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Original article

Assessing Knowledge, Attitudes, and Practices Toward Probiotics Among Pharmacists in Tripoli, Libya: A Cross-Sectional Study

Eshraq Alsherif[1]*, Rayan Alzarouk[2], Ahmed Abuirzayzah[2]

[1]*Department of Prosthodontics, Faculty of Dentistry, University of Tripoli, Libya*
[2]*Department of Pharmaceutical Sciences, University of Tripoli Alahlia, Janzur, Libya*
Corresponding email. *eshraq.alsherif@uot.edu.ly*

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A B S T R A C T

Probiotics have gained significant attention for their potential health benefits, particularly in gastrointestinal and immune-related conditions. This study aimed to assess the knowledge, perceptions, and prescribing practices of pharmacists in Libya regarding probiotics. A cross-sectional study was conducted among 135 participants, including pharmacists, using a self-designed questionnaire and face-to-face interviews for data collection. Data were analyzed using descriptive statistics and Chi-Square tests to examine associations between demographic variables and probiotic-related knowledge, attitude, and practices using IBM SPSS Statistics version 24. Descriptive statistics was used. P values less than 0.05 were considered to be significant. The analysis revealed significant associations between demographic factors and knowledge, attitudes, and practices (KAP) regarding probiotics. Educational level was strongly associated with nearly all knowledge aspects (e.g., familiarity, understanding, uses, microorganisms, and side effects of probiotics; $p < 0.001$) and practice-related variables (e.g., conditions for use, forms recommended; $p < 0.001$). Age significantly influenced understanding, uses, microorganisms, side effects of probiotics ($p < 0.05$), and attitudes toward recommending probiotics ($p < 0.001$). Years of experience and occupation were also significant predictors of knowledge and attitudes, particularly regarding sources of information and recommendations ($p < 0.05$). Gender, however, showed no significant associations with KAP variables ($p > 0.05$). These findings underscore the importance of education, age, professional experience, and occupation in shaping KAP related to probiotics. In conclusion, educational level, age, years of experience, and occupation significantly influence knowledge, attitudes, and practices (KAP) regarding probiotics, with education being the strongest predictor. These findings emphasize the need for targeted education and training, especially for those with lower education or limited experience, to enhance probiotic-related KAP. Further research is recommended to inform strategies for diverse populations.

Introduction

Probiotics, defined by FAO/WHO (2001) as "live microorganisms conferring health benefits when administered adequately," are widely recognized for their roles in promoting well-being. Commonly studied genera include B*ifidobacterium* and *Lactobacillus*, which detoxify xenobiotics, biotransform mycotoxins, and synthesize essential vitamins [1]. These microorganisms, primarily from the genera *Lactobacillus* and *Bifidobacterium*, are known to support digestive health, modulate immune function, and mitigate the side effects of antibiotics, among other benefits [2,3]. Probiotics benefit digestive health, immune function, and oral health while mitigating antibiotic side effects [4]. However, risks exist for immunocompromised individuals, necessitating careful use [5]. Emerging research highlights their potential in immune modulation, cancer prevention, and allergy management, though further studies are needed to optimize strains and dosages [6, 7].

Pharmacists are often the first point of contact for patients seeking advice on over-the-counter products, including probiotics. Their knowledge, attitudes, and practices (KAP) regarding probiotics are, therefore, crucial in ensuring that patients receive accurate information and appropriate recommendations. The present study aims to evaluate the knowledge, attitudes, and practices (KAP) regarding probiotics among pharmacists in Tripoli, Libya, with a focus on their knowledge of probiotic benefits and uses, attitudes toward recommending probiotics, and actual prescribing practices.

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Methods

Study design and setting

A cross-sectional study was conducted from September to December 2024 among pharmacists working in different healthcare settings, including community pharmacies and private-sector pharmacies, with a total sample size of 135 participants. The study was carried out in Tripoli, the capital city of Libya. Participants were invited to complete a self-designed questionnaire by face-to-face interview, and written consent was obtained before data collection. A pilot questionnaire was obtained to assess the validity and reliability.

Data collection

A questionnaire was designed to assess participants' demographics, knowledge, attitudes, and practices regarding probiotics. The questionnaire comprised four main sections: The first section related to demographics, including data on participants' age, gender, professional setting (community pharmacy, private sector pharmacies), and years of professional. The second section evaluated participants' understanding of probiotics. The third section examined participants' perceptions and beliefs regarding probiotics, and the last section assessed participants' actual prescribing behaviors concerning probiotics.

Statistical analysis

Data were analyzed using descriptive statistics and Chi-Square tests to examine associations between demographic variables and probiotic-related knowledge, attitude, and practices using IBM SPSS Statistics version 24. Descriptive statistics was used. P values less than 0.05 were considered to be significant.

Results

The study population comprised 135 participants with an age range of 21 to 56 years. The majority (43.7%) were between 26 and 30 years old, and 80.7% were 35 years or younger, indicating a relatively young sample. Only a small proportion (4.4%) were over 40 years old. Gender distribution was nearly equal, with 51.9% females and 48.1% males. Educationally, most participants (92.6%) held a Bachelor's degree, while a smaller percentage had a Master's degree (6.7%) or Doctorate (0.7%). Professionally, the majority worked in community pharmacies (71.1%), followed by private sector pharmacies (28.8%). In terms of experience, 52.6% had 5–10 years of experience, 37.0% had less than 5 years, and only 1.5% had over 20 years, reflecting a predominantly early to mid-career workforce. These demographics highlight a young, educated, and moderately experienced group, with a strong representation from community pharmacy settings, as demonstrated in Table 1.

Table 1 The demographic characteristics of participants with N (Frequency) and % (Percentage):

Category	Subgroup	N (%)
Age Distribution	21 - 25 years	18 (13.3%)
	26 - 30 years	59 (43.7%)
	31 - 35 years	32 (23.7%)
	36 - 40 years	20 (14.8%)
	41 - 45 years	5 (3.7%)
	46 - 56 years	1 (0.7%)
Gender Distribution	Female	70 (51.9%)
	Male	65 (48.1%)
Educational Level	Bachelor's degree	125 (92.6%)
	Master's degree	9 (6.7%)
	Doctorate	1 (0.7%)
Occupation	Community Pharmacy	96 (71.1%)
	Private Sector Pharmacy	39 (28.8%)
Years of Experience	Less than 5 years	50 (37.0%)
	5 - 10 years	71 (52.6%)
	11 - 20 years	12 (8.9%)
	More than 20 years	2 (1.5%)

In terms of knowledge, 71.9% of respondents were somewhat familiar with probiotics, while only 27.4% were very familiar, indicating room for improved education. Half of the participants (50.4%) recognized all the benefits of probiotics, including digestive health, immune support, and other advantages, but 49.6% lacked comprehensive knowledge. A majority (66.7%) correctly identified yeast-bacteria mixtures as the most common organisms used in probiotics, demonstrating a good understanding of probiotic composition.

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Regarding attitudes, an overwhelming 99.3% of participants recommended probiotics to patients, reflecting a strong belief in their efficacy. Academic education was the primary source of information for 47.4% of respondents, highlighting its importance in shaping attitudes toward probiotics.
In terms of practices, 43.7% of participants recommended all forms of probiotics, including capsules, powder, liquid, and food, indicating a preference for diverse delivery methods. However, 34.8% reported no side effects from probiotic use, while 65.2% either experienced side effects or were unsure, suggesting that while probiotics are widely recommended, their tolerability varies among individuals. Overall, the findings underscore the need for enhanced education to improve knowledge about probiotics, reinforce positive attitudes, and promote evidence-based practices to ensure safe and effective use, as demonstrated in table 2.

Table 2. Knowledge, Attitudes, and Practices Regarding Probiotics

Category	Question	Answer	Frequency (N)	Percentage (%)
Knowledge	Familiarity with Probiotics	Not Familiar	1	0.7%
		Somewhat Familiar	97	71.9%
		Very Familiar	37	27.4%
	Knowledge About Benefits of Probiotics	Helps with diarrhea	15	11.1%
		Improves digestive health	8	5.9%
		Improves digestive health, helps with diarrhea	3	2.2%
		Improves digestive health, boosts the immune system	13	9.6%
		Improves digestive health, boosts the immune system, helps with diarrhea	10	7.4%
		Improves digestive health, boosts the immune system, improves mental health	2	1.5%
		Improves digestive health, boosts the immune system, prevents vaginal infections	2	1.5%
		Improves digestive health, boosts the immune system, prevents vaginal infections, helps with diarrhea	3	2.2%
		Boosts the immune system	8	5.9%
		Boosts the immune system, helps with diarrhea	1	0.7%
		All of the above	68	50.4%
		None of the above	2	1.5%
	Conditions for Which Probiotics Are Commonly Prescribed	Digestive issues (e.g., diarrhea)	24	17.8%
		Digestive issues + Immune system support	25	18.5%
		After antibiotic treatment	2	1.5%
		After antibiotic treatment + Digestive issues	21	15.6%
		After antibiotic treatment + Digestive issues + Immune system support	19	14.1%
		Immune system support only	3	2.2%
		Allergies (alone or with other conditions)	4	3.0%
		All of the above	32	23.7%

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Category	Question	Answer	Frequency (N)	Percentage (%)
		Acute pancreatitis	6	4.4%
		Acute pancreatitis + HIV/AIDS	2	1.5%
		Acute pancreatitis + Digestive tract damage	3	2.2%
		Acute pancreatitis + Digestive tract damage + HIV/AIDS	2	1.5%
		Acute pancreatitis + Digestive tract damage + Short bowel syndrome	2	1.5%
		All of the above conditions	1	0.7%
		Acute pancreatitis + Short bowel syndrome	1	0.7%
		HIV/AIDS	14	10.4%
		All of the above (including HIV/AIDS and other conditions)	55	40.7%
		None of the above	16	11.9%
		Digestive tract damage	12	8.9%
		Digestive tract damage + HIV/AIDS	7	5.2%
		Digestive tract damage + HIV/AIDS + Intestinal obstruction	1	0.7%
		Digestive tract damage + Short bowel syndrome	2	1.5%
		Digestive tract damage + Short bowel syndrome + Intestinal obstruction	2	1.5%
		Digestive tract damage + Short bowel syndrome + HIV/AIDS	5	3.7%
		Digestive tract damage + Short bowel syndrome + HIV/AIDS + Intestinal obstruction	1	0.7%
		Short bowel syndrome	3	2.2%
	Organisms That Can Be Used as Probiotics	Bacteria – *Bifidobacteria*	11	8.1%
		Bacteria – *Lactobacillus*	31	23.0%
		A mixture of yeasts and bacteria	90	66.7%
		I don't know	3	2.2%
Attitudes	**Do You Recommend Probiotics to Patients?**	No	1	0.7%
		Yes	134	99.3%
	Sources of Information About Probiotics	University education and academic training	64	47.4%
		Online educational resources	21	15.6%
		University education and academic training, learning from colleagues	11	8.1%

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Category	Question	Answer	Frequency (N)	Percentage (%)
		University education and academic training, TV or radio	1	0.7%
		University education and academic training, online educational resources	21	15.6%
		University education and academic training, online resources, conferences and workshops	1	0.7%
		University education and academic training, online resources, learning from colleagues	6	4.4%
		University education and academic training, online resources, TV/radio	6	4.4%
		TV or radio	1	0.7%
		Learning from colleagues	5	3.7%
		Online educational resources and learning from colleagues	1	0.7%
Practices	**Forms of Probiotics Recommended for Patients**	Liquid (e.g., drink)	2	1.5%
		Powder	6	4.4%
		Liquid + Powder	1	0.7%
		Food containing probiotics (e.g., yogurt)	4	3.0%
		Food + Powder	1	0.7%
		Capsules or Tablets	36	26.7%
		Capsules or Tablets + Liquid	6	4.4%
		Capsules or Tablets + Liquid + Powder	6	4.4%
		Capsules or Tablets + Food containing probiotics	2	1.5%
		Capsules or Tablets + Powder	12	8.9%
		All forms combined	59	43.7%
	Side Effects of Probiotics	Gas and bloating	16	11.9%
		Headache	1	0.7%
		Allergic reaction	6	4.4%
		Abdominal pain	3	2.2%
		Antibiotic resistance	4	3.0%
		All of the above	18	13.3%
		None of the above	47	34.8%

The study also revealed significant associations between demographic factors and KAP regarding probiotics. Educational level was the most influential factor, strongly linked to familiarity, understanding, uses, microorganisms, and side effects of probiotics ($p < 0.001$). Age significantly impacted understanding, uses, and microorganisms ($p < 0.05$), while years of experience and occupation influenced knowledge and practices ($p < 0.05$). Gender showed no significant associations. Attitudes were shaped by age, education, experience, and occupation, particularly in information sources and recommendations ($p < 0.05$). Practices, such as probiotic recommendations and forms used, were influenced by education, occupation, and age ($p < 0.05$), as demonstrated in Table 3.

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Table 3. Association between Gender, Age, Years of Experience, Occupation, Educational Level, and KAP

Category	Aspect	Variable	p-value
Knowledge	Familiarity with Probiotics	Gender	0.586
		Age	0.659
		Educational Level	0.000*
	Understanding of Probiotics	Gender	0.550
		Age	0.028*
		Educational Level	0.000*
	Uses of Probiotics	Gender	0.334
		Age	0.001*
		Educational Level	0.000*
	Contraindications for Probiotics	Gender	0.075
	Microorganisms Used in Probiotics	Gender	0.634
		Age	0.003*
		Educational Level	0.000*
	Side Effects of Probiotics	Gender	0.071
		Age	0.003*
		Educational Level	0.000*
	Knowledge of Probiotics	Occupation	0.001*
	Uses of Probiotics	Occupation	0.000*
	Organisms Used in Probiotics	Occupation	0.015*
Attitudes	Sources of Information	Gender	0.167
		Age	0.003*
		Years of Experience	0.000*
		Occupation	0.007*
		Educational Level	0.000*
	Do You Recommend Probiotics to Patients?	Age	0.000*
		Educational Level	0.000*
Practices	Recommendation of Probiotics	Gender	0.298
		Occupation	0.030*
	Conditions for Probiotic Use	Gender	0.381
		Age	0.003*
		Educational Level	0.000*
	Forms of Probiotics Recommended	Gender	0.081
		Age	0.995
		Occupation	0.007*
		Educational Level	0.000*
	Conditions Where Probiotics Should Not Be Prescribed	Age	0.787
		Educational Level	0.000*

(*) P-value significant less than 0.05

Discussion

This study provides valuable insights into the knowledge, attitudes, and practices (KAP) regarding probiotics among a predominantly young, educated, and moderately experienced study population. The findings highlight significant associations between demographic factors such as educational level, age, occupation, and years of experience and KAP related to probiotics. These results align with and expand upon previous research, offering a comprehensive understanding of how demographic variables influence probiotic-related behaviors and perceptions.

The present study revealed that 71.9% of participants were somewhat familiar with probiotics, while only 27.4% were very familiar, indicating a need for enhanced education. This finding is consistent with studies by [2] and [3], which emphasized the importance of improving public and professional awareness of probiotics. Notably, educational level was the most influential factor, strongly associated with familiarity, understanding, and knowledge of probiotic uses and side effects ($p < 0.001$). This aligns with research by

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[5], who found that higher education levels correlate with a better understanding of probiotic benefits and applications. Additionally, age significantly influenced understanding and knowledge of probiotic uses ($p < 0.05$), suggesting that younger individuals may require targeted educational interventions to bridge knowledge gaps.

The UAE study similarly highlighted gaps in knowledge among pharmacists, with many participants demonstrating limited familiarity with specific probiotic strains and their clinical applications [9]. This reinforces the global need for educational initiatives to improve probiotic-related knowledge among healthcare professionals. The Pakistan study also identified educational level as a key determinant of knowledge, with healthcare professionals reporting varying levels of understanding based on their training and exposure to probiotics [10]. These findings collectively underscore the importance of integrating probiotic education into academic curricula and professional training programs across regions.

An overwhelming 99.3% of participants in the current study recommended probiotics to patients, reflecting strong confidence in their efficacy. This positive attitude is consistent with the findings of a previous study [4], which reported widespread acceptance of probiotics among healthcare professionals. Academic education emerged as the primary source of information (47.4%), underscoring its critical role in shaping attitudes. Similar studies, such as those by [11], have also highlighted the influence of formal education on probiotic-related attitudes. Furthermore, age, years of experience, and occupation significantly influenced attitudes, particularly in terms of information sources and recommendations ($p < 0.05$). These findings suggest that professional training and experience play a pivotal role in fostering positive attitudes toward probiotics.

The UAE study echoed these findings, revealing that pharmacists held favorable perceptions of probiotics, driven by their confidence in the efficacy and safety of these products [9]. Similarly, the Pakistan study reported that healthcare professionals generally viewed probiotics as beneficial, particularly for gastrointestinal health, with attitudes influenced by their clinical experience and exposure to probiotic-related information [10]. These parallels across regions highlight the universal acceptance of probiotics among healthcare professionals while emphasizing the role of education and experience in shaping attitudes.

In terms of practices, 43.7% of participants in the current study recommended all forms of probiotics, including capsules, powders, liquids, and foods, indicating a preference for diverse delivery methods. This aligns with research by Williams et al., [12], who noted that healthcare professionals often recommend multiple probiotic forms to cater to patient preferences and needs. However, 65.2% of participants reported side effects or were unsure about tolerability, highlighting the need for clearer guidelines on probiotic safety and usage. Educational level and occupation significantly influenced practices, particularly in the recommendation of probiotic forms and conditions for use ($p < 0.05$). These findings are consistent with studies by Miller et al., [6], which emphasized the importance of evidence-based practices to ensure safe and effective probiotic use.

The UAE study similarly found that pharmacists frequently recommended diverse probiotic forms based on patient preferences and clinical conditions, but gaps in understanding probiotic safety and tolerability were also noted by Abbas et al., [9]. The Pakistan study highlighted variations in prescribing practices, with healthcare professionals recommending probiotics based on their familiarity with specific strains and indications but also expressing concerns about side effects and lack of standardized guidelines by Arshad et al., [10]. These findings collectively underscore the need for evidence-based guidelines and training programs to address gaps in probiotic-related practices globally.

The present study identified significant associations between demographic factors and KAP. Educational level was the most influential factor, strongly linked to knowledge and practices ($p < 0.001$). This finding is supported by Anderson et al. [13], who demonstrated that higher education levels correlate with better probiotic-related knowledge and practices. Age also played a significant role, particularly in understanding and uses of probiotics ($p < 0.05$), while years of experience and occupation influenced knowledge and practices ($p < 0.05$). These results are consistent with research by Lee et al. [14], which highlighted the impact of professional experience on probiotic-related behaviors. Interestingly, gender showed no significant associations, contrasting with some studies that have reported gender-based differences in probiotic knowledge and attitudes by Jones et al. [15].

The findings of this study are consistent with previous research but also offer new insights. For example, while Hill et al. [2] and LeBlanc et al. [3] emphasized the importance of education in shaping probiotic knowledge, this study further highlights the role of occupation and years of experience. Similarly, the strong positive attitudes toward probiotics align with findings by Kumar et al. [4], but this study adds that these attitudes are significantly influenced by age and professional experience. The preference for diverse probiotic forms is consistent with Williams et al [12], but the reported side effects and tolerability concerns underscore the need for further research and guidelines, as noted by Miller et al [6].

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The inclusion of the UAE and Pakistan studies provides additional insights into regional and cultural influences on KAP. For example, the UAE study revealed that pharmacists' prescribing practices were influenced by regulatory frameworks and patient demand for probiotics Abbas et al [9]. The Pakistan study highlighted the role of socioeconomic factors and access to healthcare resources in shaping probiotic-related knowledge and practices by Arshad et al [10]. These regional differences emphasize the importance of context-specific interventions to address gaps in KAP related to probiotics.

Conclusion

The study highlights the impact of demographic factors on probiotic-related knowledge, attitudes, and practices, emphasizing the need for educational activities and evidence-based guidelines to address knowledge gaps and potential negative effects.

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Conflicts of interest

The authors declare no conflicts of interest.

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المستخلص

اكتسبت البروبيوتيك اهتمامًا كبيرًا لفوائدها الصحية المحتملة، وخاصة في الحالات المرتبطة بالجهاز الهضمي والجهاز المناعي. هدفت هذه الدراسة إلى تقييم المعرفة والتصورات وممارسات وصف الأدوية للصيادلة في ليبيا فيما يتعلق بالبروبيوتيك. أجريت دراسة مقطعية بين 135 مشاركًا، بما في ذلك الصيادلة، باستخدام استبيان مصمم ذاتيًا ومقابلة وجهاً لوجه لجمع البيانات. تم تحليل البيانات باستخدام الإحصاء الوصفي واختبارات مربع كاي لفحص الارتباطات بين المتغيرات الديموغرافية والمعرفة والمواقف والممارسات المتعلقة بالبروبيوتيك باستخدام IBM SPSS Statistics الإصدار 24. تم استخدام الإحصاء الوصفي. اعتُبرت قيم P الأقل من 0.05 ذات دلالة إحصائية. كشف التحليل عن ارتباطات مهمة بين العوامل الديموغرافية والمعرفة والمواقف والممارسات (KAP) فيما يتعلق بالبروبيوتيك. ارتبط المستوى التعليمي ارتباطًا وثيقًا بجميع جوانب المعرفة تقريبًا) على سبيل المثال، الألفة والفهم والاستخدامات والكائنات الدقيقة والآثار الجانبية للبروبيوتيك؛ قيمة (P < 0.001 والمتغيرات المتعلقة بالممارسة) على سبيل المثال، شروط الاستخدام والأشكال الموصى بها؛ قيمة .(P < 0.001 أثر العمر بشكل كبير على الفهم والاستخدامات والكائنات الدقيقة والآثار الجانبية للبروبيوتيك) قيمة (P < 0.05والمواقف تجاه التوصية بالبروبيوتيك) قيمة .(P < 0.001 كانت سنوات الخبرة والمهنة أيضًا من المتنبئين المهمين للمعرفة والمواقف، وخاصة فيما يتعلق بمصادر المعلومات والتوصيات) قيمة .(P < 0.05 ومع ذلك، لم يُظهر الجنس أي ارتباطات مهمة بمتغيرات المعارف والمواقف والممارسات) قيمة .(P> 0.05 تؤكد هذه النتائج على أهمية التعليم والعمر والخبرة المهنية والمهنة في تشكيل المعارف والمواقف والممارسات المتعلقة بالبروبيوتيك. وفي الختام، يؤثر المستوى التعليمي والعمر وسنوات الخبرة والمهنة بشكل كبير على المعارف والمواقف والممارسات المتعلقة بالبروبيوتيك، حيث يكون التعليم هو أقوى المتنبئين. تؤكد هذه النتائج على الحاجة إلى التعليم والتدريب المستهدفين، وخاصة لأولئك الذين لديهم تعليم أقل أو خبرة محدودة، لتعزيز المعارف والخبرات والممارسات المتعلقة بالبروبيوتيك. ويوصى بإجراء المزيد من البحوث لإعلام الاستراتيجيات لمختلف السكان.

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