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Effect of an Educational Intervention on Gut Health Knowledge among Undergraduate Students: A Comparative Pre-Post Study

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Abstract
Understanding gut health has become increasingly important due to its close association with digestion, immunity, metabolism, and overall well-being. The level of awareness related to gut health is not uniform among young adults and tends to vary across different academic disciplines. This study aimed to assess baseline gut health knowledge and evaluate the impact of an educational intervention among undergraduate students. A comparative pre-post interventional study was conducted among 400 undergraduate students aged 18–21 years at Dr. N.G.P. Arts and Science College, Coimbatore, Tamil Nadu, India. The sample included 100 students each from Biosciences, Life Sciences, Computer Science, and Commerce streams. Gut health knowledge was assessed using a structured questionnaire consisting of 30 multiple-choice questions covering seven domains, including educational pamphlet focusing on key gut health concepts, dietary practices, and lifestyle modifications was provided as the intervention. Pre- and post-intervention assessments were conducted to measure changes in knowledge levels. Pre-intervention findings showed higher baseline knowledge among Biosciences students (45.5%) and Life Sciences students (37.2%), while Computer Science (32.3%) and Commerce students (28.0%) demonstrated lower awareness. Post-intervention results revealed significant improvement across all academic streams, with knowledge scores increasing to 96.5% in Biosciences, 98.3% in Life Sciences, 99.5% in Computer Science, and 98.7% in Commerce students. The greatest relative improvement was observed among Computer Science and Commerce students. The findings suggest that structured nutrition education can effectively improve gut health awareness among undergraduate students and may serve as a practical strategy for strengthening preventive health initiatives in academic settings.

Keywords: Gut Health, Lifestyle Modification, Pre-Post Intervention, Educational Intervention, Metabolism

Introduction

Gut health has grown to be a significant factor in determining general health, impacting not only digestion but also immunity, metabolism, mental health, and skin health. Through nutrition metabolism, immunological control, and interaction with the gut-brain axis, the diverse variety of microbes found in the human gut is essential to preserving physiological homeostasis. The composition and function of gut microbes are shaped by diet, lifestyle, and daily behaviors, as evidenced by a growing body of research in recent years. As a result, gut health is a crucial part of preventative nutrition. Research interest, awareness, and comprehension of gut health issues among young adults continue to fluctuate. Particularly among undergraduate students, there is a shift in lifestyle that is characterized by irregular eating habits, stress, sedentary behavior, and an increase in processed food consumption. If these elements are not backed by the right information and dietary habits, they have an impact on gut health.

Diverse academic programs may expose students to diverse biological and health-related concepts, which may affect how well-versed they are in gut health. It has been established that nutrition education is a successful tactic for raising health-related awareness and encouraging constructive behavioral changes. When presented in an approachable and straightforward way, structured educational interventions can close knowledge gaps and promote healthy eating and lifestyle choices. Nevertheless, few researches have examined the efficacy of gut health education among undergraduates in a variety of academic fields. The goal of the current study was to evaluate the impact of a structured educational intervention utilizing a comparative pre-post study technique and to gauge gut health awareness among undergraduate students from various academic streams. This further emphasizes the possibility of focused nutrition education as a useful instrument for health promotion in academic settings by looking at shifts in knowledge levels across disciplines.

Review of Literature

Gut Health and Gastrointestinal Function

Digestion, immunological control, and metabolic balance are all impacted by gut health, which is becoming more widely acknowledged as a crucial factor in determining general health [1]. Beyond absorbing nutrients, the gastrointestinal tract carries out a number of vital tasks, such as preserving intestinal integrity and defending against harmful microbes. Optimal gut function is thought to be indicated by normal bowel habits, healthy stool consistency, and the absence of digestive discomfort [2]. The gastrointestinal tract's microbiological and functional components are also included in the notion of gut health. Immune-related illnesses, metabolic problems, and gastrointestinal disorders have all been linked to changes in gut function [3]. Therefore, early detection of digestive disorders and the adoption of suitable dietary and lifestyle changes depend on knowledge of gut health indicators.

Gut Microbiota and Systemic Health

The gut microbiota, a collection of trillions of bacteria found in the human gut, is essential to intestinal and systemic health [2]. Through the fermentation of dietary fibers, the production of vital vitamins, immunological regulation, and the avoidance of pathogen colonization, these microorganisms aid in digestion. While dysbiosis, or microbial imbalance, has been connected to a number of chronic illnesses, a diversified and balanced gut microbiota is thought to be an indicator of excellent gut health [3]. The impact of gut microbiota on health outside of the gastrointestinal system has been brought to light by recent studies. The bidirectional interactions between the gut microbiota and the central nervous system that impact mood, cognition, and stress reactions are referred to as the "gut-brain axis" [6]. The emerging evidence suggests a connection between gut health and skin conditions through immune and inflammatory pathways. These findings reinforce the importance of maintaining a healthy gut ecosystem.

Role of Diet in Maintaining Gut Health

One of the most important variable elements affecting the composition and function of the gut microbiota is diet. Microbial diversity and gut health are supported by diets high in fruits, vegetables, whole grains, and dietary fiber [4]. Short-chain fatty acids, which are produced when gut bacteria ferment dietary fiber, have a protective function in preserving the integrity of the gut barrier and controlling inflammation [4]. Conversely, diets heavy in ultra-processed foods, saturated fats, and refined carbohydrates are linked to poor gut outcomes and decreased microbial diversity [5]. Suboptimal dietary habits, such as low consumption of fiber-rich foods and excessive consumption of processed and quick foods, have been repeatedly observed in studies conducted among university students [7]. Frequent meal skipping and irregular meal scheduling are common habits that can interfere with regular digestive functions. These eating habits demonstrate the necessity of focused nutrition instruction with an emphasis on gut-friendly food selections.

Lifestyle Factors Influencing Gut Health

Maintaining gut health also depends on lifestyle choices like exercise, restful sleep, being hydrated, and managing stress. While chronic stress and sleep deprivation can have detrimental effects on gut function and microbial balance, regular physical activity has been linked to enhanced gut motility and increased microbial diversity [6]. Academic stress, erratic sleep patterns, and sedentary behavior are common among undergraduate students, which may put them at risk for gastrointestinal distress and changed bowel habits.

Gut Health Awareness and Educational Interventions

Undergraduate students' baseline knowledge differs depending on their academic background, according to research on health awareness. Students from non-science streams frequently show low comprehension of biological and health concepts, while students from life sciences and health-related subjects typically show stronger awareness due to academic exposure [7, 8]. Research on students' understanding of gut microbiota has shown knowledge gaps about dietary fiber, prebiotics, and stool markers of gut health [8]. Interventions involving nutrition education have been extensively documented as successful methods for enhancing health-related knowledge and encouraging constructive behavioral change. Students' understanding of nutrition has significantly improved as a result of structured instructional programs that use basic resources including booklets, lectures, and interactive discussions [9]. When knowledge is communicated in an understandable and relatable way, these interventions are especially successful. The majority of current research concentrates on general nutrition instruction rather than knowledge specific to gut health. A comparative pre-post design has been used in a small number of studies to investigate the efficacy of structured gut health education across various academic streams. Additionally, there are very few research comparing students from other disciplines' baseline knowledge differences and post-intervention gains. Research assessing gut health knowledge and the effects of educational interventions among undergraduate students from a variety of academic backgrounds is obviously needed. By filling this gap, successful nutrition education programs that support young people's long-term wellbeing and preventative health habits can be developed [1, 7, 9].

Methodology

Methodology refers to the systematic and theoretical framework used to conduct research. It describes how data is collected, analyzed, and interpreted, ensuring that the study's findings are reliable and valid [11]. In this study, an online survey was conducted to assess gut health awareness among undergraduate students. The methodology includes the selection of participants, development of the questionnaire, implementation of an educational intervention, and data analysis of pre and post-test scores.

Phase I

Selection of Area

The present study was carried out in Dr. N.G.P Arts and Science College, Coimbatore, a multidisciplinary institution offering diverse undergraduate and postgraduate programs in science, commerce, management, and allied health sciences. The college was selected as the study region because it offers access to a sizable and diverse student body, making it perfect for carrying out comparative studies amongst the streams of Bioscience, Life Science, Computer Science, and Commerce. The institution's structured academic environment, availability of departments across different disciplines, and supportive administrative setup made it a suitable setting for the investigation. Convenience and viability were further factors in the institution's selection. The process of gathering data was more effective and time-efficient due to the familiarity with the surroundings, personnel, and peers. Additionally, the college offered the perfect chance to examine differences in awareness levels across four different academic streams within the same institutional framework because it offers both science-oriented and commerce-oriented programs.

Figure 1 Study Setting: Dr. N.G.P Arts and Science College, Coimbatore

Selection of Subject

Undergraduate students from Dr. N.G.P. Arts and Science College, Coimbatore from Bioscience, Life Science, Computer Science, and Commerce streams made up the target group for this study. A total of 400 students—100 from the Bioscience group, 100 from the Life Science group, 100 from the Computer Science group, and 100 from the Commerce group—were chosen as samples. In order to effectively compare baseline knowledge and improvements after the educational intervention, the sample size was fixed to guarantee sufficient representation of all four categories. Students were chosen within the age group of 18–21 years, as this stage represents young adulthood, a critical period for developing lifelong dietary and lifestyle habits. In Bioscience stream, data were collected from students enrolled in the following departments: 9 from Biochemistry, 14 from Clinical Laboratory Technology, 26 from Biotechnology, 18 from Microbiology, 33 from Food Science and Nutrition. Together, these departments accounted for 100 respondents, reflecting a wide variety of scientific disciplines. Six various departments from Life Science were enrolled in data collection: 23 from Physics, 12 from Medical Physics, 6 from Chemistry, 8 from Mathematics, 14 from Catering Science & Hotel Management, 37 from Costume Design and Fashion, together 100 samples were collected. 100 samples of data were collected from Computer Science which is widely divided into 8 departments: 7 from Computer Science, 12 from Computer Science with Data Analytics, 18 from Computer Application, 26 from Computer Technology, 03 from Information Technology, 14 from Computer Science with Cognitive Systems, 06 from Artificial Intelligence and Machine Learning, 14 from Computer Science with Cyber Security. In Commerce stream, data were collected from 100 students across ten departments: 48 from Commerce (General), 13 from Commerce with Computer Applications, 9 from Commerce with Corporate Secretaryship, 7 from Commerce with Information Technology, 4 from

Commerce with Professional Accounting, 2 from Commerce with International Business, 6 from Commerce (Finance), 4 from Commerce (Banking and Insurance), 4 from Commerce with Business Process Services (BPS), and 3 from Commerce with Business Analytics. The study made sure that the sample population was wide, multidisciplinary, and ideal for comparative research by incorporating such a varied collection of departments from four streams.

Phase II

Development of Descriptive Tool

Personal Information

The research tool's first element was devoted to gathering the participant's basic personal data. This was necessary to guarantee that the study's respondents were properly documented and categorized. Information was gathered, including name, age, and academic stream (Bioscience/Life Science/Computer Science/ Commerce). By gathering these characteristics, it was possible to identify the sample, prevent duplicate responses, and examine variations in knowledge levels among particular groups. Beyond the parameters of the study, no private or sensitive information was included, and participant identity anonymity was rigorously upheld.

Structured Self-Administered Questionnaire

An organized, self-administered questionnaire that was thoughtfully created to gauge students' understanding of gut health made up the second part of the instrument. Thirty objective multiple-choice questions (MCQs) made up the questionnaire, which was divided into seven thematic areas: Understanding Your Digestive System, Gut Microbes, Nutrients & Hormones, Stools and Their Types, Foods for Gut Health, Gut-Skin Connection, and Lifestyle & Life Stages. Every question had a single right answer and was intended to be straightforward, understandable, and pertinent to the subject. Participants from all four streams could easily administer this structure using Google Forms, guaranteeing accessibility and convenience. The purpose of the tool was to analyze improvements after the educational pamphlet intervention, measure baseline knowledge (pre-test), and assess overall effectiveness (post-test). To determine the efficacy of the intervention, the responses were examined using a percentage distribution and a direct comparison of the pre-test and post-test results.

Phase III

Conduction of Pre-Test

The study participants, selected from Bioscience, Life Science, Computer Science, and Commerce streams as described in Phase I, were invited to complete the pre-test through a Google Form. Their personal details including name, age, and academic stream were recorded via the form. Participants were instructed to complete the questionnaire independently at their convenience, ensuring unbiased responses. The pre-test questionnaire, consisting of 30 objective multiple-choice questions across seven thematic areas, was used to assess the baseline knowledge of the participants. The responses collected provided a benchmark to later compare any improvements following the educational intervention.

Awareness Using Educational Tools

An informative pamphlet aimed at improving participants' understanding of gut health was given to them after the pre-test. Understanding Your Digestive System, Gut Microbes, Nutrients & Hormones, Stools and Their Types, Digestion and Skin, Foods for Gut Health, and Lifestyle & Life Stages were the seven main subjects discussed in the brochure. For undergraduate students from four streams, each section contained concise explanations, attractive pictures, and useful examples to make difficult subjects easier to understand. In order to encourage application in daily life, the brochure also highlighted important takeaways, such as

daily morning gut-friendly actions, balanced meal composition, probiotics and prebiotics inclusion, and age-specific nutritional counsel. Participants were told to read the pamphlet on their own, at their own speed, with an emphasis on comprehending the information and remembering key details. The purpose of this educational initiative was to dispel myths, raise awareness, and encourage better eating and lifestyle choices. As a self-learning resource, the pamphlet helped students prepare for the post-test that assessed the efficacy of the awareness program by enabling them to review the content as needed.

Figure 2 Educational Pamphlet Used for Gut Health Awareness (Page 1)

Phase IV

Conduction of Post-Test

The post-test was administered to gauge the success of the intervention after the participants had had enough time to read and comprehend the educational brochure on gut health. Students who finished the pre-test from the Bioscience, Life Science, Computer Science, and Commerce streams were asked to take part. The same 30 multiple-choice questions covering the seven thematic areas—Understanding Your Digestive System, Gut Microbes, Nutrients & Hormones, Stools and Their Types, Foods for Gut Health, Gut-Skin Connection, and Lifestyle & Life Stages—were used in the post-test. In order to ensure that their answers accurately reflected the information they had learned from the instructional brochure, participants were urged to respond on their own.

Data Analysis

The efficacy of the educational intervention on gut health awareness was assessed through a methodical analysis of the data gathered from the pre-test and post-test questionnaires. Every participant's answers to all 30 questions were noted, and the pre-test and post-test results were compared. The data were visually displayed for improved comprehension and visualization. Additionally, scores were transformed into percentage values and one mark was given for each right response. The four academic streams were compared both generally and by topic. To make it easier to evaluate and compare the knowledge increases after the educational intervention, the results were graphically depicted. This approach made it easy to identify regions that needed more attention and areas that had significantly improved. Overall, the analysis provided a comprehensive view of the knowledge gain achieved through the educational pamphlet and highlighted the effectiveness of the intervention across different academic streams.

Result and Discussion

A total of 400 college students—100 from the Bioscience stream, 100 from the Life Science stream, 100 from the Computer Science stream, and 100 from the Commerce stream—participated in this study. The pre- and post-assessment surveys were completed by all four groups. A structured instructional brochure covering important gut health principles was used to provide the intervention. Three main graphical representations are used to describe the findings and discussion of the study in order to give a clear picture of overall knowledge improvement, stream-wise percentage gain, and domain-wise performance.

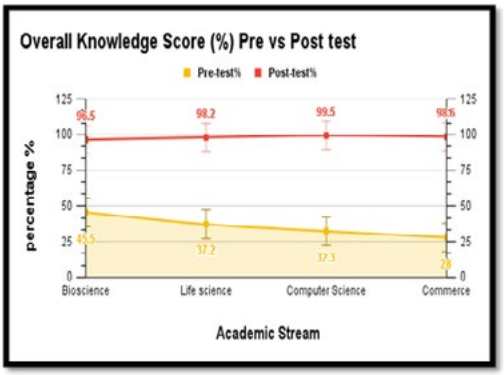

Figure 3 Educational Pamphlet Used for Gut Health Awareness (Page 2)

The comparison of general knowledge scores (%) between the pre-test and post-test for students from various academic programs is shown in Figure 4. Bioscience students showed the highest baseline knowledge (45.5%) in the pre-test, followed by Life Science students (37.2%), Computer Science students (32.3%), and Commerce students (28%). This figure illustrates how Bioscience-related students are more exposed to biological and health-related ideas in the classroom. All four streams showed a noticeable improvement after the instructional intervention. Students' post-test results significantly improved, achieving 96.5% in Bioscience, 98.2% in Life Science, 99.5% in Computer Science, and 98.6% in Commerce. Regardless of academic level, the instructional pamphlet was very successful in improving gut health knowledge, as seen by the significant increase in post-test results. The result indicates that although students from non-science streams initially had lower awareness, they were able to achieve knowledge levels comparable to Bioscience students after the intervention. This also shows the effectiveness of simple, well-structured educational tools in bridging knowledge gaps among diverse student populations.

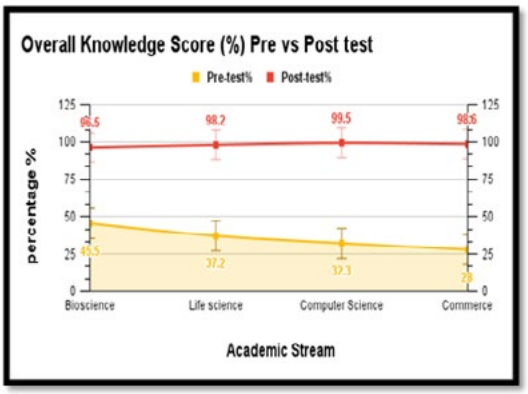

Figure 4 Overall Knowledge Score Before and After Intervention

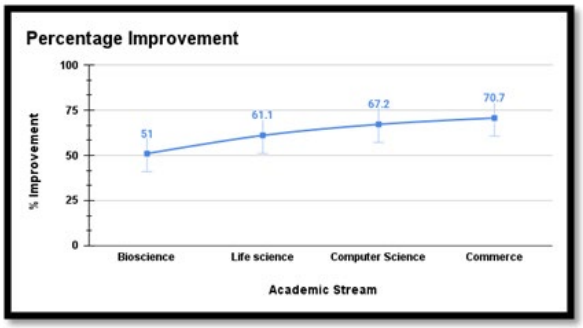

Figure 5 Stream-wise Percentage Improvements in Knowledge

The percentage increase in overall knowledge scores after the intervention is displayed in Figure 5. Students studying Commerce showed the most percentage improvement (70.7%), followed by those studying Computer Science (67.2%), Life Science (61.1%), and Bioscience (51%). Bioscience students' stronger baseline knowledge may be the reason for their relatively lower percentage improvement, which leaves less room for significant development. Students studying Computer Science and Commerce, on the other hand, showed higher knowledge improvements, suggesting that the intervention was especially helpful for those who had little prior exposure to gut health issues. Additionally, as non-science students might not otherwise have access to reliable health information, this discovery highlights the significance of focused nutrition education programs. The findings also show that knowledge levels across academic streams can be successfully standardized through educational interventions.

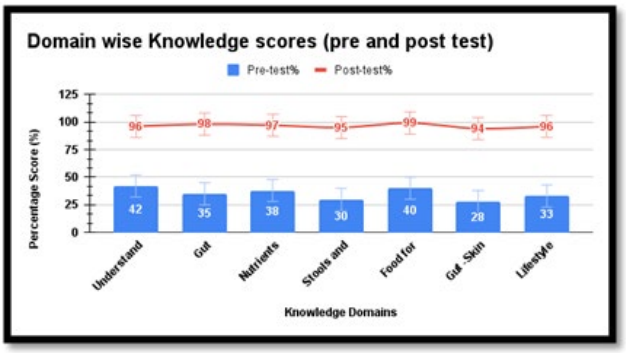

Figure 6 Domain-wise Knowledge Scores Before and After Intervention

Understanding Your Digestive System, Gut Microbes, Nutrients & Hormones, Stools and Their Types, Foods for Gut Health, Gut-Skin Connection, and Lifestyle & Life Stages are just a few of the seven gut health-related areas in which Figure 6 compares pre-test and post-test knowledge levels. Scores on the pre-test ranged from 28% to 42% and were generally poor in all domains. Understanding the digestive system (42%) and foods for gut health (40%) had higher baseline scores, whereas gut-skin link (28%) and stools and their types (30%) had lower scores, suggesting a lack of awareness in these areas. With scores ranging from 94% to 99%, the post-test results demonstrated a notable improvement in every domain. Foods for gut health (99%) and gut concepts (98%) had the highest post-test scores, indicating that diet-related and fundamental ideas were well grasped after the intervention. Despite minor differences between domains, overall performance was continuously strong, indicating constant knowledge acquisition. The educational brochure successfully covered both fundamental and less frequently discussed areas of gut

health, according to the domain-wise analysis. This well-rounded improvement implies that the intervention effectively dispelled misunderstandings and strengthened thorough comprehension. Overall, the study shows that undergraduate students in all academic streams had much better awareness of gut health as a result of the educational intervention. The efficiency of the pamphlet-based awareness program is confirmed by the significant increase in post-test scores, substantial percentage improvements, and steady domain-wise advances. In order to raise awareness of preventative health, academic institutions must implement organized health education programs. By providing young adults with vital information, these interventions can play a significant role in promoting healthier lifestyle choices and long-term wellbeing.

Summary and Conclusion

To evaluate the impact of a structured educational intervention on gut health awareness, the current study was carried out among a total of 400 undergraduate students from the Bioscience, Life Science, Computer Science, and Commerce streams. A structured questionnaire administered via Google Forms was used to measure baseline and post-intervention knowledge levels, and an instructional pamphlet that simplified important gut health concepts was used to provide the intervention.

The three graphical representations provided in the study demonstrate the overall significant improvement in gut health knowledge across all academic programs. In all four streams, Figure 4 demonstrated a significant rise in total knowledge scores from the pre-test to the post-test. Students from the Life Science, Computer Science, and Commerce streams showed significant progress after the intervention, attaining post-test scores equivalent to those of science-oriented groups, despite the fact that Bioscience students had comparatively greater baseline knowledge. This suggests that regardless of prior academic exposure, the educational tool was effective.

This observation is further supported by Figure 5, which displays the percentage improvement in knowledge. Due to their higher starting knowledge levels, Bioscience students showed a relatively less percentage gain, whereas Commerce and Computer Science students showed the most relative improvement, followed by Life Science students. This pattern demonstrates how planned educational interventions can close knowledge gaps and guarantee fair learning outcomes for students with a range of academic backgrounds.

Pre-test knowledge was moderate to low across all gut health domains, especially in areas like gut-skin relationship, stool indications, and lifestyle impacts, according to domain-wise analysis shown in Figure 6. All domains consistently demonstrated strong performance on the post-test, demonstrating consistent improvement. This suggests that the intervention effectively addressed both commonly understood and lesser-known aspects of gut health, reinforcing comprehensive awareness rather than isolated knowledge gain.

The study's findings unequivocally show that educational interventions utilizing straightforward, well-designed awareness tools are very successful in raising undergraduate students' understanding of gut health. Regardless of prior understanding, the results demonstrate that substantial gains in knowledge can be attained across all academic fields. Targeted health education reduces health literacy gaps and has a significant positive impact on non-science students. Gains across domains attest to the fact that organized interventions advance a comprehensive understanding of gut health. Young adults who are exposed to gut health education early on may make better dietary and behavioral choices. The importance of integrating nutrition and gut health education into general academic settings to support preventive health strategies and promote long-term well-being among college students cannot be overstated.

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