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ORIGINAL RESEARCH

Correlation of Knowledge, Attitude, and Practice Toward Probiotics for the Digestive System Among Health Science Students

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Background: Probiotics have numerous health benefits to the digestive system, one of them being clinically able to prevent and treat diarrhea. The growing scientific evidence of probiotic benefits has led to increased production of probiotic products. Health science students, as future healthcare professionals (HCPs), should have more knowledge about probiotics to be able to give the right recommendation to their future patients and the larger community. This study aims to assess the knowledge, attitude, and practice towards probiotics of health science students in Universitas Padjadjaran, Indonesia.

Methods: A cross-sectional study was conducted on 87 students from Medical Studies, Midwifery, Pharmacy, and Nursing majors in 2020. Proportional cluster random sampling was used to select the study subjects, and an online survey was used to collect the data. Final data were exported to statistics software for analysis. Scores of each variable were categorized. Kruskal–Wallis test was used to analyze the statistical differences among the four groups. Spearman's rank correlation coefficient was used to analyze the relationship between knowledge, attitude, and practice variables.

Results: Of all respondents, 80% had adequate knowledge. More than half (52.9%) had a positive attitude, and most (62.1%) had a positive practice. There were significant correlations between knowledge-attitude and attitude-practice variables. Most respondents gained information on probiotics from the Internet (26%) and their lecturer (24%). P-value from Kruskal–Wallis test for knowledge, attitude, and practice are 0.466, 0.801, and 0.324, respectively.

Conclusion: Most respondents had an adequate level of knowledge, a positive attitude, and a positive practice towards probiotics. Incorporating scientific evidence regarding probiotics from various studies into all health science majors' academic curricula and media may help equip the students with a better understanding of probiotics, therefore improving probiotics usage to prevent and treat digestive system diseases in the future.

Keywords: probiotics, knowledge, attitude, practice, Indonesia

Introduction

Food and Agriculture Organization of the United Nations/World Health Organization (FAO/WHO) Expert Consultation held a meeting in 2001 to evaluate the scientific evidence available on the properties, functionality, benefits, safety, and nutritional features of probiotic foods. Through this meeting, probiotics were redefined as live microorganisms which when administered in adequate amounts confer a health benefit on the host. Since then, this definition has become the most

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widely adopted and accepted version worldwide, until an expert panel was convened in October 2013 by the International Scientific Association for Probiotics and Prebiotics (ISAPP). One output of this meeting was the reworking of the definition of probiotics to the following: "live microorganisms that, when administered in adequate amounts, confer a health benefit on the host".[1,2] These health benefits come from probiotics' ability to balance the host's immune system through the gastrointestinal tract, mainly by stimulating the epithelial cells' protective responses against many pathogens.[3,4] Probiotics are widely known to take part in the prevention and treatment of diarrhea, which is one of the main causes of child mortality in developing countries, may also cause fatal complications to at-risk populations, and cause high financial burden along with decreased work productivity.[5,6] These preventive and curative properties are observable in many studies linking probiotics' effects to the duration, severity, total episode, and reinfection of diarrhea.[7–9]

The most common types of microorganisms used as probiotics are lactic acid bacteria and bifidobacteria, although other bacteria and certain yeasts are also used. The commonly used *Lactobacillus* as probiotic products are *Lactobacillus acidophilus, L. casei, L. paracasei, L. rhamnosus, L. delbrueckii subsp. bulgaricus, L. brevis, L. johnsonii, L. plantarum and L. fermentum*. The genus *Bifidobacterium* includes various Gram positive non-motile anaerobic bacteria. *Bifidobacterium infantis, B. adolescentis, B. animalis* subsp *animalis, B. animalis* subsp *lactis, B. bifidum, B. longum*, and *B. breve* are several strains used as probiotics. Other strains from bacterial species (eg, *Pediococcus acidilactici, Lactococcus lactis, Leuconostoc mesenteroides, Bacillus subtilis, Enterococcus faecium, Streptococcus thermophilus*, and certain yeasts (eg, *Saccharomyces boulardii*) also qualify as probiotics.[10] Currently, probiotics may be found in dietary supplements, drugs, functional foods and drinks, infant formula, and other non-oral probiotics.[2,11] There are also previous studies that have identified probiotic properties found in several Indonesian foods, namely Indonesian pickles, tapai, and shrimp paste.[12]

Despite the widely accepted definition and proven health benefits, the term probiotic is still misunderstood by many as fermented products that contain diverse community of live, potentially beneficial microorganisms that are not specifically probiotics. Although evidence supports the beneficial relationship between some foods containing live microbes, especially fermented dairy products, the term probiotic was agreed by the ISAPP panel to be used only on

> products that deliver live microorganisms with a suitable viable count of well-defined strains with a reasonable expectation of delivering benefits for the wellbeing of the host.[2]

The statement brings another challenge since it was acknowledged by the European Food Safety Authority (EFSA) and the US Food and Drug Administration (FDA) that commercial markets have outpaced the ability of science to support the evidence.[10]

Despite the far-reaching, accessible evidence that embraces the health benefits of probiotics use, health professionals may hesitate to recommend probiotics to their patients due to difficulties in processing large amounts of information provided by companies about the benefits of their probiotic products.[11] On top of that, the different species of probiotics may cause variable effects on an individual.[13] Hence, HCPs, who have duties in promoting prevention efforts and managing patients, should have adequate scientific knowledge about these alternative products such as probiotics to provide people with the right information and recommendation.[11] Knowledge of HCPs will directly influence the outcome of any therapy and treatment. Information from HCPs to patients has also been found to have a positive and significant correlation with the adoption of dietary behaviour and reduced risk of nutrition-related chronic disease.[14]

As future HCPs, it is important for health science students to learn about alternative products such as probiotics. This knowledge may be their starting point in developing new studies to enhance its function or preparation before engaging with patients and the larger community. However, only a few studies have assessed HCP's knowledge, attitude, and practice towards probiotics and the number is even lower in studies involving students, particularly health science students. For this reason, this study was conducted to assess the level of probiotics knowledge, attitude, and practice of the health science students of Universitas Padjadjaran, Indonesia.

Methods Research Design and Ethical Considerations

This cross-sectional, descriptive-analytical study was conducted from August to December 2020. This study was conducted in accordance with the Declaration of Helsinki and was permitted by the Health Research Ethics

Committee Faculty of Medicine Universitas Padjadjaran (number 890/UN6.KEP/EC/2020). There is an informed consent page that displays the study's objectives, instructions on filling out the questionnaire, and the respondents' rights, including their decision to withdraw their participation from this study. Please refer to the supplementary material for the complete questionnaire.

Sampling

This study's total population was 567 fourth-year students of Faculty of Medicine, Faculty of Pharmacy, and Faculty of Nursing Universitas Padjadjaran school year 2020/2021. Universitas Padjadjaran is one of the state universities of Indonesia. It is located in West Java, the most populated province of Indonesia.

The sample size was determined based on a formula for an analytical study.[15]

The formula was:

$n = \{z_{1-\alpha} + z_{1-\beta}/0.5 \ln [(1+r)/(1-r)]\}^2 + 3$

where $z_{1-\alpha}$ is the *z* score for α=5% (1.96) and $z_{1-\beta}$ is the *z* score for β=20% (0.84) for a two-tailed test. The estimated coefficient of correlation was 0.3 and was denoted as *r*.

Based on this formula, the minimum number of required sample was 85. The sample number was then further divided by majors using proportional cluster random sampling, where the proportion of medical studies, midwifery, pharmacy, and nursing students are 46%, 4.6%, 25.3%, and 24.1%, respectively, and this resulted in a minimum number of 87 for the required sample. The inclusion criteria for this study were students who, during the study, have learned about the human digestive system and gave their consent to participate in this study. The exclusion criterion was students who did not fill the questionnaire right and could not be contacted to revise the filled questionnaire.

Instrument Development

The instrument used in this study was an online questionnaire. There was no prior validated questionnaire to evaluate Indonesian students' knowledge, attitude, and practice regarding probiotics at the time of this study, thus the questions were composed by the authors based on literatures regarding probiotics and questionnaire from other similar studies.[9,11,12,14,16–20] The first version of the questionnaire were subjected to validity and reliability tests conducted on thirty students of the study population. Alpha Cronbach values for knowledge, attitude, and practice were 0.140, 0.759, and 0.807, respectively. The questionnaire was re-evaluated and corrected for further development.

The final questionnaire contained respondents' sociodemographic data, including age, sex, faculty, and address (province, district, and city). There were also questions about subjective knowledge and source of information regarding probiotics. Knowledge questions consisted of eleven items in the form of multiple-choice, true or false, and checkboxes questions. Each correct answer was given a score of one and zero for an incorrect answer. All checkboxes questions (bacterial species for probiotics production and examples of probiotics products) was given a score of one if all the right choices were checked. Hence, the maximum score of knowledge questions was eleven. Five-point Likert scale was used to assess the six items of attitude questions (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree). All items are positive attitude statements. Thus, the maximum score for attitude questions was thirty. There are twelve items of practice questions, but only ten were calculated to measure respondents' practice score. The two items not calculated were regarding whether the respondent had/had not learned about probiotics during their formal study, and their reason for consuming probiotic products. The other ten items were made in the form of yes/no, multiple-choice, and checkboxes questions. All items are positive practice statements. A positive response from each question would result in a score of one and zero for a negative response, except for the "frequency of probiotics consumption" item. For that question, the scores were ("have not consumed" = 0, "every 3–4 weeks" = 1, "every 1–3 weeks" = 2, "every 2–6 days" = 3, "daily" = 4). Thus, the maximum score for practice questions was thirteen. For items "The type of probiotics consumed in the last month" and "Most frequently consumed type of probiotic products", a score of one was given if respondents checked any other option besides "have not consumed".

Data Collection, Processing, and Analysis

The final questionnaire was distributed to study subjects via e-mail and social media platforms. Data that were collected through Google Form were then exported to Google Sheets application, and analyzed using SPSS version 25 and GraphPad Prism 7. The scores from knowledge, attitude, and practice items obtained were then categorized. Numerical variables were presented as mean

±SD, and categorical variables were presented as percentages (%). The level of knowledge was categorized as good, fair, and poor. It was categorized as good if the respondent's total score was in the range of >75%, fair if 50–75%, and poor if <50% of the maximum score.[21] Attitude scores were categorized as positive (total score ≥ mean) and negative (total score < mean). Practice scores were categorized as positive (total score ≥ median) and negative (total score < median).[21,22] D'Agostino-Pearson and Shapiro–Wilk normality test was applied to determine the nature of data distribution of all data and data categorized by majors, respectively. Kruskal–Wallis test was used to test the statistical differences among the four groups. Spearman's rank correlation coefficient was used to analyze the relationship between knowledge, attitude, and practice variables.[23,24]

Table 1 Source of Information Regarding Probiotics

Source of Information	n (%)
Internet	67 (26)
Lecturer	62 (24)
Books/magazines	29 (11.2)
Doctor	26 (10.1)
Friends	25 (9.7)
Television	18 (7)
Family	13 (5)
Pharmacist	8 (3.1)
Others	6 (2.3)
Nurse	3 (1.2)
Alternative Medicine Physician	1 (0.4)
Midwife	0 (0)
Radio	0 (0)

Notes: Respondents could choose more than one option for this question; n = number of participants that answered the related option; % = percentage of n.

Results

Characteristics of the Study Population

There were 66 (75.9%) female and 21 (24.1%) male respondents who participated in this study. Forty respondents (46%) are from medical studies and 4 (4.6%) are from midwifery majors of Faculty of Medicine, 22 (25.3%) are from Faculty of Pharmacy, and 21 (24.1%) are from Faculty of Nursing of Universitas Padjadjaran. The age range of the respondents is between 20–23 years old. A majority (66.7%) of the respondents live in the West Java province. More than half (58.6%) of the respondents stated that they are familiar/have sufficient knowledge regarding probiotics, and many of the respondents gained information on probiotics from the Internet (26%) and their lecturer (24%) (Table 1). Respondents also stated that they consume probiotics because the products are easy to find (26%), the products taste good (24.5%), the products' prices are economical (21.2%), due to the health benefits of the products (17.2%), recommended by close relatives (6.6%), and because of advertisements (2.6%).

Knowledge of Probiotics

Most respondents (80%) had a fair knowledge of probiotics. The majority of the respondents (90.8%) answered the definition of probiotics question correctly. Nearly all (97.7%) knew that one of the probiotics' functions is to strengthen the digestive system's mucous lining defense. More than half (66.7%) recognized *Lactobacillus* and *Bifidobacterium* as the mostly used genus of bacteria in probiotics production. Only 2.3% answered all options regarding bacterial species used for probiotics and examples of probiotics products items correctly (Table 2). These may happen due to the checkboxes type of question requiring respondents to check all correct options to gain score. Out of the five options, the most recognized bacterial species in order were *Lactobacillus acidophilus* (39.3%), *Lactobacillus rhamnosus* (30.3%), *Bifidobacterium bifidum* (23.4%), and *Escherichia coli* (4.5%). A small number of participants answered *Mycobacterium avium* as a probiotic (2.5%) although it was the wrong answer. It was also known that of the five options (milk, yoghurt, cereal, and Indonesian shrimp paste and also tapai), all respondents answered yoghurt as an example of probiotic products. Even though the difference was not statistically significant, midwifery students had the highest mean±SD compared to other majors (7.8±0.5, p=0.466) and pharmacy students had the lowest mean±SD (6.9±1, p=0.466) (Table 3). The statistically unsignificant result may stem from the notably different number of respondents between midwifery students (n = 4, 4.6% of all respondents) and other majors' students.

Attitude Towards Probiotics

More than half of the respondents (52.9%) had a positive attitude towards probiotics. Nearly half (48.3%) strongly agreed, and 47.1% agreed that consuming probiotics may positively affect one's health. Over half (55.2%) agreed that probiotics could be an alternate choice in preventing gastrointestinal problems due to infection. However, only 29.9% agreed that it could be used as a treatment for the same problems. More than half (51.7%) had a neutral response regarding recommending probiotics for their future patients.

Table 2 Knowledge of Probiotics Among Health Science Students in Universitas Padjadjaran

Question	Correct Answer n (%)	Incorrect Answer n (%)
Definition of probiotics	79 (90.8)	8 (9.2)
Bacterial species that can be used for probiotics production	2 (2.3)	85 (97.7)
Examples of probiotic products	2 (2.3)	85 (97.7)
Mostly used genus of bacteria in probiotics production	58 (66.7)	29 (33.3)
Probiotics can disrupt the balance of normal microorganisms found in the digestive system	68 (78.2)	19 (21.8)
Probiotics can strengthen the defense of the mucous lining of the digestive system	85 (97.7)	2 (2.3)
Probiotics can increase the secretion of anti-inflammatory cytokines and antibodies.	58 (66.7)	29 (33.3)
Only probiotics in tablets, powder, or capsules that can work effectively in the body.	82 (94.3)	5 (5.7)
Consumption of probiotics must be done regularly over a long time	71 (81.6)	16 (18.4)
Probiotics benefits are different according to their species	74 (85.1)	13 (14.9)
Optimal dosage of probiotics consumption	31 (35.6)	56 (64.4)

Notes: n, number of answers in the related category; % = percentage of n.

However, 44.8% of the respondents agreed, and 43.7% strongly agreed that they want to learn more about probiotics (Table 4). Like knowledge scores, midwifery students had the highest mean±SD of attitude scores than other majors (23.5±1.3, p=0.801) even though the results were not statistically significant (Table 3).

Practice Towards Probiotics

Most respondents (63.2%) had positive practice towards probiotics. Most of the respondents (71.3%) stated that they have learned about probiotics during their academic study and 69% stated that they have searched for more information regarding probiotics on other sources. Nearly all (98.8%) have consumed probiotic products, and the majority (94.3%) consumed them during October-November 2020, with fermented foods as the most frequently consumed type of probiotic products (47.1%). Only 36.8% stated that they consumed probiotic products to prevent gastrointestinal problems due to pathogen infection (Table 5). A question was not calculated into the practice scores, and it was regarding the respondents' reason for consuming probiotics. The respondents were able to choose more than one option. Seventy-one respondents stated that they consumed probiotics because they are easy to find, and sixty-seven respondents stated that the flavor of the products is to their liking. Forty-seven respondents stated that they consumed the products because of the health benefits. Despite having the lowest mean±SD in knowledge and attitude, pharmacy students scored the highest in practice (8.5±1.9, p=0.324) (Table 3).

Correlation Between Knowledge, Attitude, and Practice

Although weak, there is a statistically significant correlation between knowledge-attitude and attitude-practice variables. There is no statistically significant correlation between knowledge-practice variables (Table 6).

Discussion

This study was conducted to evaluate the knowledge, attitude, and practice of health science students of Universitas Padjadjaran regarding probiotics. Knowledge, attitude, and practice are aspects representing the domains of behaviour. It is widely known that knowledge and attitude can influence people's prevention practices.[22,23] This study shows that most (80%) of the respondents had fair knowledge, and only 9.2% had good knowledge regarding probiotics. The result is comparable to a study conducted on college students from various majors in Jakarta-Bogor-Depok-Tangerang-Bekasi (Jabodetabek) area in Indonesia. Most respondents of that study correctly answered five out of the six questions regarding probiotics, with the function of probiotics as the most correctly

Table 3 Respondents' Knowledge, Attitude, and Practice Scores

Major	Knowledge (%)			Mean ± SD	p-value	Attitude (%)		Mean ± SD	p-value	Practice (%)		Mean ± SD	p-value
	Poor	Fair	Good			-ve	+ve			-ve	+ve		
Medical Studies	7.5	80	12.5	7.1±1.2	0.466	50	50	22.3±2.5	0.801	45	55	7.6±2.5	0.324
Midwifery	0	100	0	7.8±0.5		25	75	23.5±1.3		25	75	8.2±1.5	
Pharmacy	9.1	86.4	4.5	6.9±1		45.5	54.5	22.5±3.9		22.7	77.3	8.5±1.9	
Nursing	19.1	71.4	9.5	6.9±1.5		47.6	52.4	22.7±2.4		42.9	57.1	7.4±2.6	
All	10.3	80.5	9.2	7±1.2		47.1	52.9	22.5±2.8		37.9	62.1	7.8±2.4	

Note: % = percentage of each category.
Abbreviations: SD, standard deviation; -ve, negative; +ve, positive.

answered question (89.6%).[25] The findings are also similar to a study conducted on Iranian medical sciences students, where 43.1% and 50.7% of the respondents had acceptable and good knowledge regarding probiotics, respectively. However, the age range of the respondents is much broader than that of this study.[17] The results of this study are also in line with a study conducted on Jordanian college students. It was known that students from health science faculties have better knowledge than students in other faculties.[19] Most respondents of this study (90.8%) answered the definition of probiotics correctly, but only very few could answer items regarding bacterial species for probiotics production (2.3%) and examples of probiotic products (2.3%). These may happen because these items were too specific, or because at the time of the study the respondents have forgotten about this topic. It may also suggests that the students did not have the right information despite knowing the correct definition of probiotics. It can also be inferred that the respondents have limited knowledge regarding the optimal dosage for probiotics consumption. These findings highlight the need for more evidence-based educational and practical contents regarding probiotics and its use. From this study, it is also known that although the result was not statistically significant, midwifery students had the highest mean±SD of knowledge scores among all majors (7.8±0.5), although 75% of

Table 4 Attitude Towards Probiotics Among Health Science Students in Universitas Padjadjaran

Items	Responses n (%)				
	SA	A	N	D	SD
Consuming probiotics are beneficial for health	42 (48.3)	41 (47.1)	4 (4.6)	0 (0)	0 (0)
Probiotics may be an alternative option to prevent complaints of the digestive system due to pathogenic infections	25 (28.7)	48 (55.2)	14 (16.1)	0 (0)	0 (0)
Probiotics may be an alternative option to treat complaints of the digestive system due to pathogenic infections	9 (10.4)	26 (29.9)	31 (35.6)	17 (19.5)	4 (4.6)
Probiotics may prevent the side effects of antibiotics	6 (6.9)	19 (21.8)	45 (51.7)	11 (12.7)	6 (6.9)
When I have worked as a healthcare provider, I would recommend probiotics for the prevention and treatment of infections of the digestive system	8 (9.2)	25 (28.7)	45 (51.7)	7 (8.1)	2 (2.3)
I want to learn more about probiotics	38 (43.7)	39 (44.8)	6 (6.9)	4 (4.6)	0 (0)

Notes: n = number of participants that answered the related option; % = percentage of n.
Abbreviations: SA, Strongly Agree; A, Agree; N, Neutral; D, Disagree; SD, Strongly Disagree.

Table 5 Practice Towards Probiotics Among Health Science Students in Universitas Padjadjaran

Items	Positive Answer n (%)	Negative Answer n (%)
Have consumed probiotic products before	86 (98.8)	1 (1.2)
Searched for additional information regarding probiotics from various sources	60 (69)	27 (31)
Have recommended family/close relatives to consume probiotics	46 (52.9)	41 (47.1)
Type of probiotic products consumed in the last month	82 (94.3)	5 (5.7)
Frequency of consuming probiotic products in the last month	13 (14.9)	74 (85.1)
Most frequently consumed type of probiotic products in the last month	82 (94.3)	5 (5.7)
Have been consuming probiotic products to prevent digestive system complaints due to pathogenic infections for the past month	32 (36.8)	55 (63.2)
Have been consuming probiotic products to treat digestive system complaints due to pathogenic infections for the past month	8 (9.2)	79 (90.8)
Have been consuming probiotic products to enhance the immune system for the past month	49 (56.3)	38 (43.7)
Have been consuming probiotic products to prevent the side effects of antibiotics for the past month	6 (6.9)	81 (93.1)

Notes: n, number of answers in the related category; % = percentage of n.

the students stated that they have not learned about probiotics during their academic study. This result is also contrary to a study conducted on 1066 HCPs from thirty countries. It was known that nurses had evaluated their knowledge on probiotics in a lower grade.[11] These findings highlight that formal education contributes to the students' knowledge regarding probiotics and that health science students also learn about alternative products and treatments affecting health. There is also a need to give correct information regarding the type of probiotic products that are available commercially and may be recommended to patients. This is supported by the fact that 62 (24%) of the respondents had learned about probiotics from their lecturer and 71.3% had learned about probiotics during their academic study. Besides that, 67 respondents (26%) stated that they knew probiotics from the Internet, 29 respondents (11.2%) and 18 respondents (7%) stated that they knew probiotics from books/magazines and television, respectively (Table 1). This result points out that access to reliable information from various sources also contributes to a person's knowledge, as seen in a study conducted on Jordanian medical students in which 62% of the students gained information on probiotics from scientific sources and media.[19] The findings of a study conducted on 1066 HCPs from thirty countries also showed that books and expert magazines (53.3%), websites (34.9%), radio or TV (9.7%) were where the respondents acquired their knowledge regarding probiotics.[11] In this study, 52.9% of the respondents had a positive attitude towards probiotics. Midwifery students had the highest mean±SD than other majors for attitude scores (23.5±1.3), although the results were not statistically significant. Nevertheless, 88.5% of all respondents agreed that they wanted to learn more about probiotics. This finding indicates that there is more information that the students want to know about probiotics and its use, or other reasons they would like to do so, and this may be a recommendation for further studies. This result is not entirely comparable but might reflect a study conducted on 1066 HCPs from thirty countries in which more than half of the respondents (57.5%) wanted to learn more about probiotics.[11] More than half of the health science students in this study (51.7%) had a neutral response when asked if in the future they would recommend probiotics to prevent/treat digestive problems. This result is contrary to a study

Table 6 Correlation Between Knowledge, Attitude, and Practice Scores

Variable	Correlation Coefficient (r_s)	P-value
Knowledge-Attitude	0.238	0.026*
Knowledge-Practice	0.207	0.054
Attitude-Practice	0.275	0.010**

Notes: r_s, Spearman's rank correlation coefficient; *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

assessing the attitude of HCPs in India that shows the majority of the respondents (85.7%) believed that probiotics are useful for patients. It is also contrary to the study conducted on 1066 HCPs from thirty countries in which 87.5% stated that they had advised friends, relatives, their sons and daughters, and others to use probiotics. Also, 79% of them had advised their patients to use probiotics.[11,14] Another study of Indonesian pediatricians also stated that 97% of 99 respondents were convinced of the probiotics' benefits and consider prescribing them to their patients.[26] These findings indicate a similarity among students and professionals of the health sector's attitude towards the use of probiotics. However, doubt is indicative regarding the respondents of this study advising their future patients to use probiotics. Hopefully, these findings may encourage the students to learn more through scientific evidence and media to have a more objective judgment towards probiotics use for their future patient's best health interest. Regarding practice towards probiotics, 62.1% of the respondents showed positive responses. Unlike knowledge and attitude variables, pharmacy students had the highest mean±SD (7.8±2.4) of practice scores compared to other majors, although the results were not statistically significant. This finding suggests that there are other factors that contribute to one's practice towards probiotics use that may be assessed in future studies. In addition, 50.6% of this study's respondents consume probiotics every 2–6 days during October-November 2020. However, only 14.9% consume it daily, although most (81.6%) also knew that probiotics consumption must be done regularly over a long time to be beneficial for health. Fermented foods (47.1%) and drinks (44.8%) are the most frequently consumed probiotic products.[27] This result is similar to a study conducted on Jabodetabek college students in which 66% of the respondents consume probiotics but do not do it daily, and 9.5% consume probiotics daily with probiotic drinks as the most frequently consumed type of probiotic products (80%).[25] From this study, it is also known that only 17.2% of the health science students consumed probiotics because they believe in its health benefits. This result is contrary to the same study mentioned earlier, which found that more than half (59%) of the respondents consumed probiotics for the same reason.[25] These findings are intriguing since the respondents of this study are health science students who mostly have fair probiotics knowledge levels. As a comparison, the majority of the respondents (86.8%) of the study conducted to 1066 HCPs from thirty countries stated that they had already used probiotics with probiotic drinks (74.5%), probiotic medicines (73.9%), and probiotic food supplements (74.4%) as the most consumed products. Most of these HCPs also believed that probiotics should be used for diarrhea (83.5%) and constipation (70.6%), yet only 36.8% had taken probiotics for improved digestion.[11] These results highlight that many HCPs acknowledge the benefits of probiotics for the digestive system. Health science students should be more aware of this fact to feel more confident about using and recommending probiotics to prevent and treat digestive problems.

The results also shows weak correlations between knowledge-attitude and attitude-practice variables. There is no statistically significant correlation between knowledge-practice variables (Table 6). The explanation for this would be due to the already weak correlation between knowledge-attitude and attitude-practice variables, and due to the cross-sectional study design that did not allow the researchers to evaluate any behavior development of the participants. It is also known that individuals who have optimal beliefs that they are likely to develop certain diseases are not expected to accept any suggested health action unless they also perceive the action as potentially beneficial by reducing the threat. There are also non-health -related perceptions that may influence decision-making regarding behaviour change, such as financial status, familial perceptions, and product-related aspects.[25,28] Nevertheless, these results are in line with a study in India that concluded that HCPs knowledge and attitude of probiotics affect their current practice.[14] Furthermore, one of the issues assessed in this study was the respondents' willingness to recommend the consumption of probiotics to their future patients, which was also largely assessed to the HCPs. Even though many of the previous studies' results indicate a favorable response towards this issue, there are still concerns and challenges faced by HCPs in recommending probiotics, mainly due to the limited knowledge on probiotics' mechanism of action, availability of the products, and the large amount of information provided by companies about the benefits of their probiotic products.[11,29,30] Some of the concerns are regarding scientific evidence, adverse effects, and availability of probiotics.[30] The wide range of probiotic products with strain-specific effects made it more challenging for HCPs to correctly select and recommend the type of probiotic products that will be beneficial for their patient, despite the vastly growing scientific evidence supporting probiotics'

benefits.[11] Hence, it is essential that a more up-to-date, evidence-based academic curricula specialized according to health science majors regarding the use of probiotics are issued as the first step in producing more HCPs that are aware of the benefits of probiotics.[10,17,20,29]

Limitations

There are limitations acknowledged in this study. The cross-sectional research design, without observation especially for the practice variable, means that we cannot prove these variables' causality. The type of questions used, especially checkboxes, may also affect the score gained by respondents. The significantly different number of population study among the students of the four majors is also a challenge for the proportional cluster random sampling. As a result, there are also significant differences in the number of our samples. The sample size is also calculated based on the minimum requirement due to the low accessibility to the study population as a result of the stay-at-home policy that was applied to all students of Universitas Padjadjaran during the study due to the COVID-19 pandemic. Despite having the questionnaire subjected to validity and reliability tests, the questionnaire administration was not monitored. That may pose a bias due to the likelihood of multi interpretation of the questions.

Conclusion and Recommendations

Most respondents showed a fair level of knowledge, positive attitude, and positive practice towards probiotics use for digestive problems. Combined with the growing studies and information from various media regarding the use and benefits of probiotics, the incorporation of scientific evidence regarding probiotics specialized to all majors' academic curricula and media may improve the students' knowledge and awareness of probiotics. From this point forward, similar studies and more studies assessing determinants related to each aspects of knowledge, attitude, and practice towards probiotics use may be needed to help increase the chance of probiotics usage to prevent and treat digestive system diseases in the future.

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Disclosure

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