($n = 120$) of the participants stated that they assumed probiotics were useful for maintaining oral health and preventing dental caries (Table 2).

Probiotics have been shown to improve oral and gastrointestinal health when consumed in the form of yogurts and lozenges. These probiotics function through a variety of mechanisms, such as the production of bacteriocin-like inhibitory substances, pH changes in the local environment, nutrient competition, formation of physical barriers, and immune system stimulation [25-29]. Probiotics are recognized by the World Health Organization as a significant avenue of health preservation if current antibiotics become ineffective due to the development of bacterial resistance [30].

In our study, 44.2% ($n = 225$) of all participants ($n = 509$) responded 'Never' to the question 'How often do you consume probiotics?'. 29.2% ($n = 82$) of the female participants and 28.1% ($n = 64$) of the male participants responded to the question 'If necessary'.

Participants stated that they preferred to consume probiotics in the form of naturally fermented foods (39.7%; $n = 202$), homemade yogurt/ayran (65.2%; $n = 332$), home-made pickles (47%; $n = 239$), and branded yogurt/kefir (37.7%; $n = 192$). The percentage of those who were recommended to take probiotics with antibiotics by their physician was 86.3% ($n = 439$) (Table 6). Many studies have also concluded that probiotic yogurt is the most consumed probiotic food [15]. In a study of

Kaysoglu and Icoz [31], 90.7% of students responded that they consume yogurt as a probiotic food. We can say that probiotic yogurt is the most consumed probiotic food in studies because it is the most easily accessible traditional food. Kefir consumption has only recently started to be investigated, and is currently arising at a very slow rate.

In the current study, 10.02% ($n = 51$) of participants stated that they used probiotics to support oral flora. 62.7% ($n = 32$) of the 51 participants were females and 37.3% ($n = 19$) were males. In terms of education level, 45.1% ($n = 23$) were university graduates. Of the participants, 19.6% ($n = 10$) were in the age category of 18-24, 25-30, 31-40, and 41-50 years (Table 7).

Faden *et al.* [3] conducted a study among 600 participants to assess their knowledge, attitudes, and awareness of the oral benefits of probiotics. It was reported that participants in this study presented good knowledge, awareness, and attitudes about probiotics and their importance in dentistry.

In our study, 35.8% ($n = 182$) of the participants stated that they had no idea which form of probiotics may be more effective for oral and dental health. 24.8% ($n = 126$) of the participants recognized probiotics may be effective if they were added to natural foods, such as yogurt in sachet or drop forms (Table 8).

In recent years, several authors have suggested that probiotic bacteria intended for gut health may also be beneficial for oral health. Consumption of products containing probiotic lactobacilli has been shown in previous studies to successfully reduce caries risk and the number of mutans streptococci in the oral cavity [7, 32].

LIMITATIONS OF THE STUDY

This study had some limitations. The study's sample size was restricted to one center only, which limits the generalization of the results. Additionally, the participants' histories of chronic diseases were not assessed in the survey.

CONCLUSIONS

Probiotics with their both protective and beneficial effects on health, are not widely consumed due to a lack of knowledge about them. More public education is required concerning the awareness, benefits for oral and dental health as well as consumption of probiotics to improve the general health of individuals, especially oral and dental health.

CONFLICT OF INTERESTS

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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