

IMPACT OF PROBIOTICS ON MOOD ELEVATION AND GUT HEALTH

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the
degree of Master of Business Administration

MBA - Pharmaceutical Management

by

Kinnari Rathod

Under the Supervision and Guidance of

Dr. Sudhinder Singh Chowhan

Associate Professor – School of Pharmaceutical Management

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Impact of Probiotics on Mood Elevation and Gut Health** is the bonafide record of my original researchwork. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished workof others has been duly acknowledged in the text.

(Signature)

Name of the Student: Kinnari K Rathod

Date:

CERTIFICATE

This is to certify that dissertation titled **Impact of Probiotics on Mood Elevation and Gut Health** is a record of the research work undertaken by Kinnari K Rathod in partial fulfillment of the requirements for the award of the degree of MBA (Pharmaceutical Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide

IIHMR University, Jaipur

Date:

School Dean

IIHMR University, Jaipur

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Kinnari Rathod

Date:

ABSTRACT

The use of probiotics as a means of improving gut health has been widely explored. However, recent research has indicated that probiotics may also have an impact on mood elevation. This paper aims to investigate the potential relationship between probiotics, mood elevation, and gut health. The research will involve a literature review of existing studies and an empirical study to examine the impact of probiotics on gut health and mood elevation. The findings of this study will provide insights into the effectiveness of probiotics in improving both physical and mental health and contribute to the growing body of literature on the benefits of probiotics. As there is increase an awareness and use of probiotics, to understand their role and benefits in gut health as well as mood elevation the necessary primary and secondary research will be performed to understand the doctors' perceptions as well about probiotics. As there has been a Covid-19 pandemic which eventually led to the increased use and attention gaining topic for immunity and maintaining of health.

A group of **doctors** will be connected and asked to respond to the form to help in better understanding of the topic from Mumbai. The doctors like GP, CP, Family physicians, BHMS, allopathy practicing were considered in the survey. This was followed by analysing to understand and interpret their take on the topic.

This project will help us understand about how probiotics are going to have a boon in the upcoming years of pharmaceutical industry. How people are consistently shifting towards natural immunity and considering maintaining health and mental health as their priorities.

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Chapter 1.

Introduction

1.1 Background of the Project

The intestines contain over 100 trillion bacteria, which are extremely prevalent in humans. Researchers have found out evidence for neuro-endocrine-immune pathways and various mood disorders that may be linked to intestinal microbiota.

Despite decades of research and numerous hopeful suggestions, the biology of psychiatric illness and its underlying aetiology remain a mystery. There is proof that the HPA pivot, monoamine synapses, irritation, early life altering situations, and the climate are undeniably involved, in addition to other things, notwithstanding, to yet, there hasn't been a bound together speculation to tie these few lines of exploration together. Developing interest has additionally been displayed in the potential effect that the stomach microbiota may have in both wellbeing and sickness. Investigation is carried out on effects of prebiotics, probiotics, and antibiotics to provide some fresh ideas for treatment options for mood disorders.

Probiotics are live microorganisms that, when consumed in sufficient amount, benefit one's health. They are found in fermented food items like yoghurt, kimchi, sauerkraut, and kimchi. Recent studies have demonstrated potential of these live microorganisms to improve mental health, immune function, and gut flora and fauna. The objective of this research paper is to investigate the impact of probiotics on mood elevation and gut health.

The complex correspondence network known as the gut-brain axis connects the focal sensory system and the gastrointestinal tract. Indeed, the gut microbiota, which controls many factors, hence contribute to mental illness, is altered by living styles and experiences and surrounding factors like food, migration, or urbanization. A few studies have looked at the gut microbiota in mental illness, but several animal studies says that it also affects behaviour and brain. Clinical studies, the gut microbiota of

psychiatric disease are necessary because there is a chance that microbiota-based therapeutic and preventative strategies will be developed.

There is proof that the HPA hub, monoamine synapses, aggravation, early life altering situations, the climate, and different elements are involved. In any case, there has not yet been a brought together hypothesis that interfaces these different lines of exploration. In parallel, there has been a rise in curiosity regarding the possibility of involvement of gut microbiota in both health or disease.

1.2. Research objective

While there is growing demand on the use of probiotics on gut health, there is still a significant research gap on the relationship between probiotics and mood elevation. However, there are some evidence that suggest the gut microbiota plays significant role in modulating frame of mind and behaviour, the exact mechanisms, relationship are not well understood. Also, there is a lack of information for the specific strains and doses of probiotics that are most effective in improving mood and gut health. Therefore, further investigation is required to determine the significant use and limitations of probiotics in mood elevation and gut health.

The major objectives of the study are as follows.

- To understand Probiotics and their uses in health management.
- To analyze how doctors perceive probiotics as their therapy line for a treatment or prevention.
- Ability to identify potential scope in the coming years in pharmaceutical and nutraceutical market.
- Understand how the gut-brain axis functions and how it relates to managing gut flora.

1.3. Scope of the project

The topic of probiotics has been extensively studied. Vertebrate skin and mucosal surfaces are home to a diverse array of microbes which includes bacteria, fungi, parasites, and viruses called as microbiota. Total bacterial species in the adult human gut microbiota range from 500 to 1000. The "microbiome," a colony of microorganisms that resides on and inside of us, is a popular research subject.

Live microorganisms called probiotics are intended to further develop one's wellbeing when ingested or directed topically. There are both beneficial and dangerous microorganisms all over our body. We refer to probiotics as "good" or "helpful" bacteria because they support the health of our digestive system.

Marketed probiotics include powder, pills, and fermented goods. Probiotics have a huge global industry that is growing every year because of customer interest in using functional foods to improve their health.

Prebiotics are also frequently used, however they are distinct from probiotics. Prebiotics are indigestible food ingredients that help beneficial microorganisms grow or function more efficiently. Symbiotic are items that combine prebiotics and probiotics. They are available in different food varieties, like yogurt, as well as enhancements. For stomach problems, doctors frequently recommend them.. However, probiotics are capable of more than just enhancing intestinal health. They could also enhance your brain.

The stomach is bountiful in synthetic substances that the microorganisms can use as food, leaning toward the colonization of the microbiota, what begins upon entering the world and becomes laid out in the initial three years of life. The gut microbiota can also direct the angiogenesis process at this point. The development of the nervous and immune systems, as well as the regulation of intestinal physiology,

depend on the early interactions between the host and the gut microbiota. Moreover, microorganisms show hostile to microbial movement, safeguarding a steady stomach environment. It has been demonstrated that this risk is influenced by changes in the early microbial colonization of the human gut. Also risk of developing this disease in later life is significantly influenced by intestinal microbial colonization. Changes during the time spent microbial colonization of the human stomach in early life have been displayed to affect ailment imperil in the near future. The host's neurophysiology, behaviour, and nervous system performance are significantly impacted by microbial colonisation of the intestine. It has been demonstrated that critical components, such as the microbial intercession of the cerebrum's capabilities and behaviour, are engaged with by various immunological pathways both inside and outside the Focal Sensory system (CNS).

Neuro-immune regulation by microbiota can manifest significant signs and symptoms in neurological and behavioural illnesses such as anxiety and depression.

Can probiotics be obtained through food?

The things you eat can undoubtedly enhance the good bacteria in your body. Certain foods include probiotics (good bacteria) that can improve the health of your microbiome.

These items can be added to your diet at any time of day. You may even be eating them on a regular basis and be unaware that they contain probiotics. Check the food label for the phrase "live and active cultures." Here are a few examples of probiotic-rich foods that you can incorporate into your diet and experiment with:

Try yoghurt, buttermilk, and sourdough bread for breakfast.

Try these for lunch: cottage cheese, fermented pickles are a tasty snack.

Currently, researchers are unknown how beneficial probiotic supplements are for addressing illnesses. Ongoing study is being conducted on the subject. While several research studies have found that probiotic supplements have a good influence.

Additionally, it is important to note that, in contrast to pharmaceuticals, dietary supplements do not require FDA approval. As a result, supplement manufacturers can simply market supplements with "claims" of effectiveness and safety.

Before taking a supplement or giving one to your child, always consult with your healthcare professional (or paediatrician). Supplements may interact with medications you are taking. If you are pregnant or breastfeeding, see your healthcare professional before taking any supplements.

1.4. Project purpose and importance

According to investigate, the stomach and brain are associated considering somebody to be the stomach frontal cortex centre. Biochemical signalling links the brain, and CNS, which includes enteric neural system in the digestive tract. Principal information conduit between the brain and gut is the vagus nerve, the longest nerve in the body. The stomach has also been referred to as a "second brain" since they generate many of the same neurotransmitters as the brain, which includes serotonin, dopamine, and gamma-aminobutyric acid, which are crucial for mood regulation. In actuality, 90% of serotonin is assumed to be produced by the gut system.

A connection has been found between the stomach and the CNS, which is expected for have homeostasis. It has been alluded to as the "cerebrum stomach hub" or "GB hub." The brain and intestine are both controlled by the brain-gut axis. It includes the focal sensory system, as well as the endocrine and neuroimmune frameworks and the digestive sensory system. Corticotropin-releasing hormone is spelled CRH. Corticotropin-releasing factor is spelled CRF. SCFAs represent short chain unsaturated fats; Adrenocorticotrophic hormone, or ACTH, and the term "hypothalamic adrenal" (HPA)

In mood disorders, 5-hydroxytryptamine the most important biological substrate. There is evidence that serotonergic signalling has an impact on the neurobiology of anxiety. More than 90% of the body's 5-hydroxytryptamine is made in the colon, where 14 different kinds of receptors in enterocytes, enteric neurons, immune system cells are activated. Various cycles, including engine and secretory reflexes, platelet total, resistance reaction regulation, bone development, and heart capability, are balanced by 5-HT from the digestive system. Furthermore, the Serotonergic framework, which makes up 10% of the 5-HT in the focal sensory system, is remembered to assume a part in the neurobiology of tension.

For example, lactobacilli are fit for changing nitrate into nitric oxide (NO), a strong controller of reactions in the resistant and sensory systems. In addition, lactobacilli increase activity of the enzyme indol-amine-2,3-dioxygenase (IDO), which is involved in the breakdown of tryptophan (TRP) as well as the synthesis of neuroactive kinuric and quinolinic acid.

Homeostasis, Brain and Gut: There are channels for signalling at the neurological, metabolic, hormonal, and immune system levels in the connection between the intestines and the brain. Changes in these pathways can alter cognitive and behavioural processes and start inflammatory processes at the periphery.

The Associations Between the Stomach and the Cerebrum When we discuss stomach sensations or individuals feeling like they have butterflies in their stomach when they are restless, we are alluding to the associations that exist between the stomach and the mind. The stomach and mind are connected by a few bidirectional flagging channels, including neuronal, humoral, and immunological frameworks.

The gut is controlled by both internal and external neuronal pathways. The intestinal sensory system, which is sometimes referred to as the subsequent mind, is made up of between 200 and 600 million neurons that are present inside the wall of the gastrointestinal plot. Among other things, it controls and organizes the GI activities that are required for processing. The intestinal sensory system's outward innervation includes splanchnic thoughtful strands and vagal and sacral parasympathetic fibers. Vagus nerve connects the psyche with the proximal stomach, while the sacral parasympathetics interface the distal piece of the colon. The vagus nerve cores are entangled in dread, excitement, and profound guidance, as well as tangible and engine errands, due to their bidirectional relationship with higher brain regions, which includes limbic framework. Immune cells in the stomach are controlled by

descending inputs and hormonal variables like cortisol, in addition to signalling to the brain via vagal and spinal afferents.

The Pivot of Microbiota, Stomach, and Cerebrum North of 100 trillion microscopic organisms live in the body, with most of them in the distal stomach. There are over 1000 species and 7000 strains included in this, which is ten times as many human cells as there are human genome genes.

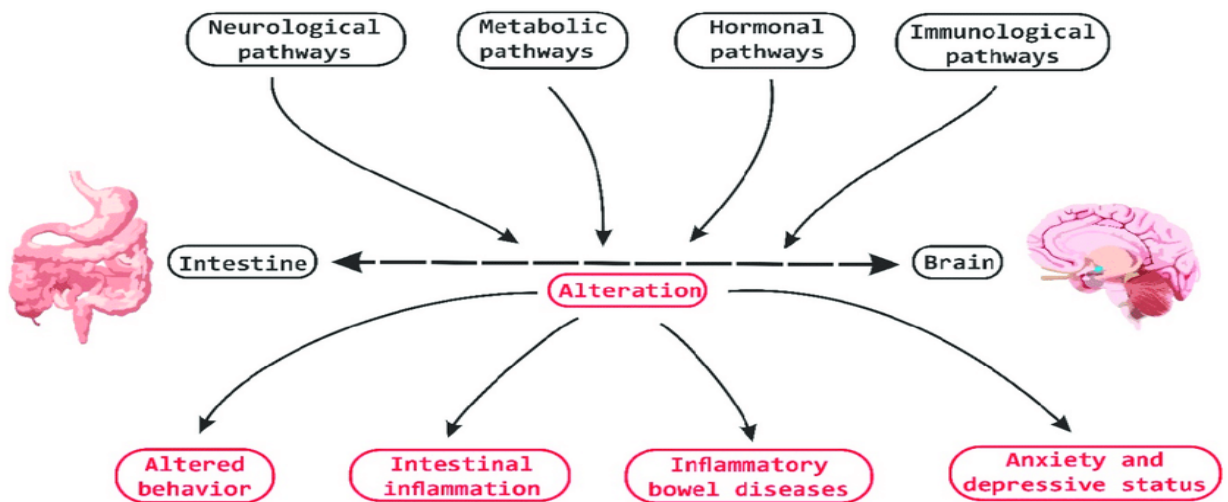


Fig.1.4(a) Homeostasis of the brain and gut.

Underscoring the significance of the stomach microbiota in regulating mind reactions, the microbiota-stomach cerebrum hub has recently replaced the stomach mind hub.

The brain and the microbiota can communicate in a variety of ways. The circumventricular organs permit bacterial mixtures delivered in the circulatory system to enter the cerebrum straightforwardly. By animating the development of cytokines by safe cells in the mucosa, microbes could possibly speak with the cerebrum through immunological channels. Particularly, the transmission of bacterial signals to the CNS requires the vagus nerve. Kynurenine and tryptophan digestion, as well as the creation of 5-hydroxytryptamine and kynurenine, the two

of which critically affect the mind, can be impacted by microorganisms. Lastly, microorganisms can also produce neurotransmitters and neuroactive compounds like gamma-aminobutyric acid, serotonin, dopamine, acetylcholine, and noradrenaline.

The brain can have a true bidirectional effect on the microbiota by releasing cortisol, influencing sympathetic neurotransmission, modifying gut motility, secretion, and mucin production, and so on. This can change the climate in which the occupant microbiota live and, thus, the microbiota's synthesis.

Invulnerable capability, bacterial quality articulation, and flagging can be in every way impacted by cortisol and different variables, which can likewise change the microbiota's arrangement and action. Creature Models of the Mind, Stomach Microbiota, and Conduct For quite a long time, it has been realized that pressure is a major piece of dysfunctional behaviours like sadness and nervousness. The stomach greenery has been demonstrated to be changed by different anxieties, including parental detachment, persevering limitation stress, and social pressure.

Inflammatory markers and the HPA axis frequently undergo changes in conjunction with these changes. The stomach microbiota has similarly been entangled in the game plan of the hypothalamic-pituitary-adrenal stress response.

Germ-free mice had a higher HPA stress response and lower Brain-derived neurotrophic factor level in the cortex and hippocampus when compared to mice with a normal microbiota free of specific infections. When *Bifidobacterium infantis* were introduced at 6 weeks, this increased HPA response was reduced, but not at 8 weeks or 14 weeks.

This demonstrates that the gut microbiota is important in programming the HPA stress response at an important developmental stage. A one-of-a-kind opportunity exists to find out how the microbiome influences behaviour in a mice which is germ

free. In tests like the elevated plus maze and light-dark testing, studies comparing bacteria-free mice to their specific pathogen-free counterparts revealed different shifts in experimental conduct and the characteristic associated with fear. Microorganism free mice have hindered social turn of events and mental lacks when contrasted with explicit microbe free creatures.

1.5. Limitations of the study

The limitations of this research for impact of probiotics on mood elevation and gut health include a small sample size and a short study duration. This could make it harder to apply the findings to a larger population or to a longer time frame. This may make it more difficult to apply the findings to a larger population or to a longer period. Likewise, the survey relied upon self-uncovered extents of attitude and gastrointestinal incidental effects, which may be obligated to inclinations and blunders. Finally, the results could have been affected if the study had considered things like diet and exercise. To confirm and expand on the findings of this study, additional research with larger sample sizes, longer study durations, objective mood and gastrointestinal health measures, and control for other factors is required.

Chapter 2.

Review of Literature

1. Liu, L., & Zhu, G. (2018). Gut–Brain Axis and Mood Disorder. *Frontiers in Psychiatry*, 9. <https://doi.org/10.3389/fpsy.2018.00223>

Different gastrointestinal microbiota constitutions can modify the side effects of state of mind problems, while temperament issues themselves can change the microbiota constitution. By analyzing these studies on prebiotics, probiotics, and antibiotics, we can not only demonstrate that there is a link between the microbiota and mood disorders, but we can also determine that administering prebiotics, probiotics, and the appropriate antibiotics can alleviate symptoms of depression and anxiety, offering alternative treatment options for mood disorders.

2. Dinan, T. G., & Quigley, E. M. (2011). Probiotics in the Treatment of Depression: Science or Science Fiction? *Australian & New Zealand Journal of Psychiatry*, 45(12), 1023–1025. <https://doi.org/10.3109/00048674.2011.613766>

In mood and anxiety disorders, one of the most important clinical and research goals is to identify variables that influence illness trajectory and outcome. The microbiota-gut-brain axis, or relationship between the gut microbiome and brain function, has been the subject of a number of studies over the past ten years. Probiotic treatment and microbiome improvement studies might offer imminent medicines and safeguard approaches for discouraged and uneasiness issues.

3. Quigley, E. M. M. (2010). Probiotics in Gastrointestinal Disorders. *Hospital Practice*, 38(4), 122–129. <https://doi.org/10.3810/hp.2010.11.349>

A new player has entered this scene: the probiotic. While many items have been claimed to be probiotics, only those that contain living organisms and have been proved to provide a health benefit in high-quality human trials may properly stake claim to this title. The administration of probiotics has been beneficial for several human disease states, most notably diarrheal illnesses, a number of inflammatory bowel diseases, and certain infectious disorders.

4. Slyepchenko, A., F. Carvalho, A., S. Cha, D., Kasper, S., & S. McIntyre, R. (2014). Gut Emotions - Mechanisms of Action of Probiotics as Novel Therapeutic Targets for Depression and Anxiety Disorders. *CNS & Neurological Disorders - Drug Targets- CNS & Neurological Disorders*), 13(10), 1770–1786.

<https://www.ingentaconnect.com/content/ben/cnsnddt/2014/00000013/00000010/art00014>

Probiotic therapy and microbiome development studies may offer prospective prevention and treatment approaches for anxiety and depression disorders. The goal of this comprehensive review of the literature is to find new studies that link major depressive disorder and anxiety disorders to the gut microbiome. In addition, the authors of this review searched for original studies that

investigated probiotics' potential therapeutic and preventative effects on these chronic diseases. According to the data, the gut microbiota uses neuronal, endocrine, and immunological means of communication with the central nervous system (CNS). The microbiota regulates the stress response (such as the hypothalamic-pituitary-adrenal axis) and CNS development at crucial stages, according to research on germ-free animals.

Chapter 3.

Research Methodology

3.1. Objective

Performing primary research with the help of doctors and Insights from secondary research about probiotics role in Mood elevation and gut Health

3.2. Research Method: Exploratory followed by descriptive. For Qualitative research, prepared a Questionnaire which is filled by doctors, like General Practitioner, BHMS, Allopathy practicing.

A Questionnaire of 7 questions is prepared and shared with a set of 30 doctors.

Below are the questions and the response obtained.

Analyzing and understanding of the response is also mentioned.

3.3. Primary Research –

1. Which type of patients do you meet frequently?
2. Which do you prefer to patients for maintaining of health?
3. What do you suggest for balancing mental health to your patients?
4. For Gut Health do you think probiotics are a healthy and better option?
5. Do you consider regular intake of probiotics to help in healthy gut flora leading to mood elevation?
6. Do you think after covid patient awareness has increased for probiotics?
7. Probiotics are definitely going to be a boon in the coming years.

3.4. Sampling Method: Stratified random

3.5. Data Collection Instrument, Method, and Analysis: An organized poll with unassuming and shut finished questions was utilized to gather the information. The information gathered is essential as well as auxiliary in nature. Essential information was gathered through the web-based channel by means of Google structures with the guide of a poll.

Books, journals, articles, websites, and other sources were utilized to collect secondary data. In addition, an extensive literature review survey was also undertaken.

The responses collected were organized in the form of an excel sheet and statistically analyzed using Microsoft Office Excel. The results were then suitably presented in the report.

3.6. Secondary Research:

- ❖ To be published in: Meta-Analysis of the Use of Probiotics to Treat Depression Diary of Full of Feeling Issues November 2017 Several preclinical and clinical studies have shown that taking probiotic supplements lowers the risk of negative side effects. Despite the fact that the overall effect of probiotics is statistically negligible for a combined data set of healthy and depressed individuals, the 1349 patients who took part in the ten included trials found that probiotics did have a positive effect on their symptoms. did not report any adverse events, indicating that probiotics are well tolerated.
- ❖ Although there is insufficient evidence to support the use of probiotics to treat depression, the connection between the microbiota in the stomach and

neuropsychiatric capacity is highly specialized. Neurologically, it has been demonstrated that the vagus nerve and the enteric nervous system produce effects that are both anxiogenic and anxiolytic when gut bacteria are presented with stimuli. Consequently, the vagus nerve serves as a significant correspondence pathway and the stomach microbiome directly affects pressure reactivity. Through microbial production and regulation of neurotransmitters like serotonin and gaba, gut microflora may also influence brain function and mood.

- ❖ More research is anticipated to determine the appropriate dosage, treatment duration, and bacterial species/strains that will have the greatest positive impact on mindset. Source of the complex illness known as chronic fatigue syndrome (CFS) remains unknown. Numerous people also suffer from emotional illnesses, the most prevalent of which is anxiety. According to study, the gut microbial flora is different in people with chronic fatigue syndrome and physical disorders. Recent studies suggested that both pathogenic and non-pathogenic gastrointestinal microbes in people and other living things may influence mental health-related side effects and even behaviour. 39 CFS patients receive a random assignment to treat either bogus treatment of 24 billion settlement framing units of *Lactobacillus casei* strain Shirota (LcS) in this study. Patients completed the Beck Depression and Beck Anxiety inventories before and after the intervention. Stool samples were also provided. We found a huge expansion in *Lactobacillus* and *Bifidobacteria* in the individuals who took the LcS, as well as a critical diminishing in nervousness side effects in the individuals who took the probiotic versus controls ($p = 0.01$). These discoveries support the presence of a stomach cerebrum interface, which could be interceded by microorganisms that live in or travel through the digestive framework.

- ❖ A singular open survey with vancomycin (oral) showed improvement in 8 out of 10 patients with late-starting discernment, yet this just can't be rehashed or inspected in a fundamentally randomised controlled design. In spite of our extensive research on animals, very few studies of the gut microbiota in clinical samples of people with psychiatric disorders other than autism spectrum disorder have been carried out. There is increased awareness amongst patients for this study, and many are attempting to alter their own gut bacteria by experimenting with yogurt, probiotics, and fermented foods. In light of the possibility that the brain and behavior are influenced by the microbiome, extensive research on psychiatrically ill individuals is required.

Chapter 4.

Data Analysis

HCP Profile

The sample size for the analysis was 30, 30 Healthcare professional participated.

N = Number of HCP Participated

nDr= Doctor count

Q1. Which type of patients do you meet frequently?

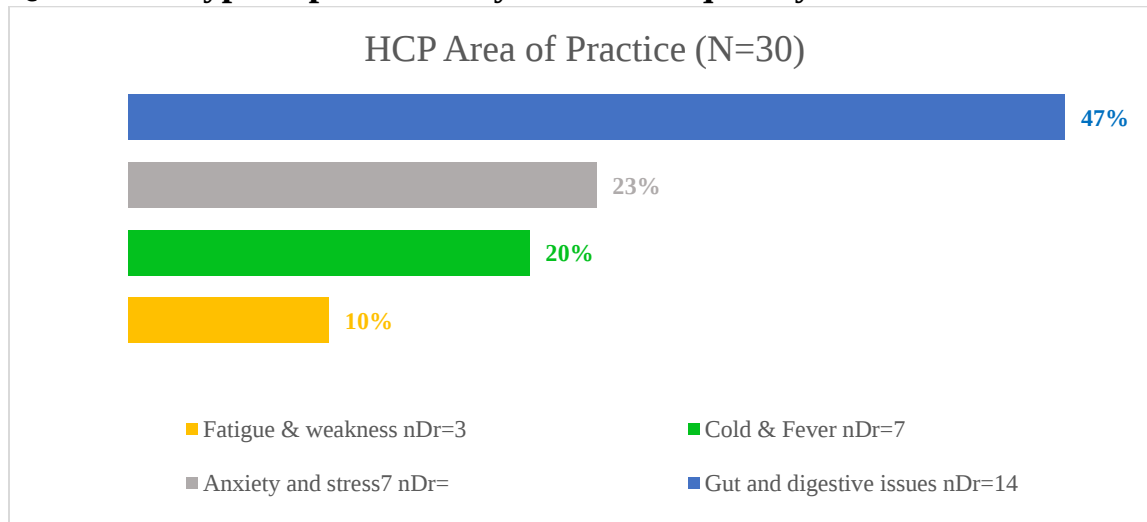


Fig. 4.1 HCP Area of Practice

Fig. 4.1 depicts that 47% of the HCP who participated in the survey were HCP who meet Gut and digestive issues related patients followed by Anxiety and stress at 23%, 20% Cold and Fever and remaining 10% were the Healthcare professional who meet Fatigue and Weakness patient.

Q2. HCP Gender

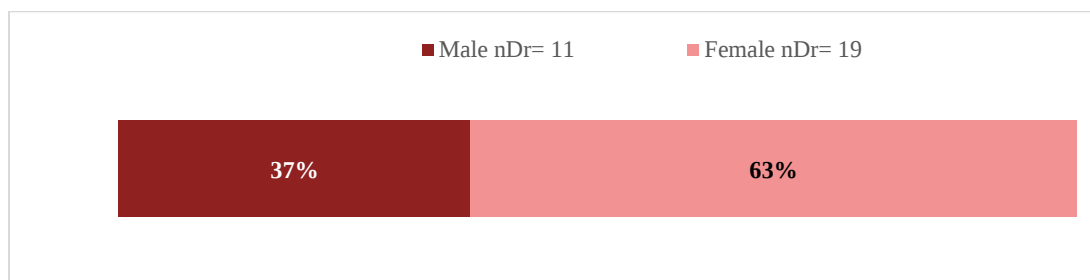


Fig. 4.2 HCP Gender

Q3. Which do you prefer to patients for maintaining of health?

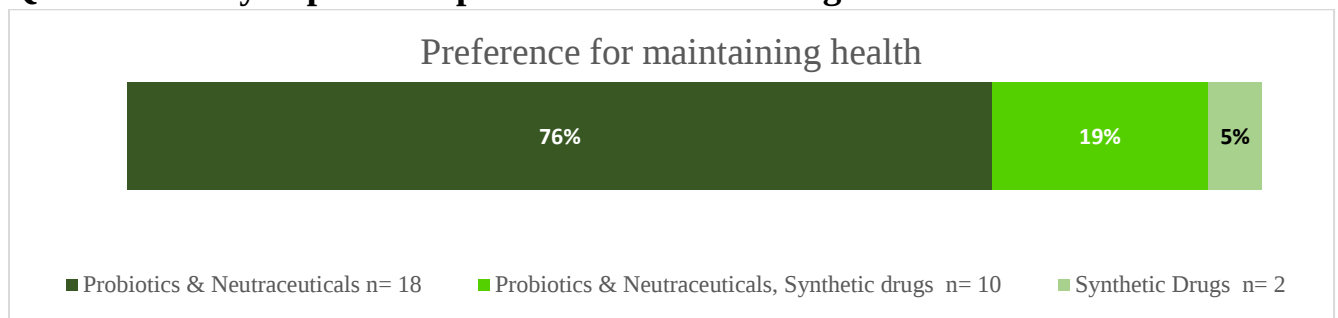


Fig.4.3 Preference for maintaining health.

Fig 4.3 Depicts the preference given by HCP for maintaining health, 76% HCP finds Probiotics and Nutraceuticals drugs for maintaining health.

Q4. What do you suggest for balancing mental health to your patients?



Fig.4.4 Preference for Balancing mental health

Yoga and Exercise is preferred by 97% of HCP for balancing mental health.

Q5. For Gut Health do you think probiotics are a healthy and better option?

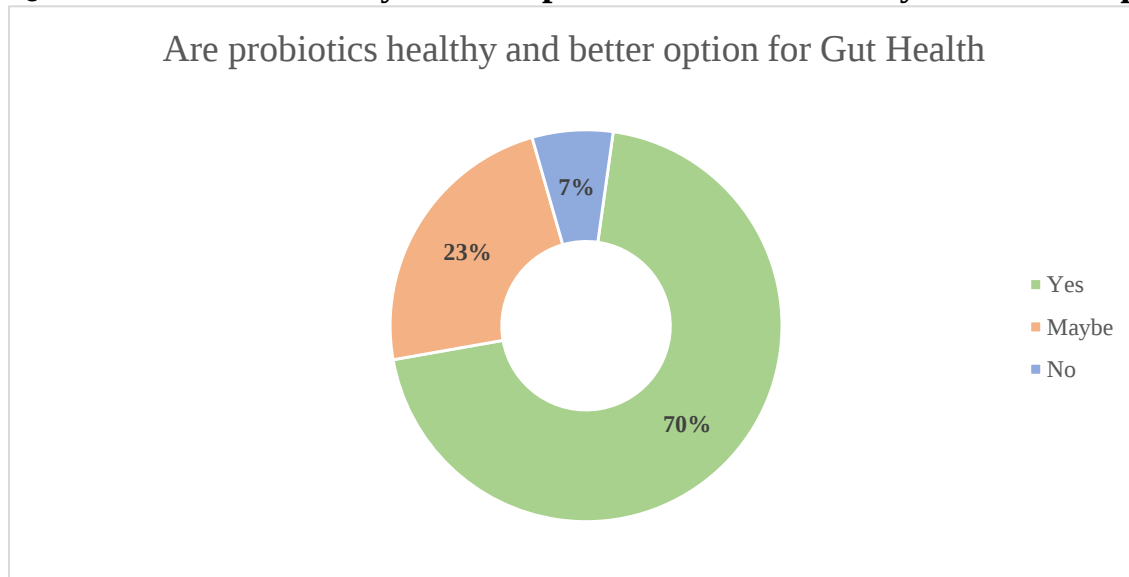


Fig.4.5 Probiotics a better option for Gut health

Q6. Do you consider regular intake of probiotics help in healthy gut flora leading to mood elevation?

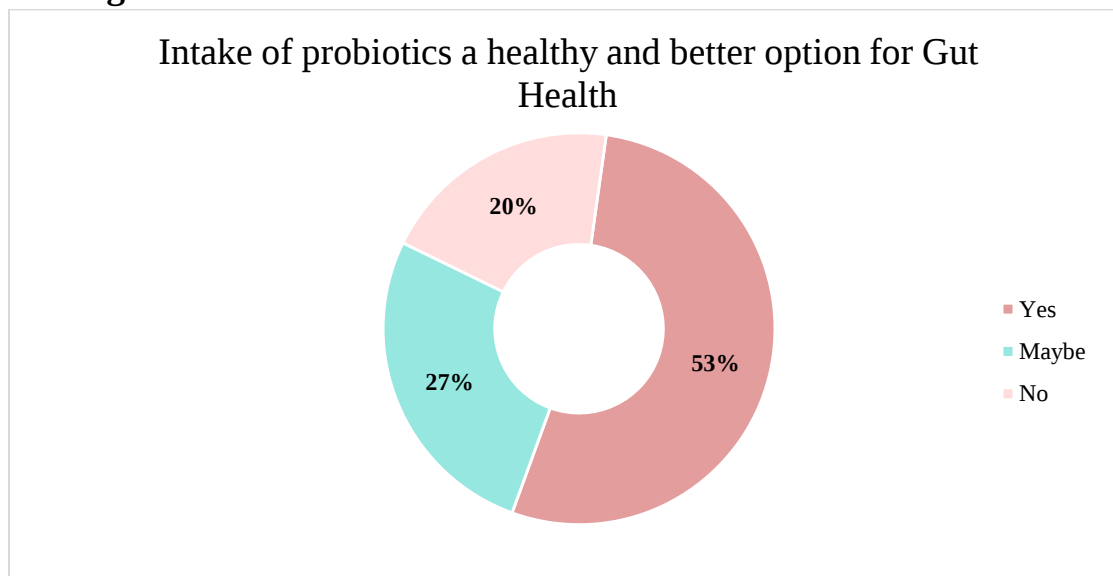


Fig.4.6 Intake of Probiotics help in healthy gut flora and mood elevation.

Q7. Do you think after covid patient awareness has increased for probiotics?

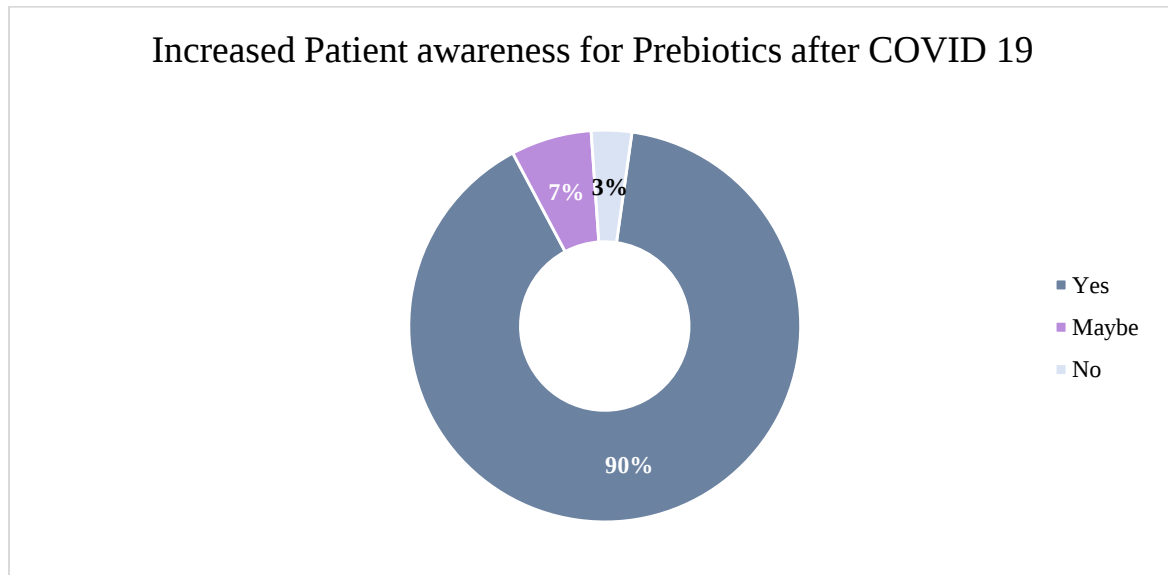


Fig.4.7 Increased Patient awareness for Prebiotics after COVID 19

Q8. Probiotics are going to be a boon in the coming years.

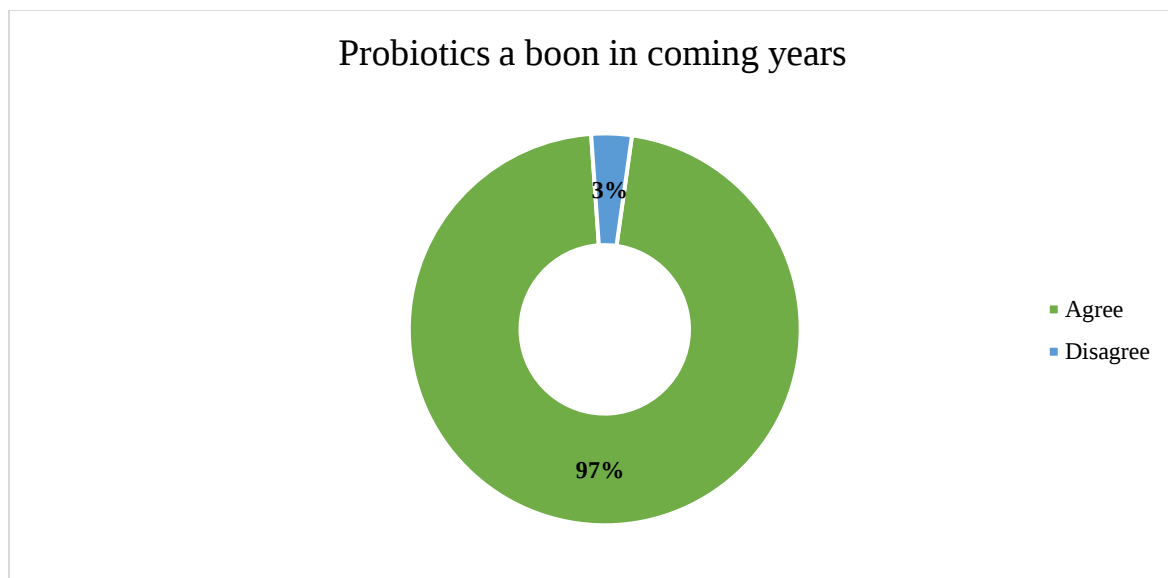


Fig.4.8 Probiotics are going to be a boon in the coming years.

Chapter 5.

Key findings and Recommendations

Based on the analysis and tabulations, some of the major findings are as follows:

The key findings of this research paper are as follows:

By increasing the number of good bacteria in the gut, probiotics can significantly improve gut health.

Probiotics have been found to have a beneficial effect on mental health, so there is a positive correlation between gut health and improved mood.

It was discovered that the specific probiotic strains used in this study varied in their effectiveness, with some strains being more effective than others at improving gut health and mood.

It was discovered that the amount of time spent taking probiotics was a significant factor, as longer periods of use were associated with greater improvements in gut health and mood.

The study emphasizes the need for additional research into the optimal probiotic dose, duration, and strains for enhancing mood and gut health.

Considering the findings, it is possible to make the following recommendations:

1. Medical services experts ought to consider suggesting probiotics as a correlative treatment for people with stomach medical problems or potentially mind-set issues.
2. Probiotics should be incorporated into daily routines for people who want to boost their mood and improve their gut health.
3. Future research should focus on identifying the most effective strains of probiotics for specific health conditions, as well as determining optimal dosages and durations of use.

Chapter 6.

Conclusion

6.1. Conclusion

The study helps us clearly understand the connection allying the health or disease of host and the microbiota. Human microbiota and probiotics need to be studied as a cohesive ecosystem. One of the essential disadvantages of utilizing psychobiotics in individuals is the absence of information about how they associate with sex chemicals (oestrogen and testosterone) and their drawn-out impacts. Discoveries on how probiotic medicines, known as psychobiotics, may assist with further developing mind-set, decline uneasiness, and fortify memory recommend that these probiotics might be endorsed to treat discouragement, nervousness, and other emotional well-being issues soon, by involving them as food or enhancements to adjust the stomach microbiome and treat mental circumstances.

Regardless of specific contrasts and systemic limitations among preliminaries, clinical exploration show that probiotics might assist with uneasiness side effects. Future studies on the anxiolytic and depressive properties of probiotics, however, ought to concentrate on populations that are more phenotypically homogeneous. Not to mention, the growing understanding of the gut-brain axis raises the possibility that changing the gut microbiota could represent a unique target for therapy for the treatment or prevention of disorders related to anxiety and mood.

Chapter 7.

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