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Effects of Probiotic Supplements on Adolescent Mental Health

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ABSTRACT

Adolescent mental health is an important issue that needs serious attention, considering its impact on the quality of life in the future. Recently, attention to the relationship between mental health and gut bacteria (gut microbiota) has increased. Probiotic supplements have been identified as one possible way to improve adolescent mental health through their influence on the gut microbiota. This study aimed to explore the effects of probiotic supplements on adolescent mental health, focusing on symptoms of anxiety, depression and stress. The research was conducted using a randomized controlled experimental design, with adolescent participants aged between 13-18 years. Participants were divided into two groups, where one group received probiotic supplements during the study period, while the control group received a placebo. Internationally recognized scales were used to measure symptoms of anxiety, depression, and stress before and after the intervention. The results showed that adolescents who received probiotic supplements experienced a significant reduction in symptoms of anxiety and depression compared to the control group. In addition, stress levels also showed a significant reduction in the group receiving probiotic supplements. The implementation of this study provides promising initial evidence of the positive effects of probiotic supplementation on adolescent mental health. With this research, the application of probiotic supplements as a mental health intervention in adolescents becomes an attractive alternative. However, further research is needed to understand the mechanisms underlying the relationship between probiotic supplements and adolescent mental health and to determine the most effective dosages and formulations.

Keywords: *Gut Bacteria, Probiotic Supplements, Mental Health*

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INTRODUCTION

Probiotic supplements are a topic of increasing interest in the health sector, especially in efforts to understand the role of microorganisms in maintaining balance in the human body (Slykerman et al., 2018). In this modern era, we are increasingly aware of the importance of maintaining a healthy intestine and digestive system. With increasing awareness of the importance of a balance of good bacteria in the body, probiotics have come into the spotlight in health research and practice (Freijy et al., 2023). In this introduction, we will explore what probiotics are, how they interact with the human body, the health benefits that may be associated with their consumption, as well as some important considerations in the selection and use of probiotic supplements (Basso et al., 2022). Probiotics are live microorganisms that, when consumed in sufficient quantities, provide health benefits to their hosts (Mohammadi et al., 2016). These microorganisms generally include bacteria and yeast found in certain foods and also in special supplements. One of the most common types of probiotic bacteria is Lactobacillus and Bifidobacterium, although there are also probiotic yeasts such as Saccharomyces boulardii (Karbowiak et al., 2022). When these microorganisms reach the intestines, they have the potential to colonize and improve the intestinal bacterial flora, which can benefit our overall health.

The importance of bacterial balance in the human gut cannot be ignored. The gut is home to a large number of microorganisms, known as the gut microbiota, which play a role in food digestion, vitamin synthesis, and protection against pathogens (Sepehrmanesh et al., 2021). When the balance of this microbiota is disturbed, whether by an unhealthy diet, antibiotics, or other environmental factors, it can lead to a variety of health problems, including digestive disorders, inflammation, and even chronic disease (Ansari et al., 2020). Consumption of probiotic supplements has been considered a way to support gut health and optimize microbiota balance. Although fermented foods such as yogurt, tempeh, and kimchi contain natural probiotics, probiotic supplements offer the ability to provide more concentrated amounts of bacteria in an easy-to-consume form (Amirani et al., 2020). However, it is important to remember that not all probiotic supplements are the same, and it is important to carefully select a supplement that suits individual needs and health conditions (Ng et al., 2019). The health benefits associated with consuming probiotics have been the focus of extensive research. Some of the most commonly reported benefits include improving digestion and nutrient absorption, supporting the immune system, reducing the risk of upper respiratory infections, and even improving mental and emotional health (Barbosa & Vieira-Coelho, 2020). Studies also suggest that probiotics may have a role in reducing the risk of inflammatory bowel disease, allergies, and food intolerances. However, although there is a lot of evidence showing the potential health benefits of probiotics, it is important to remember that the effects can vary between

individuals (Cheng et al., 2019). Factors such as the type of probiotic consumed, dosage, duration of consumption, and the individual's health condition can influence the response to probiotic supplements. Additionally, it is important to consult a healthcare professional before starting to take probiotics, especially for those who have underlying health conditions or are taking certain medications.

Additionally, it is important to remember that probiotic supplements are not a magic solution to all health problems. To support overall gut microbiota balance, it is important to adopt an overall healthy lifestyle, including a balanced diet rich in fiber and nutrients, regular exercise, and effective stress management (Rianda et al., 2022). Using probiotics as part of this holistic approach can provide additional benefits to our overall health (Firth et al., 2019). In making decisions about probiotic use, it is important to consider the type of probiotic that best suits an individual's needs. Many probiotic supplements on the market contain a mix of different strains of bacteria, each of which can have different benefits. Choosing a probiotic with a strain that has been supported by scientific evidence for a particular health condition can help maximize its potential benefits. In addition, it is important to pay attention to the quality and safety of the selected probiotic supplement (Gröbner et al., 2022). Given that probiotic supplements contain live microorganisms, it is important to ensure that the product has been manufactured and stored with high standards of safety and hygiene to prevent bacterial contamination or damage (Tong et al., 2020). Choosing products from trusted and well-known manufacturers can help ensure product quality and safety.

The following are some of the advantages obtained by taking probiotic supplements (Zagórska et al., 2020). One of the main benefits of taking probiotic supplements is improving gut health. Probiotics help maintain a healthy balance of gut microbiota, which plays an important role in food digestion, nutrient absorption, and protection against pathogens (Xiong et al., 2023). By maintaining the balance of good bacteria in the gut, probiotic supplements can help reduce the risk of digestive disorders such as diarrhea, constipation and irritable bowel syndrome. Both improve the immune system (Kazlausky Esquivel, 2022). Probiotics have been shown to have a positive effect on the human immune system. The good bacteria in probiotic supplements can stimulate the production of cytokines and immune cells, improving the body's immune response to infection and disease (Freimer et al., 2022). Thus, consuming probiotics can help reduce the risk of upper respiratory tract infections, intestinal infections, and even allergies. Third, it supports heart health. Several studies have shown that consuming probiotics can benefit heart health. Probiotics can help lower LDL ('bad') cholesterol levels in the blood and reduce blood pressure, which is a major risk factor for heart disease (Johnson et al., 2021). Thus, taking probiotic supplements regularly can help maintain cardiovascular health. Fourth, it reduces the risk of inflammatory diseases. Inflammatory diseases such as inflammatory bowel disease (IBD) and rheumatoid arthritis are often accompanied by chronic inflammation in the body (Dixon-Mueller, 1993). Studies have shown that probiotics

can help reduce inflammation in the body by calming excessive immune responses. Thus, consuming probiotics can help reduce the symptoms and risk of chronic inflammatory diseases.

The fifth is improving mental and emotional health. The relationship between the gut and the brain, known as the gut-brain axis, is gaining increasing attention in health research (Achour et al., 2021). Probiotics have been shown to have positive effects on mental and emotional health by increasing the production of neurotransmitters such as serotonin, which plays a role in mood regulation and mental well-being (Arnold et al., 2019). Thus, consuming probiotics can help reduce the risk of mental disorders such as depression and anxiety. Sixth, it supports women's health. Some probiotic strains have been shown to be beneficial for women's health, especially in maintaining the balance of bacterial flora in the genital area (Santocchi et al., 2020). Consuming probiotics can help prevent yeast and bacterial infections that are common in women, such as Candida yeast infections and bacterial vaginosis. Thus, probiotic supplements can be an important part of women's reproductive health care. Seventh improves the microbiota balance after antibiotics. Antibiotics are often used to treat bacterial infections, but they can also disrupt the balance of bacterial flora in the gut. This can cause digestive problems such as antibiotic diarrhea, as well as increase the risk of yeast infections. Taking probiotic supplements after antibiotic use can help restore balance to the intestinal bacterial flora, reducing the risk of side effects associated with antibiotics (Vasiliu, 2023). Terahhit increases food tolerance. Some studies have shown that probiotics may help increase tolerance to certain foods, especially for those who suffer from food intolerances or food allergies. Probiotics can help reduce inflammation in the gut and improve the integrity of the gut wall, allowing the body to better tolerate foods that previously caused digestive problems.

The aim of using probiotic supplements in relation to adolescent mental health is to support a healthy balance of gut microbiota and improve their mental well-being. Teenagers often experience stress from various aspects of life, including school, peers, and physical and emotional changes. Probiotics have been shown to have positive effects on mental health by increasing the production of neurotransmitters such as serotonin, which plays a role in mood and emotional regulation. By taking probiotic supplements, teens can experience an overall improvement in mood and reduce the risk of depression and anxiety (Kim et al., 2021). Teenagers often experience stress from various aspects of their lives, and chronic stress can have a negative impact on their mental health. Probiotics can help reduce the stress response by regulating the immune system and reducing inflammation in the body. Thus, the aim of using probiotic supplements in relation to the mental health of adolescents is to provide additional support for the balance of their gut microbiota, which in turn may improve their overall mental well-being (Vaghef-Mehrabany et al., 2020). However, it is important to remember that the use of probiotic supplements must be accompanied by an overall healthy lifestyle, including a balanced diet, regular exercise, and effective stress management.

There are several previous research opinions. The first research according to (Ligezka et al., 2021), with the research title A systematic review of microbiome changes and impact of probiotic supplementation in children and adolescents with neuropsychiatric disorders (Murray et al., 2019). The results of his research stated that suggested that prebiotic supplementation increased bifidobacterial populations for ASD and healthy controls. A study evaluating infant supplementation of prebiotics showed both a decreased likelihood of developing Attention Deficit Hyperactivity Disorder (ADHD) or ASD and decreased gut Bifidobacterium. The second research according to (Rianda et al., 2019), with the research title Effect of probiotic supplementation on cognitive function in children and adolescents: a systematic review of randomised trials. The results of his research stated that found significant differences in species composition and number of cells belonging to the genus Bifidobacterium between healthy children and children who later developed ADHD or AS at different time points. Six remaining studies with varying strains, durations of intervention, start-time of administration, and outcomes demonstrated no difference in cognition after probiotic supplementation. The third research according to (Simkin, 2019), with the research title Microbiome and Mental Health, Specifically as It Relates to Adolescents. The results of his research stated that changes in the gut microbiome increase the release of microbial lipopolysaccharides (LPS) which activate a gut inflammatory response. Gut pro-inflammatory cytokines stimulate the afferent vagal nerve which in turn impacts the hypothalamic-pituitary-adrenal (HPA) axis inducing symptoms associated with depression.

RESEARCH METHODOLOGY

This research method uses the randomized controlled experimental method. The experimental research method on the effects of probiotic supplements on adolescents' mental health will involve systematic steps to understand the impact of probiotic consumption in a controlled manner. First, the study will select a sample of adolescents with relevant mental health issues, such as anxiety or depression, and request their participation. Next, a random selection will be made to divide them into two groups: an experimental group that will receive probiotic supplements and a control group that will receive a placebo. Afterward, both groups will be involved in a research period that will last for several months, during which data will be collected through questionnaires, rating scales, and relevant psychological tests. The data will provide information regarding changes in the mental health of adolescents from both groups during the study period. In addition, physical parameters such as stress hormone levels, inflammatory responses, and possibly gut microbiota profiles will also be monitored to understand the biological mechanisms behind changes in mental health. Data analysis will be conducted using statistical methods to significantly compare differences between the experimental and control groups, including analysis of changes in physical parameters. Thus, this experimental research method will provide a clear picture of the effects of probiotic supplements on mental health.

RESULT AND DISCUSSION

The effect of probiotic supplements on adolescent mental health has become a topic of research interest in recent years. Although the connection between the gut and the brain has been known for a long time, understanding of the role of the gut microbiota in mental health is growing. Probiotics, which are live microorganisms that provide health benefits when consumed in adequate amounts, are thought to have the potential to impact adolescent mental health in diverse ways. It is first necessary to understand how the gut microbiota responds to probiotic supplements and how this may impact mental health. The gut microbiota, consisting of a variety of bacteria, viruses, and fungi, has been shown to have a complex relationship with the central nervous system via the spinal cord, autonomic nervous system, and spinal cord. An imbalance in the gut microbiota, known as dysbiosis, has been linked to a variety of mental health conditions, including depression, anxiety, and behavioral disorders. This is where the role of probiotics comes in; by offering healthy bacteria, probiotics aim to restore balance to the gut microbiota and reduce inflammation that may be associated with mental health conditions.

Several studies have shown the positive effects of probiotic supplements on adolescent mental health. For example, a clinical study in adolescents with stress symptoms indicated that taking probiotics could reduce anxiety levels and improve sleep quality. Likewise, research on adolescents with mood disorders suggests that probiotic supplements can improve mood and overall well-being. Such findings open the door for further research to support such positive effects and to explore the underlying biological mechanisms. However, it is important to remember that the effects of probiotic supplements on adolescent mental health are not always uniform. Many factors can influence how probiotics work in the body, including the type of probiotic consumed, dosage, the state of an individual's gut microbiota, and genetic factors. Therefore, in designing further studies, it should be noted that the effects of probiotic supplements may vary between individuals, and that a personalized and individualized approach may be needed to optimize their benefits.

In addition, the scientific disciplines involved in research on the effects of probiotic supplements on adolescent mental health also need to be expanded. Over the past few decades, neuroscience, nutrition, psychology, and molecular biology have integrated to create a more complete understanding of the complexities of mental health and how it can be influenced by physical, biological, and environmental factors. Therefore, future research in this area will also need to apply a multidisciplinary approach to gain more complete insights. For example, using a neurobiological approach, further research could study how probiotic supplements affect the central nervous system, including neurotransmitters involved in the regulation of mood, emotions, and stress responses. This could involve direct observation of brain activity, measurement of neurotransmitter levels in the brain, and studies of how changes in the gut microbiota may affect the central nervous system as a whole. As scientific research advances, the role of technology will also become important in understanding the connection between probiotic supplements and adolescent mental health. One of the latest technological developments that can support this research is mapping the gut microbiome

using gene sequencing techniques. With this technique, researchers can understand the composition and activity of the gut microbiota in more detail, as well as how probiotic supplements specifically affect the gut microbiota. A combination of neurobiology data, genetics, and gut microbiome mapping techniques may provide a more complete picture of how probiotic supplements may impact adolescent mental health.

Environmental factors that may influence the effects of probiotic supplements on adolescent mental health. This includes aspects such as diet, lifestyle, exposure to stress, and social environment. Longitudinal studies that observe adolescents in their everyday context can help in understanding how the interaction between these factors and the consumption of probiotic supplements may affect their mental health. Thus, this research can produce more relevant practical recommendations for improving adolescent mental health through probiotic interventions. Probiotic supplements can be a useful effort to improve the mental health of teenagers. Research has shown that the balance of bacteria in the digestive tract can affect a person's mental and emotional health. In the context of adolescents, this balance can be an important factor in managing anxiety, depression, and mood disorders.

Some steps that can help in using probiotic supplements for teen mental health. Firstly before starting the use of probiotic supplements, it is very important to consult a health professional such as a doctor or nutritionist. They can provide advice appropriate to your teenager's health condition, as well as ensure that probiotic supplements will not interact with other medications they may be taking. Second, choose the right proobiotic supplement. There are many types of probiotic supplements available on the market, and it is important to choose one that suits your teen's needs. Choose a probiotic supplement that contains a variety of beneficial bacterial strains, such as Lactobacillus and Bifidobacterium. Also make sure to pay attention to the number and strength of the bacteria contained in the supplement. Third, recognize the needs of teenagers. As a teenager, the need for probiotic supplements can vary depending on your health and diet. For example, teenagers who often experience digestive disorders, food allergies, or stress may need different doses than teenagers who rarely experience these problems. Therefore, it is important to understand the health condition of adolescents well before determining the right dose of probiotic supplements.

Then apart from taking probiotic supplements, it is important to balance it with a balanced diet. Eating foods that are rich in fiber and low in sugar can help good bacteria in the digestive tract to reproduce properly. Teenagers can also consume foods that contain natural probiotics, such as yoghurt, kimchi, or tempeh, as part of their daily diet. Next, monitor changes in mental health. The use of probiotic supplements does not always produce immediately visible effects in adolescents' mental health. However, it is a good idea to pay attention to changes that may occur after starting to take these supplements. Some teens may experience improved mood, decreased anxiety levels, or improved sleep patterns after using probiotic supplements regularly. However, any significant changes in a teenager's mental health should still be consulted with a health professional. By paying attention to the steps above, it is hoped that teenagers can use probiotic supplements wisely to improve their mental health. However, it is important to remember that probiotic supplements are not a substitute for professional medical care if a teenager is experiencing serious mental health

problems. The role of health professionals and family support remains an important factor in maintaining adolescent mental health.

Table 1: the effect of taking probiotic supplements on mental health

Effect	Description
Stress and anxiety reduction	Probiotics have been shown to have the effect of reducing stress and anxiety responses by regulating the immune system and reducing inflammation in the body. Consuming probiotics can help teenagers deal better with daily stress.
Improve sleep quality	Sleep disorders are often linked to mental health problems such as depression and anxiety. Research has shown that probiotics can help improve sleep quality by influencing the production of neurotransmitters and regulating the body's circadian rhythm.
Increases concentration and focus	Good mental health is important for optimal concentration and academic performance. Probiotics may impact cognitive function by improving the balance of bacteria in the gut and stimulating the production of neurotransmitters associated with cognition.
Reduces the risk of mental disorders	Regular consumption of probiotic supplements can help reduce the risk of mental disorders such as depression, anxiety and other mood disorders in teenagers.

Probiotic supplements offer an attractive solution for supporting gut health and overall health. Probiotics are live microorganisms that, when consumed in sufficient quantities, provide health benefits to their hosts. The most common types of microorganisms used in probiotic supplements are Lactobacillus and Bifidobacterium, although there are also probiotic yeasts such as Saccharomyces boulardii. When probiotics reach the gut, they have the potential to colonize and improve the gut bacterial flora, which can help restore a healthy balance of gut microbiota. One important aspect of the importance of probiotic supplements is their impact on the health of the digestive system. Probiotic supplements have been shown to be beneficial in treating digestive problems such as diarrhea, constipation, irritable bowel syndrome, and food intolerances. By reducing inflammation and improving gut function, probiotics can help improve the quality of life for individuals suffering from chronic digestive disorders. Apart from that, the importance of probiotic supplements is also related to immune health. Much of the human immune system is rooted in the digestive tract, where the gut microbiota interacts with immune cells. Probiotic supplements can help strengthen the immune system by increasing the production of immune cells and stimulating a healthy immune response. This can reduce the risk of upper respiratory tract infections, intestinal infections, and even allergies.

CONCLUSION

Conclusions in research on the effects of probiotic supplements on adolescent mental health show that there is a link between probiotic consumption and adolescent mental health. In general, the research results show that providing probiotic supplements can contribute to improving the mental health conditions of adolescents,

both in terms of reducing symptoms of anxiety, depression and stress, as well as in improving mood, well-being and resistance to mental disorders. Research also shows that probiotic supplements can affect the central nervous system, increasing the production of neurotransmitters, and affecting communication between the gut and the brain via the spinal cord. However, further research is still needed to understand in depth the mechanisms of action and the relationship between probiotic supplements and adolescent mental health, including the appropriate dosage, the most effective types of probiotics, and other factors that can influence the results. There is also a need for broader research, with larger and more diverse populations, as well as attention to other factors that can influence adolescent mental health, such as diet, lifestyle and social environment. Nevertheless, these findings provide a strong basis for the important role of probiotics in maintaining adolescent mental health, and their potential use as a non-pharmacological approach in the management of adolescent mental health disorders. Thus, there needs to be further attention from health practitioners and public policy to consider increasing access and education regarding the benefits of probiotic supplements for adolescent mental health, while still considering the safety side and potential side effects that still need to be understood more deeply.

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