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ORIGINAL ARTICLE / ÖZGÜN MAKALE

PHARMACY STUDENTS' KNOWLEDGE, ATTITUDES AND PRACTICES ABOUT PROBIOTICS

ECZACILIK ÖĞRENCİLERİNİN PROBİYOTİKLER HAKKINDA BİLGİ, TUTUM VE UYGULAMALARI

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ABSTRACT

Objective: *Probiotics are an important and fast-growing functional food group. Pharmacy students, as pharmacists of the future, need to have sufficient knowledge on this subject. Therefore, this study aims to evaluate pharmacy students' knowledge, attitudes, and practices about probioti cs.*
Material and Method: *A cross-sectional survey study was conducted among students of Suleyman Demirel University Faculty of Pharmacy in Türkiye between 9 October and 30 October 2023. The paper-based questionnaires consisted of 23 questions and were administered for approximately 10-15 minutes.*
Result and Discussion: *The questionnaires were answered by 347 (74.7%) students. The mean±SD of the knowledge score was 5.14±1.53. The majority of respondents (79%) correctly identified probiotics. Approximately half of the participants knew the type of bacteria used in probiotic production The mean±SD of the attitude score was 11.13±1.44. Most respondents (91.9%) believed that probiotic consumption was beneficial for health. The mean±SD of the practice score was 3.72±2.77. 45.2% of respondents stated that they had used probiotic supplements before and 31.1% stated that they had sought additional information about probiotics from various sources. 40.6% of the respondents stated that they recommend probiotics to their family/close relatives. This study showed that although the attitudes of pharmacy students were acceptable, they had some knowledge deficiencies and their practices were poor. To increase the knowledge and practices of pharmacy students about probiotics, this subject should be given more space in undergraduate education and relevant scientific events should be organized.*
Keywords: *Attitude, knowledge, pharmacy students, practices, probiotics*

ÖZ

Amaç: *Probiyotikler önemli ve hızla büyüyen fonksiyonel bir gıda grubudur. Geleceğin eczacıları olarak eczacılık öğrencilerinin bu konuda yeterli bilgiye sahip olmaları gerekmektedir. Bu nedenle bu çalışmada eczacılık öğrencilerinin probiyotiklere ilişkin bilgi, tutum ve uygulamalarının değerlendirilmesi amaçlanmaktadır.*
Gereç ve Yöntem: *Kesitsel bir anket çalışması Türkiye'de Süleyman Demirel Üniversitesi Eczacılık Fakültesi öğrencileri arasında 9 Ekim - 30 Ekim 2023 tarihleri arasında gerçekleştirildi. Kağıt bazlı anketler 23 sorudan oluşmaktaydı ve yaklaşık 10-15 dakika süreyle uygulandı.*
Sonuç ve Tartışma: *Anketler 347 (%74.7) öğrenci tarafından yanıtlanmıştır. Bilgi puanının ortalama±SS'si 5.14±1.53 idi. Ankete katılanların çoğunluğu (%79) probiyotikleri doğru bir şekilde*

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tanımlamıştı. Katılımcıların yaklaşık yarısı probiyotik üretiminde kullanılan bakteri türünü biliyordu. Tutum puanının ortalama±SS'si 11.13±1.44 idi. Katılımcıların çoğu (%91,9) probiyotik tüketiminin sağlığa faydalı olduğuna inanıyordu. Uygulama puanının ortalama±SS'si 3.72±2.77 idi. Ankete katılanların %45.2'si daha önce probiyotik takviyesi kullandığını ve %31.1'i probiyotikler hakkında çeşitli kaynaklardan ek bilgi aradığını belirtti. Katılımcıların %40.6'sı ailesine/yakın akrabalarına probiyotik önerdiğini belirtti. Bu çalışma eczacılık öğrencilerinin tutumlarının kabul edilebilir olmasına rağmen bilgi eksikliklerinin olduğunu ve uygulamalarının zayıf olduğunu gösterdi. Eczacılık öğrencilerinin probiyotikler konusundaki bilgi ve uygulamalarını arttırmak için lisans eğitiminde bu konuya daha fazla yer verilmeli ve konuyla ilgili bilimsel etkinlikler düzenlenmelidir.

Anahtar Kelimeler: *Bilgi, eczacılık öğrencileri, probiyotik, tutum, uygulama*

INTRODUCTION

The desire for a healthy diet has led to an increase in people's interest in nutritional supplements and functional foods [1,2]. The term functional food refers to foods that contain these ingredients naturally or are enriched with healthy ingredients, and are foods that can be effective in protecting against diseases and improving the quality of life. Probiotics are an important and fast-growing functional food group [2,3]. Probiotic is defined as ‘‘Probiotic is live microorganisms which when administered in adequate amounts confer a health benefit on the host’’according to The Food and Agriculture Organization/World Health Organization [4]. Studies have proven that lactic acid bacteria, bifidobacteria, *Saccharomyces cerevisiae, Saccharomyces boulardii*, *Streptococcus lactis*, *Escherichia coli*, etc. can be used as probiotics [5].

Probiotics are beneficial in many diseases such as prophylaxis of diarrhea, treatment of inflammatory bowel diseases, gastric ulcer treatment, urogenital infections, obesity treatment, liver diseases, hypercholesterolemia, and diabetes prevention [5,6]. The effects of different types of probiotics also vary [7].

Since probiotics are generally sold through pharmacies and pharmacists are health consultants that are easily accessible to the public [8,9], pharmacists need to keep their knowledge on this subject up to date and provide accurate information to patients [10,11]. Therefore, pharmacy students, as pharmacists of the future, need to have sufficient knowledge on this subject [12,13]. It is also important to identify students' deficiencies in probiotics and include them in the pharmacy curriculum. As far as is known, there is no study evaluating the use of probiotics only in pharmacy faculty students. This study aims to evaluate pharmacy students' knowledge, attitudes, and practices about probiotics.

MATERIAL AND METHOD

Study Design

This cross-sectional survey was conducted among the students of Suleyman Demirel University Faculty of Pharmacy in Türkiye between 9 October and 30 October 2023. Ethical approval for the research was received from Suleyman Demirel University Clinical Research Ethics Committee (No:156 / Date:21.07.2023). Undergraduate students over the age of 18 studying at Suleyman Demirel University Faculty of Pharmacy were included in the research, but postgraduate students were not included.

Sample Size

According to the Raosoft sample size calculator, the sample size was calculated as minimum 211 students with a 5% margin of error, 95% confidence interval, and 50% response rate [14].

Data Collection

The survey was prepared in Turkish by revising two previously validated current studies and taking the opinions of two pharmacists and a pharmacologist academician [15,16]. The questions were mostly created from the study conducted by Ong et al. [16], and questions were selected to measure students' general probiotic knowledge, attitudes and practices. A pilot study was conducted with 30 students to examine the questions in terms of content and understandability. The questions were found

to be clear and understandable. Cronbach's alpha score was calculated for internal consistency and was found to be 0.76.

Before the questionnaires were distributed, students were informed about the study and informed consent was obtained. The paper-based questionnaire consisted of 23 questions and was administered for approximately 10-15 minutes. The first 3 questions were about demographic information.

8 questions were about knowledge, 3 questions were about attitude and 9 questions were about practice.

Statistical Analysis

Data were analyzed with IBM SPSS Statistics for Versions 20.0. Quantitative variables were defined as mean-standard deviation (SD), median-interquartile range (IQR) and quantitative variables as percentages, respectively. The normality of the data was determined by the Kolmogorov Smirnov test. Variables were compared using Mann-Whitney U test for comparison of two groups with non-parametric data." The Chi-square test was used to compare categorical variables. p value <0.05 was considered statistically significant.

In the knowledge section, correct answers were scored as 1 and incorrect answers as 0. The attitudes section was recorded on a 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree). In the practices section, the positive answer was 1 and the negative answer was 0. Scores only for the "frequency of probiotic supplement consumption" question were as follows (4 = every day, 3 = every 2-6 days, 2 = every 1-3 weeks, 1 = every 3-4 weeks, 0 = did not consume). The total score was a maximum of 8 for knowledge, 15 for attitudes and 12 for practice. ≥80% of the total score was attributed to a good level of knowledge, attitude, and practice.

RESULT AND DISCUSSION

The questionnaires were answered by 347 (74.7%) students. The majority of respondents (68.6%) were female students and the median age was 21 (IQR,19-22) years. Participation rates of students in the study according to academic years: 88 (25.4%) students in the 1st year, 80 (23.1%) students in the 2nd year, 68 (19.6%) students in the 3rd year, 58 (16.7%) students in the 4th year, 53 (15.3%) students in the 5th year.

Knowledge

The mean±SD of the knowledge score was 5.14±1.53. The majority of respondents (79%) correctly identified probiotics. Approximately half of the participants knew that the type of bacteria used in probiotic production was *Lactobacillus acidophilus*. Most respondents (77.5%) knew that probiotics can reinforce the defenses of the mucosal barrier in the digestive tract. 44.7% of the respondents disagreed and answered correctly that probiotics disrupt the balance of normal microorganisms in the digestive system. 38.9% of respondents agreed on the immune benefits of probiotics. 42.1% of the respondents believed that probiotics should be consumed regularly. Table 1 shows students' knowledge about probiotics.

Attitudes

The mean±SD of the attitude score was 11.13±1.44. Most respondents (91.9%) believed that probiotic consumption was beneficial for health. 37.7% of respondents agreed that probiotics may prevent the side effects of antibiotics. Table 2 shows students' attitudes about probiotics.

Practices

The mean±SD of the practice score was 3.72±2.77. 45.2% of the respondents stated that they had used probiotic supplements before. 31.1% of respondents declared that they sought additional information about probiotics from various sources. 40.6% of the respondents stated that they recommend probiotics to their family/close relatives. Most respondents (73.2%) stated that they had not used probiotic supplements in the last month. 73% of the students declared that they consumed yogurt as a probiotic product. 17.6% of the survey participants stated that they used probiotic products to prevent

digestive system complaints due to infections in the last month, 32.3% of the respondents to strengthen the immune system, and 9.8% of the respondents to prevent the side effects of antibiotics. Table 3 shows students' practices about probiotics.

Table 1. Students' knowledge about probiotics

Questions	Items	n (%)
Which of the following best defines probiotics?	Antibiotics prescribed to treat infections caused by bacteria.	36 (10.4)
	Live microorganisms that can be beneficial to humans when digested.	274 (79)
	A vitamin supplement that benefits human health.	37 (10.7)
Which of the following is a type of bacteria that can be used in probiotic production?	*Lactobacillus acidophilus*	173 (49.9)
	Campylobacter jejuni	25 (7.2)
	Listeria monocytogenes	36 (10.4)
	Staphylococcus aureus	48 (13.8)
	Proteus mirabilis	65 (18.7)
Which of the following foods can be a natural source of probiotics?	Yogurt	330 (95.1)
	Fish and poultry	10 (2.9)
	Fruits and vegetables	7 (2)
Probiotics can increase the defense of the mucous lining of the digestive system.	Yes	269 (77.5)
	No	13 (3.7)
	Don’t know	65 (18.7)
Probiotics are known to disrupt the balance of normal microorganisms found in the digestive system.	Yes	89 (25.6)
	No	155 (44.7)
	Don’t know	103 (29.7)
Inhibition of pro-inflammatory cytokines and promotion of anti-inflammatory cytokines are immune benefits of probiotics.	Yes	135 (38.9)
	No	19 (5.5)
	Don’t know	193 (55.6)
Probiotic consumption should be done regularly.	Yes	146 (42.1)
	No	124 (35.7)
	Don’t know	77 (22.2)
The benefits of probiotics vary depending on their species.	Yes	302 (87)
	No	10 (2.9)
	Don’t know	35 (10.1)

Table 2. Students' attitudes about probiotics

Questions	Items	n (%)
Consuming probiotics is beneficial for health.	Strongly agree	100 (28.8)
	Agree	219 (63.1)
	Uncertain	24 (6.9)
	Disagree	3 (0.9)
	Strongly disagree	1 (0.3)

Table 2 (*continue*). Students' attitudes about probiotics

Questions	Items	n (%)
Probiotics may be an alternative option in preventing digestive system complaints due to pathogenic infections.	Strongly agree	42 (12.1)
	Agree	180 (51.9)
	Uncertain	107 (30.8)
	Disagree	16 (4.6)
	Strongly disagree	2 (0.6)
Probiotics may prevent the side effects of antibiotics.	Strongly agree	31 (8.9)
	Agree	100 (28.8)
	Uncertain	142 (40.9)
	Disagree	70 (20.2)
	Strongly disagree	4 (1.2)

Table 3. Students' practices about probiotics

Questions	Items	n (%)
Have you used probiotic supplements before?	Yes	157 (45.2)
	No	190 (54.8)
Have you sought additional information about probiotics from various sources?	Yes	108 (31.1)
	No	239 (68.9)
Have you ever recommended probiotics to your family/close relatives?	Yes	141 (40.6)
	No	206 (59.4)
Which pharmaceutical form of probiotic supplement did you use last month?	Capsule	18 (5.2)
	Tablet	20 (5.8)
	Dust	24 (6.9)
	Liquid	31 (8.9)
	I didn't use	254 (73.2)
How often have you used probiotic supplements in the last month?	Daily	11 (3.2)
	Every 2-6 days	35 (10.1)
	Every 1-3 weeks	21 (6.1)
	Every 3-4 weeks	26 (7.49)
	I didn't use	254 (73.2)
What type of probiotic product have you consumed most frequently in the last month?	Yogurt	256 (73.8)
	Kefir	20 (5.8)
	Tarhana	6 (1.7)
	Pickle	37 (10.7)
	Boza	1 (0.3)
	I didn’t use	27 (7.8)
For the last month, I have been consuming probiotic products to prevent digestive system complaints due to pathogenic infections.	Yes	61 (17.6)
	No	286 (82.4)
For the last month, I have been consuming probiotic products to strengthen the immune system.	Yes	112 (32.3)
	No	235 (67.7)
For the last month, I have been consuming probiotic products to prevent the side effects of antibiotics.	Yes	34 (9.8)
	No	313 (90.2)

Table 4. Comparison of demographic characteristics with knowledge, attitudes and practices about probiotics

Variables	Knowledge Level			Attitudes Level			Practices Level		
	Poor (%) n	Good (%) n	p	Poor (%) n	Good (%) n	p	Poor (%) n	Good (%) n	p
Gender									
Male	91 (83.5)	18 (16.5)	0.276[a]	73 (67)	36 (33)	0.06[c]	106 (97.2)	3 (2.8)	0.762[d]
Female	185 (77.7)	53 (22.3)		134 (56,3)	104 (43,7)		228 (95.8)	10 (4.2)	
Age years (median± IQR)	20 (19-22)	22 (20-22)	<0.001[b]	20 (19-22)	21 (20-22)	0.007[b]	21 (19-22)	21 (21-22)	0.104[b]
Academic year									
First year	77 (87.5)	11 (12.5)	0.002[c]	61 (69.3)	27 (30.7)	0.012[c]	87 (98.9)	1 (1.1)	0.112[c]
Second year	70 (87.5)	10 (12.5)		52 (65)	28 (35)		79 (98.8)	1 (1.2)	
Third year	54 (79.4)	14 (20.6)		38 (55.9)	30 (44.1)		65 (95.6)	3 (4.4)	
Fourth year	37 (63.8)	21 (36.2)		24 (41.4)	34 (58.6)		53 (91.4)	5 (8.6)	
Fifth year	38 (71.7)	15 (28.3)		32 (60.4)	21 (39.6)		50 (94.3)	3 (5.7)	

IQR: Interquartile range [a] Continuity Correction test, [b] Mann Whitney U test, [c] Pearson Chi Square test, [d] Fisher's Exact test

Older age (median 20, vs. 22, p<0.001) and higher academic years (4th, and 5th grade, vs. 1st, 2nd, 3rd grade p =0.002) were found to be associated with better knowledge levels. Older age (median 20 vs. 22, p=0.007) was found to be associated with better attitude level. Additionally, respondents in the fourth year were associated with better attitude levels than other classes (p=0.012). The variables were not found to be significant in terms of practice level (Table 4).

This study showed that although the attitudes of pharmacy students were acceptable, they had some knowledge deficiencies and their practices were poor. Studies similar to this study showed that students' knowledge about probiotics was poor or limited [17-19]. In the study conducted by AbuKhader et al. [17], it was revealed that 70% of medical students and 59.4% of dentistry students correctly identified probiotics, and in the study conducted by Babina et al. [18], 77.4% of dentistry students identified probiotics correctly.

In the study conducted by Wilson et al. [20] among health professionals, 55.7% of dietitians, 76.3% of pediatricians, and 70% of general practitioners knew the definition of probiotics. In our study, probiotic definition was made correctly by pharmacy students at a higher rate (79%) compared to most studies. In the study conducted by Rahmah et al. [15] in health sciences students, 97.7% of the students knew that probiotics can strengthen the defenses of the mucous membrane of the digestive system, and 66.7% of the students knew that probiotics increase the secretion of anti-inflammatory cytokines and antibodies. Additionally, 66.7% of the students knew that probiotics should be consumed regularly. In our study, these questions were answered at a lower rate (77.5%, 38.9%, and 42.1% respectively). This shows that the students in this study have some lack of knowledge about the mechanism of action of probiotics.

In most studies, respondents had neutral or positive attitudes about probiotics, as in this study [15,16,18,21]. However, in this study they agreed at a lower rate (37.7%) with the idea that probiotics can prevent the side effects of antibiotics. Antibiotic-associated diarrhea may occur while being treated with antibiotics. This can affect patients at any time during or after treatment. Antibiotic-associated diarrhea occurs when antibiotics change the diversity and number of bacteria in the stomach and disrupt the ecosystem of the intestinal microbiota [5,22]. In a meta-analysis of randomized placebo-controlled

trials, the probiotic proved effective for antibiotic-associated diarrhea in adults [23]. Additionally, probiotics have been shown to significantly prevent the risk of developing *C. difficile*-associated diarrhea in patients taking antibiotics [24,25].

In this study, 45.2% of the students had used probiotic supplements before. This rate was lower than in studies conducted in other countries [15,16], it was found to be higher (20%) than in a study conducted on university students in Türkiye [26]. The low consumption of probiotic supplements by students in this study could be due to the fact that they were not known, were not needed, or were considered expensive. In this study, 40.6% of the students recommended probiotics to their family/relatives. In a study conducted on nutrition and dietetics students, this rate was 69% [27], while in a study conducted on doctor and dentist students [17], this rate was 63.5% and 50.8%, respectively. The rate in this study was lower than in other studies. This may be because students do not know the health benefits of probiotics. Additionally, since probiotics may have some risks [28], students may have refrained from recommending them. Most of the students consumed yogurt as the most probiotic product (79%) in the last month. This situation is not surprising because yogurt is a frequently consumed product in Türkiye [29,30]. Research conducted in 15 countries revealed that those who consume the most yogurt live in the Netherlands, France, Türkiye, Spain, and Germany [29].

In this study, parallel to other studies, no statistical relationship was found between gender and attitude level [16,21]. Older age was also associated with better knowledge and attitudes, contrary to other studies [15,21,31]. Similar to the study by Ong et al. [16], respondents in the fourth grade had better knowledge and attitude levels than other grades.

One of the limitations of this study was that it was single-center. This situation may prevent the generalizability of the results. There is a need to conduct multicenter national surveys. Additionally, some items were removed from the original scale. Therefore, it is necessary to verify the factor structures with exploratory and confirmatory factor analyses and to conduct appropriate validity and reliability analyses.

This study showed that although the attitudes of pharmacy students were acceptable, they had some knowledge deficiencies and their practices were poor. Pharmacy faculty students have a critical role in the healthcare system as future pharmacists. To increase the knowledge and practices of pharmacy students about probiotics, this subject should be given more space in undergraduate education and relevant scientific events should be organized.

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AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST

The authors declare that there is no real, potential, or perceived conflict of interest for this article.

ETHICS COMMITTEE APPROVAL

Ethical approval for the research was received from Suleyman Demirel University Clinical Research Ethics Committee (No:156 / Date:21.07.2023).

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