

## ORIGINAL RESEARCH

# Parental knowledge and consumption of probiotics: a cross-sectional study in a pediatric dentistry clinic in Turkey

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**Abstract**

**Background:** This study aimed to assess parental knowledge and consumption habits regarding probiotic products in a paediatric dentistry setting. **Methods:** A 23-item questionnaire was administered to 352 parents who visited the Mersin University Paediatric Dentistry Clinic between October 2023 and March 2024. Power analysis was conducted using the GPower 3.1 package program with a 95% confidence level, a medium effect size, and an 80% power value. Data were analysed using IBM SPSS Statistics V23. **Results:** Parental knowledge of probiotics increased significantly with educational level, with mothers demonstrating higher awareness than fathers ( $p < 0.001$ ). Most parents identified probiotics as beneficial ( $p = 0.006$ ), primarily for digestive and intestinal health, while many also recognized their positive effects on oral health, particularly in preventing dental caries. Parents were indecisive regarding the co-administration of probiotics with antibiotics. Most parents reported giving their children probiotic products once a day, with a lack of knowledge being cited as the main reason for non-use. Brand and content were the most influential factors in purchasing decisions. Yoghurt was the most commonly given probiotic food, followed by kefir and pickles, with a greater preference observed among more educated parents. **Conclusions:** Despite the growing interest in probiotics, parents' knowledge of their oral and dental health effects and their use in conjunction with antibiotics is limited. The fact that probiotic use depends on knowledge, and that awareness increases with higher education levels, highlights the need to raise parental awareness and education about the health benefits of probiotics.

**Keywords**

Dentistry; Probiotics; Pediatrics; Knowledge; Consumption

## 1. Introduction

In recent years, as public awareness of healthy nutrition has increased, expectations have extended beyond basic nutritional needs, leading to a rise in the consumption of functional foods, which are rapidly evolving within the food industry [1]. Among these, products containing probiotics have gained increasing popularity [2]. With the global population expanding rapidly, preventive healthcare has become a greater priority than curative approaches. As a result, research on probiotics—known for their protective health benefits—has intensified, and various probiotic-containing products, such as capsules, powders, milk, yogurt, buttermilk, kefir, and cheese, are now widely available on the market [3].

Probiotics are live microbial components that, when consumed in adequate amounts, confer health benefits to the host by modulating the gut microflora. The most common probiotic microorganisms include *Lactobacillus*, *Bifidobacterium*, and *Enterococcus* [4]. These

microorganisms have been shown to prevent the growth and proliferation of pathogens, strengthen the immune system, alleviate lactose intolerance, regulate cholesterol, and exhibit antimicrobial and antimutagenic effects. Furthermore, their influence extends to the oral environment, the upper respiratory tract, and the mucosal surfaces of the digestive and reproductive systems [5].

The oral microbiome represents a critical component of the human microbiota. Recent studies have increasingly explored the link between oral microbiota and the pathogenesis of both oral and systemic diseases [6]. The balance of host-microbe interactions in the oral cavity, a complex and dynamic ecosystem of microorganisms that interact symbiotically with human hosts, is essential for maintaining host health. While antimicrobial agents such as chlorhexidine, triclosan, and antibiotics are commonly used in the treatment of oral diseases, their application has been associated with the development of antimicrobial resistance, adverse effects, and the elimination of beneficial microorganisms alongside

pathogenic ones. Dental caries, in particular, is a result of dysbiosis in the oral microbiome. Therefore, there is a need for alternative therapeutic strategies aimed at restoring oral microbiota balance, including biotic supplements such as prebiotics, probiotics, synbiotics, and postbiotics, which hold promise for the prevention and treatment of oral diseases [7]. Probiotics contribute to oral health by reducing the number of pathogenic microorganisms in the oral cavity [8]. Their effects have been associated with reduced colony formation of cariogenic bacteria, the prevention of periodontal infections, the production of bioactive substances such as lactic acid, hydrogen peroxide, and bacteriocins, as well as the modulation of inflammatory responses [9]. It has been reported that probiotics can inhibit the growth of *Streptococcus mutans* (*S. mutans*) [10]. Additionally, probiotic dairy products have been shown to alter the oral microbiota and influence the development of dental caries in children [11].

Over the past decade, interest in probiotics has grown substantially, accompanied by a significant increase in scientific research [12]. The literature supports the public health benefits of probiotic use, particularly in reducing the risk of chronic disease. However, limited consumer knowledge about probiotics remains a barrier to their widespread adoption [13]. Although existing studies on parents' knowledge and use of probiotics are available in Turkey, the majority of these are concentrated within the field of medicine or other fields [14]. In Turkey, there is a scarcity of studies examining the level of knowledge and consumption of probiotics in the field of dentistry. It has been established that there is a correlation between the oral health literacy level of parents and the oral health of their children, and that the risk of developing tooth decay is higher in children of parents with low oral health literacy [15].

Therefore, this study aimed to assess the knowledge and consumption patterns of probiotic products among parents visiting the Department of Pediatric Dentistry at Mersin University Faculty of Dentistry. The null hypothesis of the study was the absence of significant differences in parents' knowledge and consumption according to the degree of relationship and educational status.

## 2. Materials and methods

This cross-sectional study was conducted among parents aged 18–70 years who visited the Paediatric Dentistry Clinic at Mersin University for their children's dental examinations between October 2023 and March 2024. The study was approved by the Mersin University Clinical Research Ethics Committee (Date: 20 September 2023; Approval No: 2023/629) and was conducted in accordance with the Declaration of Helsinki. It also adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

A total of 352 parents (221 mothers and 131 fathers) who met the inclusion criteria and voluntarily agreed to participate were included in the study. All participants provided informed consent and had no comprehension or speech difficulties. The questions in this survey were prepared by examining relevant studies in the literature and revised according to the opinions of experts (1, 4, 13). The survey consisted of 23 questions: 4 demographic questions and 19 questions assessing knowl-

edge and consumption of probiotic products (**Supplementary material**). For standardization, all surveys were administered through face-to-face interviews by the same clinician. This cross-sectional study design was chosen to provide a general overview of existing knowledge, attitudes, and consumption by capturing the current situation through data collection from a large sample at a specific point in time.

The content validity of the questionnaire was assessed using a 5-point Likert scale and evaluated by three independent experts via email. Based on their feedback, the questions were revised and finalized. To determine reliability, the test-retest method was employed, and Cronbach's alpha coefficient was calculated. Values between 0.70 and 1.00, with a median value of 0.82, were considered indicative of acceptable reliability.

Inclusion criteria were: age between 18 and 70 years, biological parent (mother or father) of the child receiving treatment, no comprehension or speech difficulties, and voluntary participation. Exclusion criteria encompassed: age <18 or >70 years, comprehension or speech difficulties, individuals accompanying the child other than the mother or father, and refusal to participate. The wide age range was chosen to account for cultural variations in parental age within the local population.

Power analysis was conducted using the G\*Power 3.1 package program (Heinrich Heine University Düsseldorf, Düsseldorf, NRW, Germany) with a 5% margin of error, a 95% confidence level, a medium effect size, and an 80% power value. Data analysis was conducted using IBM SPSS Statistics version 23 (IBM Corp., Armonk, NY, USA). Categorical variables were analysed using Pearson's chi-square test and Yates' continuity correction where appropriate. For results that were statistically significant in the chi-square analysis, multiple comparisons of proportions were conducted using the Bonferroni-adjusted Z test. In this process, the SPSS software automatically applies the Bonferroni correction and presents the results through letter-based groupings. Statistical significance was set at  $p < 0.05$ .

## 3. Results

Demographic information about the parents is shown in Table 1.

Significant differences were observed in parental knowledge and perceptions of probiotics, as shown in Table 2. Specifically, there were statistically significant differences between "yes" and "no" responses regarding awareness of the term "probiotic" ( $p = 0.009$ ), beliefs about the health benefits of probiotic products ( $p = 0.006$ ), the likelihood of recommending probiotic products to others ( $p = 0.015$ ), and willingness to receive educational training about probiotics ( $p = 0.048$ ). Additionally, a significant difference was found in the sources from which probiotic products were purchased, particularly between the options "from the market" and "I produce it myself" ( $p = 0.011$ ).

Parents' educational levels were significantly associated with their knowledge and perceptions of probiotics, as shown in Table 3. A notable difference was observed in understanding the term "probiotic" between those with a high school education or less and those with a university degree

**TABLE 1. Demographic information of parents.**

	Frequency	Percentage
The relationship		
Mother	221	62.8
Father	131	37.2
Age (yr)		
Under 30	34	9.7
30–39	154	43.8
40–49	148	42.0
50–59	15	4.3
60–70	1	0.3
Number of children		
1	28	8.0
2	134	38.1
3	112	31.8
More than 3	78	22.2
Educational background		
Illiterate	11	3.1
Primary education	95	27.0
Secondary education	47	13.4
High school	104	29.5
University	90	25.6
PhD	5	1.4

**TABLE 2. The relationship between the degree of relationship of parents and their level of knowledge and consumption status.**

	The degree of relationship		Test Statistics	<i>p</i>	Effect Size
	Mother	Father			
Knowing the meaning of the word “probiotic”					
Yes	129 (58.4) <sup>a</sup>	59 (45.0) <sup>b</sup>	9.392	0.009 <sup>1</sup>	0.163
No	67 (30.3) <sup>a</sup>	61 (46.6) <sup>b</sup>			
Indecisive	25 (11.3)	11 (8.4)			
Finding probiotic products beneficial for health					
Yes	157 (71.0) <sup>a</sup>	78 (59.5) <sup>b</sup>	10.345	0.006 <sup>1</sup>	0.171
No	5 (2.3) <sup>a</sup>	12 (9.2) <sup>b</sup>			
Indecisive	59 (26.7)	41 (31.3)			
If the answer is “Yes”, the topic/s that are thought to be beneficial ~					
Digestive system and intestinal health	123 (78.3)	52 (67.5)	11.379	0.077 <sup>1</sup>	
Protective against allergy and infection	38 (24.2)	13 (16.9)			
Immune system strengthener	108 (68.8)	50 (64.9)			
Protective against cancer	33 (21.0)	7 (9.1)			
Cardiovascular health	22 (14.0)	8 (10.4)			
Other	16 (10.2)	10 (13.0)			

TABLE 2. Continued.

	The degree of relationship		Test Statistics	<i>p</i>	Effect Size
	Mother	Father			
Thinking that probiotic products affect oral and dental health					
Yes	129 (58.4)	67 (51.1)	1.761	0.415 <sup>1</sup>	
No	21 (9.5)	14 (10.7)			
Indecisive	71 (32.1)	50 (38.2)			
If the answer is "Yes", the issue/s that are thought to affect oral and dental health ~					
Tooth decay	77 (57.9)	37 (53.6)	1.656	0.948 <sup>1</sup>	
Halitosis	43 (32.3)	23 (33.3)			
Eliminating tooth sensitivity	39 (29.3)	18 (26.1)			
Tooth whitening	18 (13.5)	6 (8.7)			
Gum diseases	72 (54.1)	37 (53.6)			
Other	16 (12.0)	9 (13.0)			
Finding it beneficial to use probiotic products together with antibiotics					
Yes	48 (21.9)	26 (19.8)	0.680	0.712 <sup>1</sup>	
No	71 (32.4)	48 (36.6)			
Indecisive	100 (45.7)	57 (43.5)			
Thinking that social media has an impact on probiotic food consumption					
Yes	119 (53.8)	61 (46.6)	5.073	0.079 <sup>1</sup>	
No	47 (21.3)	42 (32.1)			
Indecisive	55 (24.9)	28 (21.4)			
Giving probiotic food to the child					
Yes	160 (72.4)	90 (68.7)	0.546	0.460 <sup>1</sup>	
No	61 (27.6)	41 (31.3)			
If the answer is "Yes", the reason/s for the answer ~					
Finding it delicious	16 (9.9)	21 (23.3)	12.370	0.054 <sup>1</sup>	
Advertisements	6 (3.7)	3 (3.3)			
Finding it beneficial for health	139 (86.3)	70 (77.8)			
Education received	12 (7.5)	8 (8.9)			
Environmental advice	17 (10.6)	13 (14.4)			
Other	11 (6.8)	7 (7.8)			
If the answer is "No", the reason/s for the answer ~					
Not knowing what it is	38 (62.3)	18 (43.9)	5.062	0.536 <sup>1</sup>	
Finding it expensive	7 (11.5)	5 (12.2)			
Disliking the taste	4 (6.6)	2 (4.9)			
Not needing	5 (8.2)	6 (14.6)			
Not finding natural	8 (13.1)	5 (12.2)			
Other	10 (16.4)	9 (22.0)			
The most preferred probiotic food for children ~					
Yogurt	178 (80.5)	106 (81.5)	3.595	0.609 <sup>1</sup>	
Cheese	83 (37.6)	55 (42.3)			
Kefir	35 (15.8)	28 (21.5)			
Pickle	53 (24.0)	28 (21.5)			
Other	15 (6.8)	6 (4.6)			

TABLE 2. Continued.

	The degree of relationship		Test Statistics	<i>p</i>	Effect Size
	Mother	Father			
Frequency of giving probiotic food/s to the child ~					
1 time per day	148 (67.6)	71 (56.3)			
1 time per week	14 (6.4)	14 (11.1)			
2–3 times per week	48 (21.9)	34 (27.0)	7.906	0.162 <sup>1</sup>	
1 time per month	3 (1.4)	2 (1.6)			
Other	10 (4.6)	6 (4.8)			
Criteria for buying probiotic products ~					
Brand-content	113 (52.8)	59 (46.5)			
Taste	74 (34.6)	50 (39.4)			
Price	28 (13.1)	24 (18.9)	4.488	0.611 <sup>1</sup>	
Design	5 (2.3)	2 (1.6)			
Suggest	37 (17.3)	21 (16.5)			
Other	36 (16.8)	20 (15.7)			
Place of buying probiotic products ~					
Market	122 (56.2) <sup>a</sup>	93 (71.5) <sup>b</sup>			
Internet	7 (3.2)	6 (4.6)			
Acquaintance/relative	54 (24.9)	30 (23.1)	14.956	0.011 <sup>1</sup>	
Self-production	95 (43.8) <sup>a</sup>	40 (30.8) <sup>b</sup>			
Other	12 (5.5)	5 (3.8)			
Storage of probiotic products ~					
Refrigerator	200 (92.6)	117 (90.0)			
Cupboard	13 (6.0)	12 (9.2)	2.296	0.681 <sup>1</sup>	
I don't keep it, I consume it immediately	26 (12.0)	13 (10.0)			
Other	5 (2.3)	3 (2.3)			
Giving probiotic product supplements (powder, drops, capsules, <i>etc.</i> ) to the child					
Yes	26 (11.9)	18 (13.7)			
No	193 (88.1)	113 (86.3)	0.118	0.731 <sup>2</sup>	
Thinking that there is sufficient information about probiotic products in our country					
Yes	35 (15.9)	15 (11.5)			
No	135 (61.4)	95 (72.5)	4.526	0.104 <sup>1</sup>	
Indecisive	50 (22.7)	21 (16.0)			
Recommending probiotic products to people around you					
Yes	176 (80.7) <sup>a</sup>	90 (68.7) <sup>b</sup>			
No	8 (3.7) <sup>a</sup>	13 (9.9) <sup>b</sup>	8.411	0.015 <sup>1</sup>	0.155
Indecisive	34 (15.6)	28 (21.4)			
Wanting to receive informational training about probiotic products					
Yes	110 (50.2) <sup>a</sup>	50 (38.2) <sup>b</sup>			
No	60 (27.4) <sup>a</sup>	51 (38.9) <sup>b</sup>	6.057	0.048 <sup>1</sup>	0.132
Indecisive	49 (22.4)	30 (22.9)			

<sup>1</sup>Pearson Chi-Square Test; <sup>2</sup>Yates Correction; <sup>a,b</sup>: There is no difference between degrees of proximity with the same letter; ~: Multiple Response.

**TABLE 3. The relationship between parents' educational status, knowledge level, and consumption status.**

		Educational Status		Test Statistics	<i>p</i>	Effect Size
		High school and under	University and higher			
Knowing the meaning of the word "probiotic"						
Mother	Yes	82 (49.7) <sup>a</sup>	47 (83.9) <sup>b</sup>	22.057	<0.001 <sup>1</sup>	0.360
	No	63 (38.2) <sup>a</sup>	4 (7.1) <sup>b</sup>			
	Indecisive	20 (12.1)	5 (8.9)			
Father	Yes	31 (33.7) <sup>a</sup>	28 (71.8) <sup>b</sup>	16.954	<0.001 <sup>1</sup>	0.349
	No	53 (57.6) <sup>a</sup>	8 (20.5) <sup>b</sup>			
	Indecisive	8 (8.7)	3 (7.7)			
Finding probiotic products beneficial for health						
Mother	Yes	108 (65.5) <sup>a</sup>	49 (87.5) <sup>b</sup>	10.112	0.006 <sup>1</sup>	0.261
	No	4 (2.4)	1 (1.8)			
	Indecisive	53 (32.1) <sup>a</sup>	6 (10.7) <sup>b</sup>			
Father	Yes	49 (53.3)	29 (74.4)	5.340	0.069 <sup>1</sup>	
	No	9 (9.8)	3 (7.7)			
	Indecisive	34 (37.0)	7 (17.9)			
If the answer is "Yes", the topic/s that are thought to be beneficial ~						
Mother	Digestive system and intestinal health	81 (75.0)	42 (85.7)	13.038	0.042 <sup>1</sup>	
	Protective against allergy and infection	21 (19.4) <sup>a</sup>	17 (34.7) <sup>b</sup>			
	Immune system strengthener	72 (66.7)	36 (73.5)			
	Protective against cancer	19 (17.6)	14 (28.6)			
	Cardiovascular health	18 (16.7)	4 (8.2)			
	Other	13 (12.0)	3 (6.1)			
Father	Digestive system and intestinal health	28 (58.3)	24 (82.8)	8.918	0.178 <sup>1</sup>	
	Protective against allergy and infection	9 (18.8)	4 (13.8)			
	Immune system strengthener	30 (62.5)	20 (69.0)			
	Protective against cancer	3 (6.3)	4 (13.8)			
	Cardiovascular health	4 (8.3)	4 (13.8)			
Other	8 (16.7)	2 (6.9)				
Thinking that probiotic products affect oral and dental health						
Mother	Yes	96 (58.2)	33 (58.9)	1.661	0.436 <sup>1</sup>	
	No	18 (10.9)	3 (5.4)			
	Indecisive	51 (30.9)	20 (35.7)			
Father	Yes	42 (45.7)	25 (64.1)	1.661	0.436 <sup>1</sup>	
	No	11 (12.0)	3 (7.7)			
	Indecisive	39 (42.4)	11 (28.2)			
If the answer is "Yes", the issue/s that are thought to have an effect on oral and dental health ~						
Mother	Tooth decay	56 (56.0)	21 (63.6)	11.038	0.087 <sup>1</sup>	
	Halitosis	29 (29.0)	14 (42.4)			
	Eliminating tooth sensitivity	29 (29.0)	10 (30.3)			
	Tooth whitening	15 (15.0)	3 (9.1)			
	Gum diseases	49 (49.0)	23 (69.7)			
	Other	15 (15.0)	1 (3.0)			

TABLE 3. Continued.

		Educational Status		Test Statistics	<i>p</i>	Effect Size				
		High school and under	University and higher							
Father	Tooth decay	56 (56.0)	21 (63.6)	11.038	0.087 <sup>1</sup>					
	Halitosis	29 (29.0)	14 (42.4)							
	Eliminating tooth sensitivity	29 (29.0)	10 (30.3)							
	Tooth whitening	15 (15.0)	3 (9.1)							
	Gum diseases	49 (49.0)	23 (69.7)							
	Other	15 (15.0)	1 (3.0)							
Finding it beneficial to use probiotic products together with antibiotics										
Mother	Yes	28 (17.2) <sup>a</sup>	20 (35.7) <sup>b</sup>	12.844	0.002 <sup>1</sup>	0.202				
	No	62 (38.0) <sup>a</sup>	9 (16.1) <sup>b</sup>							
Father	Indecisive	73 (44.8)	27 (48.2)	0.904	0.637 <sup>1</sup>					
	Yes	17 (18.5)	9 (23.1)							
	No	36 (39.1)	12 (30.8)							
Mother	Indecisive	39 (42.4)	18 (46.2)	1.047	0.306 <sup>2</sup>					
	Yes	116 (70.3)	44 (78.6)							
Father	No	49 (29.7)	12 (21.4)	3.761	0.052 <sup>2</sup>					
	Yes	58 (63.0)	32 (82.1)							
Mother	No	34 (37.0)	7 (17.9)	6.657	0.354 <sup>1</sup>					
	Yes	13 (11.1)	3 (6.8)							
Mother	Advertisements	4 (3.4)	2 (4.5)	8.431	0.208 <sup>1</sup>					
	Finding it beneficial for health	100 (85.5)	39 (88.6)							
	Education received	7 (6.0)	5 (11.4)							
	Environmental advice	15 (12.8)	2 (4.5)							
	Other	6 (5.1)	5 (11.4)							
	Finding it delicious	16 (27.6)	5 (15.6)							
Father	Advertisements	3 (5.2)	0 (0.0)	5.499	0.482 <sup>1</sup>					
	Finding it beneficial for health	41 (70.7)	29 (90.6)							
	Education received	5 (8.6)	3 (9.4)							
	Environmental advice	9 (15.5)	4 (12.5)							
Mother	Other	5 (8.6)	2 (6.3)	18.748	0.005 <sup>1</sup>					
	Not knowing what it is	33 (67.3)	5 (41.7)							
	Finding expensive	2 (4.1) <sup>a</sup>	5 (41.7) <sup>b</sup>							
	Disliking the taste	3 (6.1)	1 (8.3)							
	Not needing	4 (8.2)	1 (8.3)							
	Not finding natural	5 (10.2)	3 (25.0)							
	Other	9 (18.4)	1 (8.3)							
	Father	Not knowing what it is	15 (44.1)				3 (42.9)	5.499	0.482 <sup>1</sup>	
		Finding expensive	3 (8.8)				2 (28.6)			
		Disliking the taste	1 (2.9)				1 (14.3)			
Not needing		6 (17.6)	0 (0.0)							
Not finding natural		4 (11.8)	1 (14.3)							
Mother	Other	8 (23.5)	1 (14.3)							
	Other									

TABLE 3. Continued.

		Educational Status		Test Statistics	p	Effect Size
		High school and under	University and higher			
The most preferred probiotic food for children ~						
	Yogurt	129 (78.2)	49 (87.5)			
	Cheese	60 (36.4)	23 (41.1)			
Mother	Kefir	21 (12.7) <sup>a</sup>	14 (25) <sup>b</sup>	17.921	0.003 <sup>1</sup>	
	Pickle	32 (19.4) <sup>a</sup>	21 (37.5) <sup>b</sup>			
	Other	14 (8.5)	1 (1.8)			
	Yogurt	72 (79.1)	34 (87.2)			
	Cheese	41 (45.1)	14 (35.9)			
Father	Kefir	15 (16.5) <sup>a</sup>	13 (33.3) <sup>b</sup>	14.698	0.012	
	Pickle	14 (15.4) <sup>a</sup>	14 (35.9) <sup>b</sup>			
	Other	3 (3.3)	3 (7.7)			
Frequency of giving probiotic food/s to the child ~						
	1 time per day	109 (66.9)	39 (69.6)			
	1 time per week	10 (6.1)	4 (7.1)			
Mother	2–3 times per week	37 (22.7)	11 (19.6)	1.660	0.894 <sup>1</sup>	
	1 time per month	3 (1.8)	0 (0.0)			
	Other	8 (4.9)	2 (3.6)			
	1 time per day	55 (62.5) <sup>a</sup>	16 (42.1) <sup>b</sup>			
	1 time per week	7 (8.0)	7 (18.4)			
Father	2–3 times per week	22 (25.0)	12 (31.6)	13.265	0.021 <sup>1</sup>	
	1 time per month	0 (0.0)	2 (5.3)			
	Other	5 (5.7)	1 (2.6)			
Giving probiotic product supplements (powder, drops, capsules, etc.) to the child						
Mother	Yes	16 (9.8)	10 (17.9)	1.865	0.172 <sup>2</sup>	
	No	147 (90.2)	46 (82.1)			
Father	Yes	14 (15.2)	4 (10.3)	0.227	0.634 <sup>2</sup>	
	No	78 (84.8)	35 (89.7)			
Criteria for buying probiotic products ~						
	Brand-content	80 (49.7)	33 (62.3)			
	Taste	56 (34.8)	18 (34.0)			
Mother	Price	19 (11.8)	9 (17.0)	5.720	0.455 <sup>1</sup>	
	Design	3 (1.9)	2 (3.8)			
	Suggestion	30 (18.6)	7 (13.2)			
	Other	25 (15.5)	11 (20.8)			
	Brand-content	36 (40.4)	23 (60.5)			
	Taste	35 (39.3)	15 (39.5)			
Father	Price	15 (16.9)	9 (23.7)	6.016	0.421 <sup>1</sup>	
	Design	2 (2.2)	0 (0.0)			
	Suggestion	15 (16.9)	6 (15.8)			
	Other	14 (15.7)	6 (15.8)			
Thinking that social media has an impact on probiotic food consumption						
	Yes	77 (46.7) <sup>a</sup>	42 (75) <sup>b</sup>			
Mother	No	41 (24.8) <sup>a</sup>	6 (10.7) <sup>b</sup>	13.548	0.001 <sup>1</sup>	0.231
	Indecisive	47 (28.5) <sup>a</sup>	8 (14.3) <sup>b</sup>			
	Yes	36 (39.1) <sup>a</sup>	25 (64.1) <sup>b</sup>			
Father	No	32 (34.8)	10 (25.6)	7.593	0.022 <sup>1</sup>	0.365
	Indecisive	24 (26.1) <sup>a</sup>	4 (10.3) <sup>b</sup>			

<sup>1</sup>Pearson Chi-Square Test; <sup>2</sup>Yates Correction; <sup>a,b</sup>: There is no difference between degrees of proximity with the same letter; ~: Multiple Response.

or higher ( $p < 0.001$ ). Among mothers, those with higher education levels were significantly more likely to believe that probiotics are beneficial for health ( $p = 0.006$ ), particularly in protecting against allergies and infections ( $p = 0.042$ ). Additionally, mothers with a university education or higher were significantly more likely to consider using probiotics alongside antibiotics as beneficial ( $p = 0.002$ ).

Consumption patterns also varied significantly by educational level. Mothers' educational attainment was significantly associated with the types of probiotic products preferred for their children, especially kefir and pickles ( $p = 0.003$ ). Similarly, fathers' education levels influenced their children's preferred probiotic products, with significant differences observed for kefir and pickles ( $p = 0.012$ ). Fathers' age groups showed substantial variation in their criteria for purchasing probiotic products, particularly in terms of taste and price ( $p = 0.015$ ). Fathers over 40 years of age tend to prioritize price when purchasing probiotic products, whereas those under 40 prioritize taste. Educational level among fathers was also significantly associated with the frequency of administering probiotic products to their children, especially among those who provided them once daily ( $p = 0.021$ ).

Moreover, mothers' educational level was significantly linked to citing cost as a barrier to providing probiotic products to their children ( $p = 0.005$ ). Attitudes toward the influence of social media on probiotic consumption also varied significantly by parental education. Mothers with higher education were more likely to acknowledge the impact of social media ( $p = 0.001$ ), as were fathers, with a significant difference between "yes" and "undecided" responses based on educational level ( $p = 0.022$ ).

#### 4. Discussion

The therapeutic benefits of probiotics in preventing and managing various diseases have garnered increasing attention in recent years. As public interest in health and nutrition grows, so does the demand for probiotic-containing foods and products [16]. In this study, a higher proportion of mothers than fathers were familiar with the term "probiotic", and parental understanding of the term improved significantly with higher education levels. Mothers were also more likely, than fathers, to perceive probiotic products as beneficial for their health, with this perception increasing significantly with higher maternal education levels. Parents generally believe that probiotics are most helpful for digestive and intestinal health, as well as for strengthening the immune system. Additionally, an increase in maternal education was associated with a heightened awareness of the protective potential of probiotics against allergies and infections. Similar to this study, a survey conducted in Turkey with 447 general consumers aged 18–65 found that most consumers were aware of probiotics, with women being more aware of them, and knowledge levels increasing with education level. However, probiotics were not commonly used, mainly because they were not needed. Those who consumed them did so as a food rather than a supplement [17].

Previous research supports these findings. In a study evaluating healthcare professionals' awareness and access to probi-

otics, 72.4% were familiar with the term, 80.1% believed in the health benefits of probiotics, and 25.8% had prescribed probiotic products. All respondents expressed a desire for more information on the topic [18]. Another study at Sakarya University found that Food Engineering students had greater knowledge and higher consumption of probiotics than Chemistry students, with most associating their benefits with digestive health [4]. In a study by Ozgül *et al.* [19], 96% of working individuals recognised the term "probiotic", and most consumed yoghurt daily; those who abstained cited beliefs that probiotics were unnatural or unnecessary. Surveys of gastroenterologists and nutritionists showed high awareness and endorsement of probiotics for managing digestive disorders [20]. An international study of 1066 health professionals revealed that 36.4% rated their knowledge of probiotics as moderate, and that women were generally more informed than men. Additionally, 57.5% expressed interest in learning more [21]. Similarly, Tejaswi *et al.* [22] reported that 83.1% of dental students were familiar with probiotics, although most associated them solely with intestinal health.

Regarding oral health, controlling bacterial activity in the oral cavity is crucial for preventing dental caries, the most common chronic disease worldwide. One of the primary cariogenic bacteria is *S. mutans* [23]. Although most participants in the present study believed that probiotics benefit oral and dental health, they primarily associated these benefits with preventing tooth decay, followed by gum disease. A systematic review supports the role of probiotics in oral health by inhibiting pathogenic colony formation [8]. A meta-analysis also demonstrated their preventive role in early childhood caries [24]. Studies have shown that probiotic yoghurt can reduce *S. mutans* levels in the oral cavity, with long-term use recommended for caries prevention [23]. Janiani *et al.* [25] reported that probiotic milk and powder significantly reduced plaque and salivary *S. mutans* in children, while probiotic tablets were effective in reducing halitosis among university students [26]. It has been reported that the imbalance between microbiota within the host is associated with the pathogenesis of oral mucosal diseases, and that probiotics, which play a crucial role in regulating microbiota, can support oral health by modulating various functions, including oral-intestinal microbiota and host immunity [27]. In contrast to concerns regarding the potential side effects of live microorganisms, postbiotics are non-viable bacterial metabolites or metabolic byproducts that exert beneficial biological effects on the host. Due to their advantages—such as enhanced safety, greater stability, longer shelf life, ease of administration, and the ability to confer health benefits without the need for live microorganisms—postbiotics have emerged as a promising alternative to probiotics [28]. Postbiotics have demonstrated antimicrobial activity against the microbial etiology of dental caries [7]. Accordingly, it offers a novel and promising approach for preventing dental caries.

Compared to chlorhexidine, a widely used antimicrobial agent, probiotics have been suggested as a viable alternative for improving periodontal health [29]. In a study by Tejaswi *et al.* [22], 42.5% of dental students believed probiotics could be used to treat halitosis and periodontal disease. Inchingolo *et al.* [30] emphasized the therapeutic advantages of probiotics

in reducing pathogenic oral bacteria, enhancing immunity, and protecting against various oral diseases. However, some studies report mixed results. For example, Hasslöf *et al.* [31] conducted a small-scale trial among preschool children, finding no significant change in caries recurrence after using probiotic drops. However, the COVID-19 pandemic affected the sample size and study duration. Laleman *et al.* [32] reported a reduction in periodontal pocket depth following probiotic lozenge use, but no change in periodontopathogen levels; probiotic drops were similarly ineffective. An *in vitro* study found that probiotic toothpastes lacked antibacterial activity against *S. mutans* [33].

In the present study, most parents reported giving their children probiotic products, typically once daily, based on perceived health benefits. Interestingly, as fathers' education levels increased, daily administration of probiotics to their children decreased significantly. Parents cited brand and content as primary factors when purchasing probiotic products, with fathers more likely to buy from markets and mothers more inclined to prepare them at home. As fathers aged, taste became less critical while price sensitivity increased. Yoghurt and cheese were the most commonly preferred probiotic products, typically stored in refrigerators. Although educational level was not significantly associated with the frequency of probiotic food administration, both mothers and fathers with higher education levels were more likely to choose kefir and pickles. Lack of awareness was the primary reason parents did not give probiotic products to their children, while among mothers, higher education was associated with citing cost as a barrier. Most parents had not provided their children with probiotic supplements such as powders, drops, or capsules. In Özgül *et al.*'s [19] study, non-consumers avoided probiotics due to concerns about naturalness and necessity, while consumers primarily used kefir and pickles alongside yoghurt for digestive health. Tejaswi *et al.* [22] found that 23.7% of students identified yoghurt as the richest source of probiotics, while 17.1% recognised tablets as a commercially available form. Another study showed that Food Engineering and Chemistry students mostly consumed probiotics on a weekly basis, preferred market purchases, were brand-conscious, and considered them expensive [4].

Probiotics have also been studied as adjuncts to antibiotic therapy. Bacteriocins produced by probiotics may reduce the pathogenic bacteria load on mucosal surfaces, enhance the efficacy of antibiotics, and support mucosal immunity. This may be particularly important in the management of antibiotic-resistant infections [34]. Co-administration of probiotics with antibiotics can help maintain gastrointestinal microbiota balance, improve treatment efficacy, and reduce side effects [35]. Ouwehand *et al.* [36] reported that the use of probiotics decreased the frequency, duration, and severity of antibiotic-associated diarrhea, depending on the dosage. In a global survey, Fijan *et al.* [21] found that 90.2% of medical professionals agreed that probiotic supplementation alongside antibiotics is both appropriate and beneficial. In the present study, parental attitudes toward combining probiotics with antibiotics were generally hesitant; however, as maternal education increased, the proportion of mothers who considered this combination beneficial also increased.

This study comprises responses specific to the unique aspect of Turkish parents' attitudes regarding oral health. One of the limitations of this study is that it is a single-center study covering a specific population, thus its findings cannot be generalized to all Turkish parents or other populations. Another limitation of this study is that causality could not be established due to the cross-sectional design. The sampling strategy included parents who visited the clinic, with participants randomly selected from those who voluntarily agreed to take part in the study. This approach minimized the potential for selection bias. Although extending the study duration beyond October–March might have provided more meaningful results, the timeframe was determined based on the estimated period required to reach the sample size calculated through power analysis. Therefore, the limited duration of the study represents one of its limitations. The study's other limitations include its reliance on self-reported knowledge and consumption via questionnaires; potential gaps in knowledge areas assessed from multiple response analysis; not relating to actual child oral health outcomes because of focusing on parents' knowledge and practices; as well as the lack of multivariable analyses to control for potential confounding factors such as number and age of children, and socioeconomic status. There is no verification of the actual probiotic content/strain/viability in foods reported (especially those produced at home). The definition of "probiotic food" relies on parental perception. We recommend that future studies address these limitations in greater detail by employing larger sample sizes and more comprehensive analytical approaches.

## 5. Conclusions

Probiotics have garnered increasing interest due to their potential to support and enhance various aspects of human health. In the context of widespread antibiotic use and growing concerns about antimicrobial resistance and the disruption of the gut microbiota, probiotics offer a promising adjunctive strategy to restore microbial balance and mitigate antibiotic-associated side effects. Beyond their gastrointestinal benefits, probiotics also contribute to oral and dental health by modulating both oral and intestinal microbiota. Their ability to influence the oral microbial environment positions them as a valuable tool in the prevention of dental caries and periodontal diseases, thus highlighting their potential role in preventive dentistry. However, despite these promising applications, further well-designed clinical studies are needed to clarify the specific mechanisms by which probiotics interact with the oral ecosystem and evaluate their long-term effectiveness in promoting and maintaining oral health. Targeted interventions for parents with lower educational levels, along with educational programs addressing the concomitant use of antibiotics and probiotics, are necessary.

## AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this published article.

## AUTHOR CONTRIBUTIONS

MS—designed the research study, performed the research, analyzed the data, and wrote the manuscript. The author contributed to editorial changes in the manuscript. The author read and approved the final manuscript.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Mersin University Clinical Research Ethics Committee (Date: 20 September 2023; Approval No: 2023/629). Informed consent to participate was obtained from each participant.

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## CONFLICT OF INTEREST

The author declares no conflict of interest.

## SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.jocpd.com/files/article/2028751874000076800/attachment/Supplementary%20material.docx>.

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