# The Influence of Diet on Adolescent Psychological Well-Being Through Gut Microbiota

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## Abstract

The complex interplay of the gut and brain reveals how choices made early on regarding diet can have a long-term impact on an individual and the lifestyle they follow. The current literature review discusses how dietary choices made from childhood to adolescence can influence emotional health through gut microbiota. Overwhelming evidence supports the correlation between poor diet, such as fatty foods and artificial sugars, and negative psychological well-being. Likewise, the consumption of vegetables is related to a healthier mind. These results hold potential for new dietary guidelines and improved lifestyle choices for healthy adolescents. The growing concern regarding mental health issues in this age group further highlights the importance of societies needing to adopt more knowledge on diets and the complex relationship between the gut and brain.

## Introduction

Adolescence is a crucial time for mental health, as youth develop their identities, learn to interact with others, and regulate their emotions (Neufeld et al., 2016). Adolescents are facing higher rates of suicide in the 21st century with statstics indicating a rise of 65% since 2010 (Simkim, 2019). This indicates a struggling population of teenagers, and it is important to explore potential factors, such as diet, that may impact how we feel. The complex interplay of the gut and brain reveals how choices made early on regarding diet can have a long-term impact on an individual and the lifestyle they follow. The current literature review discusses how dietary choices made from childhood to adolescence can influence emotional health through gut microbiota, beginning with a review of diet and gut microbiota and then analyzing how they impact psychological well-being.

## Diet and Gut Microbiota

Diet is food consumed habitually to satisfy hunger and fuel the body (Wickham et al., 2020). A healthy diet can be determined with the amount of vegetables, fiber, and fruit consumed by the individual (Singh et al., 2017). Unhealthy diets are characterized by artificial sugar and with high fat intake (Singh et al., 2017). Diets can be influenced by location and culture (Lin etal., 2013). The typical Western diet in the United States includes processed foods and artificial sweeteners (Singh et al., 2017). This diet lacks the necessary fiber intake that creates a healthy colon of microbiota (Davis et al., 2020).

A healthy gut is associated with numerous microorganisms that inhabit the human intestine and colon, called “microbiota” (Neufled et al., 2016). These organisms metabolize fiber and absorb nutrients that strengthen the immune system (Davis et al., 2020). There is a direct relationship on how diet can impact the ecosystem of microbiota. (Neufled et al., 2016) Since the gut emulates a “changing ecosystem” it constantly changes based on what a person consumes and is negatively affected by an unbalanced diet (Rinninella et al., 2019). Therefore, an unhealthy diet can cause the gut microbiome to suffer because it does not provide any nutritional input, whereas a healthy diet that has essential nutrients will empower the gut.

For example, a study compared stool samples between Bangladesh and United States children and found a significant difference in diet and how it contributes to the overall health of the gut (Lin et al., 2013). The Western diet offered less fiber and more animal fat as protein with abundant amounts of carbohydrates. The Bangladeshi diet consisted of a variety of foods from rice to fiber-rich vegetables. One explanation proposed by the authors is that the Bandgladeshi diet is associated with a more diverse microbiome which relates to a strong immune system.

Gut microbiota is shaped early in life and the composition depends on diet during infancy. Diet alters human microbiota readily and reproducibly. (Davis et al., 2020) Breastfeeding for a longer duration is associated with a more stable bacterial composition (Davis et al., 2020). However, once children consume more complex diets, dietary patterns and microbiota emerge (Davis et al., 2020). The pattern is that the richer and more diverse the microbiota, the better they withstand external threats. Therefore, introduction of foods high in protein and fiber increases microbial diversity and coupled with breast milk can create a thriving gut which may cause less issues in the future regarding diseases both physical and mental. (Davis et al., 2020).

Collective studies have shown that alterations made in diet can have meaningful impacts on gut microbiota, which is influenced by fiber from fruits and vegetables and other plant foods. (Leeming et al., 2019). Furthermore, a longitudinal study involving daily gut microbiota investigations of two individuals over the course of a year found that changes in fiber intake are positively correlated with an abundance of 15% of the microbial community the following day. (Leeming et al., 2020) The findings of these several studies support the conceptual idea that diet and the gut microbiome are connected and one impacts the other.

## Psychological Well-Being

The choices we make on our plates may hold profound consequences for our minds. The transition from childhood to adolescence requires mental and physical transformation. Emerging research has revealed a connection between diet, gut microbiota, and how they work with the intricate design of an adolescent brain. This section will uncover the compelling evidence that highlights the role of dietary choices and how they shape the adolescent mind, offering a new perspective on mental health and how we can improve the well-being of youth in our society.

Evidence from O-Neil and colleagues (2014) indicated that habitually poor diet, characterized by increased consumption of Western processed foods, is independently associated with a higher chance of depression and anxiety among young adults. This link supports the concept that dietary choices do shape mental health outcomes during the critical developmental stage of a human. This point can be further supported with a recent systematic review in 2020 (Boonchooduang et al., 2020), that connects diet and ADHD in adolescents. The findings suggest that diets such as the typical Western plate that contains high in refined sugar and saturated fat increase risk of ADHD. Conversely, a healthy diet full of fruits and vegetables provides protection against ADHD and hyperactivity. Vegetable consumption was mentioned in other studies as well. In a study conducted in New Zealand and the United States raw fruit and vegetable consumption resulted in greater well-being and no depressive symptoms (Wickham et al., 2020) Furthermore, a study with two large cohort studies suggested the same findings and concluded that dietary improvement could be a strategy for the prevention of depression (Dash et al., 2015). These studies all demonstrated the idea that an unhealthy diet correlates with mental disorders, while a vegetable rich diet lessens such symptoms or prevents them altogether.

Another layer to the discussion added by Simkim (2019) is how the state of the body due to diet affects the well-being in adolescents. Adolescents who experience depression have a 70% increased risk of obesity, while obese adolescents face a 40% increased risk of depression (Simkim, 2019). This is due to external societal pressures that cause bullying, which outcast the adolescent leaving them more prone to depressive symptoms.  Like the other studies, Simkim highlights that excessive sugar consumption exceeds daily limits set by the American Heart Association in the United States. The data shows that the recommended amount of sugar is between 5 and 8 grams, however most Americans consume a whopping 41 grams daily (Simkim, 2019). Once again, diet is the culprit of the depressive symptoms presented in young adults.

Poor diets are associated with increased risks of depression,anxiety, ADHD, and obesity, while a healthy diet can offer protection. The gut microbiome, diet, and body work in unison and impact the feelings of an adolescent. Understanding these relationships can allow us to ensure a healthy and stable future generation.

**Future Directions/Limitations**

While the study has explored the insights into the relationship between diet and adolescent well-being through the lens of gut microbiota, there are several limitations to take into consideration. These limitations become an essential part of future research regarding such topics.

The existing body of literature predominantly lacks focus on the transitional period between 7 to 12 year olds. (Davis et. al, 2020) Future studies should focus on the true stages of puberty because it is the time period where various changes occur that set up humans for adulthood.

It is essential to acknowledge the scarcity of long-term follow up studies on dietary interventions. (Leeming et al, 2019) Most research seems to provide short-term

insights, which may not cover the bigger changes that a certain diet has on an individual. In this literature review, only a couple sources such as Leeming and O'Neil provided longitudinal studies. Long-term studies will provide observable patterns that can make conclusive statements about a study.

The dominance of studies conducted on animal models, such as mice, and the low sample sizes in human research is another limiting factor within the research studied. Animal studies do provide valid conclusions, however, it is unknown how these connect to humans. Future studies should have a diverse array of human samples that will allow them to analyze the human mental health rather than other species, which may not give correct results.

The study primarily focused on the impact of diet on adolescent well-being, however, multiple factors were failed to be mentioned. It is important to consider results may be influenced by genetics, physical activity, or financial situations. The upcoming studies must find ways to create a study that considers these factors into their results to create a more accurate data set.

Addressing limitations that the research study has collected and pursuing suggested future directions will lead to more conclusive results in this area. The advice of using bigger sample sizes, including human participants between ages of 7 and 12, and conducting long-term studies will help gain more knowledge on understanding how diet can impact on adolescent mental wellness.

## Conclusion

This paper reviewed the literature on the interactions between diet and psychological well-being and found that an unhealthy diet (characterized by artificial sugars and fatty foods) relates to poor mental health in adolescents. The results hold potential for new dietary guidelines such as consumption of fiber rich vegetables, which protects from declining mental health. Adolescence is a vulnerable state in life that should focus more on developing new habits that could protect them from widespread poor mental health. More research on the correlation between diet and mental health could lead to new ways adolescents can feel good mentally. As a society, it is important we keep addressing novel ideas to sustain a healthy mind.

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