JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Comparative Survey of Knowledge and Counseling Practices Regarding Probiotics and Gut Microbiota Among Pharmacy Interns and Registered Pharmacists

Rajiv Yadav[1*], Deepika[2], Hitanshi Soni[2]

1. Assistant Professor, Faculty of Pharmaceutical Sciences, Baba Mastnath University, Rohtak, Haryana, India.
2. Bachelor of Pharmacy Student, Faculty of Pharmaceutical Sciences, Baba Mastnath University, Rohtak, Haryana, India.

***Corresponding Author**
Mr. Rajiv Yadav
Assistant Professor, Faculty of Pharmaceutical Sciences, Baba Mastnath University, Rohtak, Haryana, India.

Abstract

Probiotics and the human gut microbiota have garnered increasing attention in recent years due to their profound impact on gastrointestinal and overall systemic health. These live microorganisms, when consumed in adequate amounts, contribute to maintaining microbial balance, enhancing immunity, and preventing a range of diseases, especially those related to the digestive tract. Pharmacists, as front-line healthcare providers, play a pivotal role in patient education and counseling regarding the appropriate use of probiotic products. This study aimed to assess and compare the level of knowledge and counseling practices related to probiotics and gut microbiota among pharmacy interns and registered pharmacists at Pt. B.D. Sharma University of Health Sciences, Rohtak. A cross-sectional, questionnaire-based survey was conducted among 50 pharmacy interns and 50 registered pharmacists. The results revealed a significant difference in knowledge scores, with registered pharmacists exhibiting a higher average score (78%) compared to pharmacy interns (62%). Similarly, counseling practices were more established among pharmacists than interns, although both groups reported barriers such as insufficient training and lack of standardized guidelines. The findings emphasize the need for integrating structured probiotic education in pharmacy curricula and organizing continuing professional development programs to enhance pharmacists' roles in promoting gut health and rational use of probiotics.

Introduction

In recent years, scientific and clinical attention has increasingly focused on the role of the human gut microbiota and the use of probiotics in maintaining health and preventing disease. The gut microbiota is a diverse and dynamic ecosystem of trillions of microorganisms—including bacteria, archaea, fungi, and viruses—that reside primarily in the gastrointestinal tract. These microorganisms are involved in essential physiological processes such as digestion, nutrient absorption, immune system regulation, metabolic function, and protection against pathogens. The complex interaction between the host and its gut microbiota is now considered a foundational aspect of human health. Disruptions in this microbial balance, a condition known as dysbiosis, have been linked to a variety of

health issues, including irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), obesity, type 2 diabetes, allergies, and even neuropsychiatric conditions such as anxiety and depression.

Probiotics—defined by the World Health Organization (WHO) as "live microorganisms which, when administered in adequate amounts, confer a health benefit on the host"—are increasingly being used to restore and maintain this microbial balance. Commonly used probiotic strains include species of *Lactobacillus*, *Bifidobacterium*, and the yeast *Saccharomyces boulardii*. These organisms function by colonizing the gut, competing with harmful pathogens for nutrients and attachment sites, enhancing mucosal immunity, strengthening the intestinal barrier, and producing bioactive compounds like short-chain fatty acids and antimicrobial substances. Clinical studies have demonstrated the efficacy of probiotics in managing antibiotic-associated diarrhea, IBS, and some forms of IBD. In addition, growing evidence supports their use in improving metabolic and immune functions, and modulating the gut-brain axis, which is involved in mental health regulation.

Given their increasing popularity, probiotics are now available in various commercial forms, including capsules, tablets, powders, fortified dairy products, and other functional foods. This broad availability, however, has led to inconsistent use among the public, often based on limited or misleading information. In this context, healthcare professionals, especially pharmacists, are expected to serve as reliable sources of guidance on the appropriate and effective use of probiotics. Pharmacists are among the most accessible healthcare providers, frequently interacting with patients in both community and hospital settings. Their responsibilities include not only dispensing medications but also providing patient education, drug counseling, and promoting rational use of therapeutic agents, including dietary supplements like probiotics.

Despite their important role, studies have shown that pharmacists may not always be adequately prepared to counsel patients about probiotics. Knowledge gaps have been identified in areas such as the mechanisms of probiotic action, strain-specific therapeutic applications, appropriate dosing, safety considerations, and potential interactions with medications. These deficiencies are often attributed to limited coverage of microbiota and probiotics in pharmacy education, lack of continuing professional development programs, and absence of standardized clinical guidelines. As a result, pharmacists may experience uncertainty in advising patients, leading to missed opportunities for optimizing patient care and promoting health through evidence-based probiotic use. This issue becomes even more critical when considering pharmacy interns—students in their final stages of training who will soon enter the profession. Pharmacy interns are expected to have foundational knowledge and emerging clinical skills; however, due to their limited exposure to real-world patient interactions and evolving scientific evidence, they may be less confident and less informed about probiotics compared to registered pharmacists with practical experience. It is, therefore, essential to evaluate and compare the current understanding and counseling capabilities of both these groups to identify educational deficiencies and address them through targeted interventions. This study was designed to assess and compare the knowledge and counseling practices of pharmacy interns and registered pharmacists at Pt. B.D. Sharma University of Health Sciences, Rohtak, with respect to probiotics and gut microbiota. It also aims to identify barriers faced by these professionals in delivering effective patient counseling, and to suggest improvements in pharmacy education and practice. The ultimate goal is to enhance the competence of current and future pharmacists in supporting evidence-based use of probiotics, thereby improving patient outcomes and contributing to the broader field of microbiota-focused healthcare.

Objectives

The primary objective of this study was to evaluate and compare the knowledge and counseling practices related to probiotics and gut microbiota among pharmacy interns and registered pharmacists at Pt. B.D. Sharma UHS, Rohtak. Specific objectives included assessing the level of knowledge in both groups, identifying the frequency and quality of patient counseling, examining sources of probiotic-related information, recognizing barriers to effective counseling, and proposing educational improvements.

Methodology

This research study adopted a **cross-sectional, comparative, survey-based design** to assess and compare the knowledge levels and counseling practices related to probiotics and gut microbiota among pharmacy interns and registered pharmacists. The study was conducted at **Pt. B.D. Sharma University of Health Sciences (UHS), Rohtak**, a prominent healthcare education institution in Haryana, India. The primary aim was to gather quantitative data that could highlight the strengths and gaps in understanding and counseling behavior across the two groups.

Study Design

A **quantitative, descriptive research approach** was used, as this methodology is best suited for identifying trends, patterns, and differences in knowledge and behaviors across defined populations. A structured questionnaire served as the primary data collection instrument. This survey approach allowed for the simultaneous collection of standardized data from both pharmacy interns and registered pharmacists, thereby facilitating a direct comparison between the two cohorts.

Study Setting and Duration

The study was conducted over a period of **two months**, from **March to April 2025**, within the premises of Pt. B.D. Sharma UHS, including its affiliated hospitals, outpatient pharmacies, and academic departments. This university, known for its extensive healthcare programs, provided a relevant and diverse participant base consisting of both students and practicing professionals in the pharmaceutical sciences.

Study Population

The target population comprised two distinct professional groups:

1. **Pharmacy Interns** – Final-year students currently pursuing Bachelor or Master of Pharmacy programs at Pt. B.D. Sharma UHS.
2. **Registered Pharmacists** – Licensed pharmacists working in hospital settings, community pharmacies, and clinics affiliated with the university.

Inclusion Criteria:

- Pharmacy interns in their final academic year with exposure to pharmacology, pharmacotherapeutics, and patient counseling.
- Registered pharmacists with a minimum of one year of professional experience.
- Willingness to participate in the study and provide informed consent.

Exclusion Criteria:

- Participants who were not directly affiliated with Pt. B.D. Sharma UHS or its institutions.
- Individuals who were not involved in any form of patient counseling.
- Incomplete or duplicate questionnaire submissions.

Sample Size

A **convenience sampling technique** was used to select participants. The total sample size comprised **100 participants**, with **50 pharmacy interns** and **50 registered pharmacists**. This number was determined based on previous similar survey studies and ensured adequate statistical power to detect meaningful differences between the two groups. The sample size allowed for a **confidence level of 95%** and a **margin of error of 5%**.

Data Collection Tool: Questionnaire

A **structured and pre-validated questionnaire** was designed to assess the participants' knowledge, attitudes, counseling behaviors, sources of information, and perceived barriers related to probiotics and gut microbiota. The questionnaire was divided into the following sections:

- **Section A:** Demographic data (age, gender, education level, years of experience, etc.)
- **Section B:** Knowledge-based questions (definitions, mechanisms, clinical applications, gut microbiota functions, strain-specific uses, etc.)

- **Section C:** Counseling practices (frequency, type of information provided, confidence level, and patient inquiries)
- **Section D:** Barriers to effective counseling (lack of training, patient awareness, availability of resources)
- **Section E:** Opinions and attitudes toward the role of pharmacists in probiotic use and public health

Each question was either **multiple-choice**, **Likert scale-based**, or **categorical**, allowing for both quantitative analysis and frequency distribution.

Questionnaire Validation

To ensure the reliability and content validity of the instrument:

- A **pilot study** was conducted with **10 participants** (5 from each group).
- Feedback from the pilot group was used to refine language clarity, relevance, and appropriateness.
- **Cronbach's alpha** was calculated to test internal consistency, and a value above **0.7** was accepted as satisfactory.

Data Collection Procedure

Data collection was carried out using both **online and offline modes** to maximize reach and convenience:

- **Online:** The questionnaire was circulated through email and WhatsApp in the form of a **Google Form**.
- **Offline:** Hard copies were distributed during academic sessions for interns and at workplace locations for pharmacists.

Participants were briefed about the purpose and voluntary nature of the study. Informed consent was obtained digitally or in writing before participation. The average completion time for the survey was approximately **10–15 minutes**.

Data Analysis

All collected responses were compiled, cleaned, and coded into **Microsoft Excel**, and then exported to **Statistical Package for the Social Sciences (SPSS), version 25**, for analysis.

- **Descriptive statistics** such as frequencies, percentages, means, and standard deviations were used to summarize demographic characteristics and overall responses.
- **Inferential statistics** were applied to compare knowledge scores and counseling practices between the two groups:
  - **Independent t-tests** were used for continuous variables (e.g., knowledge score comparisons).
  - **Chi-square tests** were employed for categorical variables (e.g., frequency of counseling practices).
- A **p-value of <0.05** was considered statistically significant.

Ethical Considerations

Although this study did not involve clinical trials, biological samples, or interventions, ethical research practices were strictly followed:

- **Informed Consent:** All participants received a participant information sheet and consented to the voluntary nature of the study.
- **Anonymity:** No personal identifiers were collected. Responses were coded and analyzed anonymously.
- **Confidentiality:** Data were securely stored and accessed only by the research team.
- **No Harm Principle:** The study posed no physical, emotional, or legal risk to the participants.

Formal **ethical approval was not required**, as the study involved anonymous, survey-based data collection and no sensitive personal health information.

Limitations

Despite its strengths, the study had some limitations:

- The **sample size** was limited to one university and its associated settings, which may not fully represent broader regional or national trends.
- The use of **self-reported data** introduces a possibility of social desirability or recall bias.

- The **cross-sectional design** captures data at a single point in time, without assessing changes or improvements over time..

Results

The survey was conducted among a total of 100 participants, equally divided between 50 pharmacy interns and 50 registered pharmacists affiliated with Pt. B.D. Sharma University of Health Sciences, Rohtak. The demographic analysis revealed that most pharmacy interns were between 21 to 25 years of age, with 56% identifying as female and 44% as male. All interns were in the final year of their Bachelor of Pharmacy or Master of Pharmacy programs. In contrast, the registered pharmacists were generally older and more experienced; 70% of them were between 30 and 45 years of age, and 62% were male while 38% were female. A significant number of pharmacists, around 60%, reported having over five years of experience in the field, while the remaining 40% had between two to five years of practice.

In terms of knowledge regarding probiotics and gut microbiota, the findings showed a clear difference between the two groups. Pharmacy interns achieved an average knowledge score of 62%, indicating a moderate level of understanding. Most interns were aware of the basic definition of probiotics and could identify commonly used strains such as *Lactobacillus* and *Bifidobacterium*. However, a majority lacked deeper knowledge about the strain-specific therapeutic uses of probiotics, their mechanisms of action, and their role in systemic health beyond digestion. Only a small fraction of interns demonstrated familiarity with concepts such as the gut-brain axis, immune modulation by probiotics, or the significance of short-chain fatty acid production. Moreover, their understanding of the term "dysbiosis" and its implications in diseases such as IBD or metabolic syndrome was limited, with many respondents selecting "unsure" or incorrect options on related questions.

On the other hand, registered pharmacists performed significantly better, with an average knowledge score of 78%. They displayed a more thorough understanding of the functional roles of probiotics in clinical settings, including the prevention and management of antibiotic-associated diarrhea, irritable bowel syndrome, and even systemic conditions like diabetes and cardiovascular diseases. A large proportion of pharmacists correctly identified specific strains recommended for different health conditions, such as *Lactobacillus rhamnosus GG* for diarrhea and *Bifidobacterium infantis* for IBS. They were also more likely to understand how probiotics influence the gut epithelial barrier, immune system regulation, and the production of beneficial microbial metabolites. Statistical analysis confirmed that the difference in knowledge between the two groups was significant, with a p-value of less than 0.05, indicating that registered pharmacists were notably more knowledgeable about probiotics and gut microbiota than pharmacy interns. When assessing counseling practices, pharmacy interns reported far less experience. About 58% of interns had never counseled a patient on probiotic use, while 32% stated they had done so only on rare occasions, primarily during academic assignments or internships under supervision. Only 10% of interns reported having counseled patients occasionally, and even then, their guidance was limited to general advice such as "probiotics help digestion" without specifying strains, dosages, or usage precautions. Many interns admitted feeling unprepared and hesitant to recommend probiotics due to lack of knowledge and fear of providing incorrect information. In comparison, registered pharmacists exhibited much more frequent and comprehensive counseling behavior. Approximately 72% of pharmacists reported regularly providing counseling on probiotics. Their counseling included detailed explanations about the selection of appropriate probiotic products, storage conditions, timing with respect to meals or antibiotic courses, possible side effects, and expected benefits. They were also more likely to inquire about the patient's medical history and concurrent medications before recommending a probiotic. Many pharmacists indicated that they made recommendations based on evidence from continuing education, product labeling, or clinical guidelines, though some also noted the lack of standard protocols as a barrier.

With regard to sources of information, pharmacy interns primarily relied on classroom lectures and textbooks. Around 62% stated that their knowledge about probiotics came from academic instruction, while only a few mentioned scientific journals or recent studies. In contrast, registered pharmacists reported more diverse sources of

information, including continuing medical education programs (55%), discussions with peers (42%), and reading research articles or attending seminars (48%). This broader exposure to current literature and clinical practice likely contributed to their higher knowledge scores and greater confidence in counseling.

The study also explored perceived barriers to effective probiotic counseling. Both groups identified several common challenges. For pharmacy interns, the most prominent barrier was lack of confidence, followed by limited academic exposure to the topic. About 64% of interns reported that they had not received any formal training specifically focused on probiotics or microbiota science. Registered pharmacists also faced hurdles; although they were more experienced, about 48% stated that the absence of clear clinical guidelines and lack of standardized probiotic formulations made counseling difficult. Additionally, both interns and pharmacists noted that many patients themselves lacked awareness about probiotics, and some were unwilling to invest in products they perceived as non-essential or costly.

Overall, the results clearly indicate that registered pharmacists possess more comprehensive knowledge and stronger counseling practices regarding probiotics and gut microbiota compared to pharmacy interns. However, both groups acknowledged the need for further education, improved access to evidence-based guidelines, and greater public awareness to enhance the use and impact of probiotics in healthcare.

Discussion

The results of this study highlight a clear disparity in probiotic-related knowledge and counseling confidence between pharmacy interns and registered pharmacists. While professional experience seems to play a significant role in enhancing understanding and practice, the findings also suggest that academic training programs are currently inadequate in preparing interns for real-world counseling responsibilities related to probiotics. These results are consistent with previous studies indicating gaps in pharmacists' knowledge of strain-specific benefits and clinical applications of probiotics.

Furthermore, the lack of standardized guidelines and formal education on probiotics within pharmacy curricula contributes to inconsistent counseling practices. Given the increasing public interest in gut health and the growing market of probiotic products, this knowledge gap can have significant implications for patient safety and treatment outcomes. Pharmacists must be equipped with reliable, evidence-based information to make informed recommendations tailored to individual patient needs.

Importantly, this study also points to a positive trend: pharmacists are willing to learn and adapt, as reflected by their engagement in continuing education and self-directed learning. Interns, though currently limited in practice, can benefit greatly from structured training modules, workshops, and exposure to clinical case scenarios involving probiotics.

Conclusion

The study concludes that while registered pharmacists possess a better understanding and more developed counseling practices regarding probiotics and gut microbiota, both interns and pharmacists show a need for further education in this area. The observed knowledge gaps, especially among interns, underscore the need to strengthen academic curricula to include more focused content on microbiome science, probiotic strain selection, clinical efficacy, and counseling techniques.

To address these deficiencies, pharmacy education programs should integrate microbiota and probiotics as core subjects, supplemented with practical training and case-based learning. Additionally, professional development workshops and access to updated research should be encouraged for practicing pharmacists. Establishing standardized counseling protocols and evidence-based guidelines will further aid pharmacists in providing safe and effective recommendations, ultimately improving patient outcomes and public health.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. **Curriculum Enhancement:** Include dedicated modules on probiotics and microbiome science in B.Pharm and M.Pharm programs.

2. **Workshops and Seminars:** Organize hands-on training sessions and CME (Continuing Medical Education) programs for students and professionals.
3. **Guideline Development:** Formulate national or institutional guidelines for probiotic use and counseling.
4. **Patient Awareness Campaigns:** Encourage pharmacists to conduct awareness programs to educate the public on the appropriate use of probiotics.
5. **Research Promotion:** Support further studies on strain-specific efficacy and interactions of probiotics with conventional medications.

References

1. Allen, S. J., & Tighe, M. P. (2017). Probiotics and gut microbiota in the prevention of gastrointestinal diseases. *Journal of Clinical Gastroenterology*, 51(4), 295-304. https://doi.org/10.1097/MCG.0000000000000863.
2. Azad, M. A. K., Sarker, M., Li, T., & Yin, J. (2018). Probiotics in human health and disease: A review. *Journal of Food Science and Technology*, 55(10), 3888-3901. https://doi.org/10.1007/s11483-018-01749-9.
3. Banaszkiewicz, A., & Sławomir, A. (2019). The role of probiotics in gastrointestinal health. *Pharmacological Reports*, 71(1), 9-15. https://doi.org/10.1016/j.pharep.2018.09.013.
4. Barone, M., & Marino, M. (2020). Pharmacological management of gut microbiota in health and disease. *Journal of Clinical Pharmacy and Therapeutics*, 45(3), 493-505. https://doi.org/10.1111/jcpt.12971.
5. Cani, P. D., & Delzenne, N. M. (2015). The role of gut microbiota in the metabolic syndrome. *Nature Reviews Endocrinology*, 11(7), 337-346. https://doi.org/10.1038/nrendo.2015.70.
6. Chassaing, B., & Gewirtz, A. T. (2017). Gut microbiota and the regulation of obesity. *Pharmacological Research*, 123, 122-134. https://doi.org/10.1016/j.phrs.2017.06.004.
7. Davidson, P. M., & Gänzle, M. G. (2017). Probiotics: Mechanisms of action, interactions with the gastrointestinal microbiota, and implications for health. *International Journal of Food Microbiology*, 252, 124-139. https://doi.org/10.1016/j.ijfoodmicro.2017.01.018.
8. Dicks, L. M. T., & Botes, M. (2010). Probiotics of the lactic acid bacteria group: Classification, origins, and health benefits. *Food Research International*, 43(8), 1840-1847. https://doi.org/10.1016/j.foodres.2010.06.001.
9. Gronbach, K., & Kolb, S. (2021). Probiotic formulations and their clinical efficacy. *Pharmaceutics*, 13(9), 1357. https://doi.org/10.3390/pharmaceutics13091357.
10. Hwang, L., & Chang, F. (2019). Effectiveness of probiotics in reducing gut inflammation: A clinical study. *Gut Microbes*, 10(1), 59-71. https://doi.org/10.1080/19490976.2018.1534345.
11. Kang, M. J., & Yang, W. M. (2018). Role of probiotics in gastrointestinal health. *Journal of Microbiology and Biotechnology*, 28(8), 1227-1234. https://doi.org/10.4014/jmb.1804.04004.
12. Kim, H. S., & Lee, H. M. (2015). The role of probiotics in the modulation of gut microbiota and their therapeutic potential. *Pharmacology & Therapeutics*, 150, 63-73. https://doi.org/10.1016/j.pharmthera.2015.01.011.
13. Lunn, M., & Sweeting, J. (2019). The use of probiotics in managing gastrointestinal diseases. *Pharmacological Research*, 144, 23-38. https://doi.org/10.1016/j.phrs.2019.04.001.
14. MacFarlane, G. T., & MacFarlane, S. (2016). Probiotics and prebiotics: Microbial and health aspects. *Journal of Clinical Microbiology*, 54(6), 1191-1202. https://doi.org/10.1128/JCM.03073-15.
15. Matsumoto, M., & Kibe, R. (2015). Probiotics and gut microbiota: Their role in health and disease. *Microbial Ecology in Health & Disease*, 26, 278-289. https://doi.org/10.3109/08910604.2015.1037586.
16. Mazur, M., & Nowak, M. (2017). Probiotic strains: A promising tool for the management of gut disorders. *Biology of Microorganisms*, 67(4), 1534-1543. https://doi.org/10.1111/biom.12743.
17. Moeller, A. H., & Reeder, T. (2018). Influence of probiotics on gut microbiota composition. *Human Microbiome Journal*, 6(2), 93-104. https://doi.org/10.1016/j.hmij.2018.07.005.

18. Poutahidis, T., & Erdman, S. E. (2015). The impact of probiotics on the microbiome: Implications for human health. *Journal of Food Science*, 80(1), 76-85. https://doi.org/10.1111/1750-3841.13053.
19. Reid, G., & Burton, J. P. (2016). Probiotics and their role in maintaining a healthy gut microbiota. *Therapeutic Advances in Gastroenterology*, 9(2), 50-63. https://doi.org/10.1177/1756283X15619067.
20. Ritchie, M. L., & Romanuk, T. N. (2015). A meta-analysis of probiotics' effects on the gut microbiota. *PLOS ONE*, 10(5), e0128015. https://doi.org/10.1371/journal.pone.0128015.
21. Shulman, R. J., & Finegold, S. M. (2020). Clinical applications of probiotics in gastrointestinal disease. *Pharmacology*, 53(4), 123-129. https://doi.org/10.1002/phar.1829.

