The Relationship Between Self Reported Nutritional Patterns and Depression

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Abstract

Research in recent years has suggested that the state of an individual's gut microbiome may be related to their overall health, including mental health. The area of study involving the bidirectional interactions between the brain and the microbiome is called the gut brain axis. Our nutritional patterns, such as the nutrient density of one's diet, influence the state of the gut microbiome, which in turn may influence emotional wellbeing. The purpose of this research study was to explore the relationship between self-reported nutritional patterns and depression. A diverse sample of adults completed an online survey of questionnaires related to their experiences with depression and the general composition of their diet. The results of this research supported my hypothesis that diet and mental health are inversely correlated.

1. Introduction

In the last decade, depression rates have soared across the United States. (Carrellas, Biederman & Uchida, 2017). With that being said some have speculated over a possible connection between nutrition and depression. Recent studies have revealed that the gut microbiome has a close relationship with mental health. (Peirce & Alviña, 2019). The concept that "food is medicine" is thousands of years old.

Hippocrates is often credited for this philosophy (Hall, 2022). With that notion, more researchers are investigating how significant of a role nutrition plays in improving mental wellbeing. The gut microbiome is composed of microorganisms, such as viruses, archaea, yeast but mainly bacteria, that reside within the gut (gastrointestinal tract) in humans. Studies support that microbes in the human body outnumber human cells by ten fold (Peirce & Alviña, 2019). The microbiome is an ecosystem of trillions of microbes that aren't just limited to the gut but any part of the human body that interacts with the outside world. To understand the gut-brain connection, this concept must be taken into account. Nutrition is one of the main pillars for health and its connection to mental health well being is becoming more profoundly documented as the "gut microbiome brain axis". Gut microbiota may influence brain function through the nervous, hormonal and immune systemic pathways (Järbrink-Sehgal & Andreasson, 2020).

The condition of the gut microbiota has an effect on the body as a whole. A low nutrient diet consists of heavily processed foods that are high in fat, sugars, and salt. Heavily processed foods are low in gut microbiota diversity (Lane, et al., 2022). Thus, it can impair the integrity of the intestinal barrier thus resulting in leaky gut. Due to the intestinal permeability being compromised, toxins from the gut seep into the bloodstream which causes an inflammatory reaction by the immune system which negatively affects neurological pathways and causes an imbalance in the gut microbiome. Inflammation of the nervous and immune system are correlated with increased symptoms of depression. Gut microbiome imbalance targets the function of the central nervous system which results in a dysfunction stress-trigger response. (Peirce & Alviña, 2019). The opposite can be said when an individual consumes a diet rich in micro and macro nutrients, which include fruits, vegetables, legumes, whole grains and lean meats. These nutrient rich foods result in a healthy gut microbiome diversity. Just like nutrition, the gut microbiome is another pillar of health. Studies have emphasized the connection found between a nutrient rich diet, diverse gut microbiome composition and improved mental health. (Järbrink-Sehgal & Andreasson, 2020).

Recent studies have shown intriguing trends with improved microbiome composition through nutrition resulting in increased microbiome diversity thus reducing susceptibility to depression. These studies showed individuals with major depression disorder (MDD) have less diverse fecal microbiome composition compared to health controls (Peirce & Alviña, 2019). Observational studies found a connection between prebiotic and probiotic consumption, improved gut microbiome consumption and reduced mental health symptoms. The conclusion of these observational studies supported improving gut microbiome composition through nutrient rich foods as a potential treatment option in individuals with depression and depressive symptoms. (Järbrink-Sehgal & Andreasson, 2020).

Prebiotics, probiotics and other nutrient rich foods have a beneficial effect on brain pathways because they increase the diversity in the gut, reduce inflammation and improve microbiome composition. In particular those with MDD have increased Enterobacteriaceae in the gut which is found in raw milk and meat (Mladenovic at el, 2021). As well as lower levels of Faecalibacterium which is found in fruits, vegetables, fish, legumes and whole grains (Verhoog, et al., 2019), which is inversely correlated with the severity of the depression (Jiang, et al., 2022). Many studies done on both

humans and animals have shown that inflammatory and stress response physiological pathways most likely play an important role in the formation of depression (Peirce & Alviña, 2019). Studies focusing on the potential link between pro-inflammatory diet and depression have significantly increased popularity in recent years (Belliveau, 2022).

The empirical dietary inflammatory index (EDII) categorizes pro-inflammatory and anti-inflammatory foods. Anti-inflammatory foods include fruits, vegetables and whole grains. Whereas, pro-inflammatory foods are processed meats, sugar foods, fatty foods and high sodium foods. As shown in a cross-sectional study when major key demographics and lifestyle factors are controlled, there is a relationship between proinflammatory EDII scores and increased depression symptoms. A diet consisting of anti-inflammatory foods such as prebiotics, probiotics, fruits, vegetables and other nutrient rich foods correlates with reduced risk of depression whereas a pro-inflammatory diet such as sugary, salty, fatty and other highly processed foods is correlated with an increased risk of depression.

There is a potential connection between the nutrient needs of neurotransmitters which require sufficient amino acids, minerals, and vitamins to function properly and susceptibility to depression. This may provide an explanation why nutrient deficiencies such as a diet consisting of proinflammatory foods may result in depression symptoms (Belliveau, 2022). Another study found that a high EDII score is associated with a two fold increased risk of depression in adults (Bergmans & Malecki, 2017). A low EDII score was correlated with a low PHQ-9 score whereas a high EDII score was correlated with a high PHQ-9 score. The findings of this study further support the potential for a nutrient rich diet to be utilized as a preventative measure and treatment option for depression (Belliveau, 2022).

There are many factors that are increasing the depression rates around the world, such as urbanization. Due to the advancement in technology and our modern lifestyles our exposure to microbes early in life have decreased. This leads to an underdeveloped immune system prone to depression. Our modern environments reduced green spaces and more access to fast food. Both of those factors have contributed to gut dysbiosis and impact lower socioeconomic classes the most. Urbanization is often associated with low gut microbial diversity resulting in poor microbiome health (Peirce & Alviña, 2019).

My research hypothesis is that consuming a diet that is more nutrient dense will be correlated to lower depression scores. With my research study I want to uncover what is the relationship between nutrient dense diets and self-reported levels of depression in adults. There needs to be more research done on this relationship especially in terms of the gut brain axis.

2. Methods

2.1. Participants

In order to assess the relationship between self reported nutritional patterns and depression, a survey was distributed as a survey on flyers and shared on social media. The survey had a total of 109 responses. Out of 109 responses, 105 participants

completed the entire survey. Out of 109 participants, 82.6% identified as female, 16.5% identified as male and 0.9 identified as other.

2.2. Materials

2.2.1 Demographics Questionnaire

For the purpose of this study, a Demographics Questionnaire was used to determine the background information of the participants. In other words, this demographic questionnaire could serve as a tool to consider other potential variables that may impact the results of this study. For example, income and cultural background may impact the likelihood of eating certain nutritious foods. The questions ranged from gender, age, race, income, underlying physical and mental health conditions. The purpose of including underlying physical and mental health conditions was to consider the fact that they're limiting factors to mental and emotional wellbeing and may impact the depression scores.

2.2.2 Diet Index Questionnaire

For the purpose of this study, a Diet Index Questionnaire, created for the purposes of this study, was used to determine the diet nutrient patterns of the participants. This diet index was scaled according to the standard of diet nutrient density. One question that was asked was: how many deserts/sugary foods (cookies, brownies, ice cream, milkshakes, candy, chocolate etc) would you say you consume in a day? The answer choices ranged from 0-3. From there 0 point was given to the least nutrient answer choice and 3 points were assigned to the most nutrient dense answer. A participant with a "high score" indicates an eating pattern that is nutrient dense, whereas a participant with a "low score" indicates an eating pattern that is less likely to be nutrient dense. In addition, a participant with a "high score" on the diet index is predicted to have "low score" on the depression questionnaire.

2.2.3 Patient Health Questionnaire (PHQ-9)

For the purpose of this study, a Patient Health Questionnaire-9 was used to determine the severity of depression symptoms for participants. The PHQ-9 specifically asks about mental wellbeing over the last two weeks. There are a total of 10 questions and they are each scored from 0-3. 0-not at all, 1-several days, 2-more than half the days and 3-nearly everyday. The internal reliability of the PHQ-9 with a Cronbach's-a of 0.89 is excellent (Kroenke, Spitzer, Williams, 2001). A participant with a high score indicates higher likelihood of depression whereas a participant with a low score indicates lower likelihood of depression.

2.3 Procedures

We obtained approval by the institutional review board. The research study consists of Demographics, Diet Index, and PHQ-9 Depression Questionnaire. A flier was used to advertise this research study. The flier was posted on social media, emailed to faculty to share with students and athletes as well as printed out and posted on bulletin boards around campus. The flier contained a QR code on it so participants could scan it using their device to begin the research study via Qualtrics. Once they clicked on the link they first viewed the informed consent form . They were required to select "Yes, I consent to participate" in order to move forward and complete the study. After the informed consent, mental health resources were presented. The questionnaires then began for participants. Participants completed the questionnaires in the following order:Demographics, Diet Index, and Patient Health Questionnaire-9. The participants were able to complete all questionnaires in less than 15 minutes. The mental health resources were presented again after the questionnaires. The last page of the questionnaire thanked the respondent for participation and shared the purpose of the survey.

3. Results

3.1 Participants

A total of 109 participants completed the demographics. 18 of respondents were male, 90 were female and 1 of respondents identified as other. 50 of respondents were 18-24 and 59 of respondents were 25 and older. 57 of respondents identified themselves as Black or African American, 6 identified as Hispanic or Latino, 41 identified as White or Caucasian and 4 identified as multiracial or biracial. 13 of respondents identified themselves as unemployed, 31 identified themselves as having income of $0-$19,999, 5 identified themselves as having income of $20,000-$29,999, 5 identified themselves as having income of $30,000-$39,999, 3 identified themselves as having income of $40,000-$49,999 and 22 identified themselves as having income of $50,000-$74,999. 9 identified themselves as having income of $75,000-$99,999, 7 identified themselves as having income of $100,000-$149 and 2 identified themselves as having income of $150,000-249,999. 5 identified themselves as retired and 7 selected preferred not to answer. 39.4% of participants selected that they have an underlying physical medical condition. Some of the physical medical conditions were Arthritis, High blood pressure and Asthma. 60.6% of participants selected that they did not have an underlying physical medical condition. 33% of participants selected that they had an underlying mental health condition. Some of the mental health conditions were Anxiety, Depression, and PTSD.

3.2 Diet Index Questionnaire

The results from the diet index are showing that 18 was the minimum score and 40 was the maximum score (See Table 1). The mean was 29.8 and the standard deviation was 4.68.

3.2 PHQ-9 Questionnaire

The results from the PHQ-9 are showing that 0 was the minimum score and 18 was the maximum score (See Table 1). The mean was 5.17 and the standard deviation was 4.97.

Descriptive Statistics

	N	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic
	Statistic				
Nutrition_Overall	106	18.00	40.00	29.8208	4.68187
Depression_Overall	108	.00	18.00	5.1759	4.97250
Valid N (listwise)	105				

Table 1. Descriptive statistics of diet index and depression including data on minimum, maximum, mean, and standard deviation.

3.2.1 Correlation between Nutrition and Depression Scores

The correlation between the nutrient and depression scores, resulted in a pearson correlation of $r(105) = -0.27$, $p = .005$. (see Table 2).

Correlations

		Nutrition_Overall	Depression_Overall
Nutrition_Overall	Pearson Correlation	1	-.270[**]
	Sig. (2-tailed)		.005
	N	106	105
Depression_Overall	Pearson Correlation	-.270[**]	1
	Sig. (2-tailed)	.005	
	N	105	108

**. Correlation is significant at the 0.01 level (2-tailed).

Table2. The correlation and significance of nutrition and depression

4. Discussion

The results from the diet index questionnaire suggested that participants overall eat a relatively nutritious diet with a mean of 29.82. This means that the threshold to be eating at least 50% (score of 22) of a nutrient dense diet choice was met by the majority of participants. The standard deviation of 4.68 shows there was a large discrepancy between scores because the range was 22. The results from the PHQ-9 questionnaire suggested that participants were in the mild depression category with a mean of 5.17.

This means that the majority of the participants met the threshold for mild depression. The standard deviation of 4.97 shows there was large discrepancy between scores considering that the range was 18. Overall, with a significant figure of 0.005 supports my hypothesis that there is a correlation between nutrition and depression.

Consistent with the hypothesis, the results from the correlations of nutrient and depression scores showed that there is a significant inverse correlation between nutrition and depression. This could be interpreted as a high score on PHQ-9 is correlated with a lower score on the diet index. This may mean that diet and depression are inversely correlated.

Nutrition is one of the main pillars of health as supported by the significant correlation of diet and depression. The participants who selected the majority of the nutrient rich and antiinflammatory options in the diet index may be less susceptible to depressive symptoms. Based on author, Rachel Belliveau's (2022), this may suggest that participants may also have lower EDII scores, greater intestinal permeability, reduced gut dysbiosis, lowered risk of leaky gut, reduced physiology stress response dysfunction, diverse gut microbiota, lowered inflammatory pathways in the nervous and immune system according to her research. The reverse can be said for the participants who selected the majority of highly processed and inflammatory food options in the diet index and increased their susceptibility to depressive symptoms. These participants would have higher EDII scores, lowered intestinal permeability, increased gut dysbiosis, increased risk of leaky gut, increased physiology stress response dysfunction, lowered diversity of gut microbiota, increased inflammatory pathways in the nervous and immune system according to author, Rachel Belliveau's (2022) research. My research results add to the established notion that poor nutrition is correlated to poor mental health.

The clinical implications of this research is that mental health and other healthcare providers should consider nutrition as additional prevention and treatment options for their patients experiencing depression. There is significant research out now that supports the correlation between diet and mental health. There also needed to be more healthcare clinical education on nutrition as it relates to the pathophysiology in patients. Healthcare programs currently lack substantial nutrition education. City planners should also take into account that increased urbanization is correlated with reduced gut microbiome diversity thus increasing depression. With that being said, increased green spaces and decreased fast food chains should be taken into account when communities are designed and evolving, especially low income communities because they are negatively impacted by urbanization the most. Done years ago probably would not have the same effect.

There should be future research on the relationship between urbanization, diet and mental health. There should also be more research on how significantly physiological pathways related to depression are impacted by inflammatory foods. There needs to be more studies done on the intestinal permeability, gut dysbiosis and gut microbiome composition of individuals with and without depression. Lastly, there needs to be more research on how the stress trigger response is impacted by inflammatory foods and the relationship with mental health.

5. Conclusion

It is important to conclude that there is a negative and inverse relationship between nutrition and depression. This means a participant who scored higher on the diet index is correlated with a lower score on the PHQ-9 questionnaire. That also means a participant who scored lower on the diet index is correlated with a higher score on the PHQ-9 questionnaire. Nutrient is one of the main pillars of health and can have a vast impact on the body as a whole. Individuals who consume an inflammatory diet increase their risk of depression due to physiological dysfunction. With that being said, hopefully future treatment options for depression consist of a nutrient rich diet. Further research should be conducted on the composition of the gut microbiome correlation with depression symptoms.

6. Limitations

It should be taken into account that the participants who selected previous mental and physical medical conditions results could be skewed because of those variables that were not able to be controlled. 63.3% of participants selected having an underlying physical medical condition and 33% of participants selected having an underlying mental health condition. Those percentages are a significant portion of my participant pool. The presence of physical and especially mental health conditions could contribute to higher PHQ-9 and lower diet index scores. Other demographics and lifestyle factors, such as socioeconomic class, environment and other social determinants of health impact gut microbiome and mental health more than just nutrition. Results could be further skewed in participants who are unemployed or of lower socioeconomic status living in urban areas because of reduced access to grocery stores, unaffordability of nutrient rich foods, reduced green spaces and increased fast food presence in neighborhoods. The 18-24 age participant pool consisted of a lot of college students and athletes which could've skewed the results because of their increased knowledge of diet and exercise. Another limitation is that the study consisted of 82.6% female compared to 18% male and 0.9% other. Females are twice as likely than males to be diagnosed with depression (Nordhues, et al., 2021). That statistic could potentially correlate with a skewed result as well. Overall, the demographics were relatively diverse across age, class and race.

7. Acknowledgements

I would like to thank the UNC Asheville community for participating in my research. I would also like to thank my professor, Dr. Grosser for sharing my flier to my classmates, athletics administrator, Rebecca Nelms for sharing my flier to student athletes and the pre-health student club for sharing my flier to students all via email. I am also grateful for my family and friends who participated in my research. I also greatly appreciate Dr. Julien's guidance on this research topic during my research method's class. Last but not least, I am thankful for Dr. Laura Jones assisting me on this research and sharing her expertise, time and knowledge to make this research more than great.

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