

Adherence to the Mediterranean Diet and Depression: A Systematic Review of Recent Studies

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Abstract. Depression is a leading cause of disability that affects approximately 280 million people across the globe. This systematic review intends to report the latest cohort and cross-sectional studies, randomized control trials, and meta-analysis published in the past decade that investigates the relationship between adherence to the Mediterranean Diet (MD) and risk of depression or perceived well-being. The inclusion of both observational and experimental designs from recent studies has allowed this review to synthesize the results reached from different experimental designs. This review identifies MD as a promising subject for investigation in future studies, which is necessary to determine whether components of MD work at reducing symptoms of depression singularly or in aggregate.

1 Introduction

Depression is the leading cause of disability around the world. The World Health Organization estimates that approximately 280 million people worldwide have depression¹. The National Institute of Mental Health reports that around 14.8 million adults in the United States have experienced at least one major depressive episode in 2020². The high prevalence of depression in our present times prompts further research into the link between our lifestyle choices—our diet—and our mental health. In the past decade, an increasing number of studies sought to gain a deeper understanding of the influence of dietary patterns on depression to further prevention and treatment efforts. This review reports the most recent research made on one of the healthiest eating models acknowledged by leading nutritionists, the Mediterranean Diet (MD), and its relationship with health and depression. Exploration of how our dietary habits relate to our risk of depression may further prevention or treatment efforts in the field of psychiatry.

2 Depression: Symptoms and Diagnosis

Depression is defined by the American Psychological Association (APA)'s Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition (DSM-V) as having at least one of the major symptoms, anhedonia (loss of interest) or a depressed mood, and five or more secondary symptoms within two weeks³. Other secondary symptoms that may be present are poor appetites and weight changes, psychomotor impairment, insomnia, loss of energy or fatigue, feelings of worthlessness, and the presence of suicidal thoughts. All these symptoms are rated as either present or not present.

Since the severity of depression is variable, the all or none method the DSM-V relies on to diagnose depression may not be indicative of fluctuations of the disorder³. As a result, depression is more often assessed with The Hamilton Depression Rating Scale (HAMD), one of the most widely used rating scales for diagnosing depression, by rating symptoms (depressed mood, feelings of guilt, suicidality, insomnia, retardation, agitation, and general somatic symptoms) according to a scale of 0-4. The total score of all the subcategories of the symptoms is then added up. A score of 0-7 is within the normal range, whereas a score of 20 or above indicates severe depression⁴.

The Depression Anxiety Stress Scale, known as the DASS-21, is widely used in Australia; it relies on a self-reported scale to measure the emotional states of depression and anxiety in order to gauge the participant's response to the level of treatment⁵. One Spanish study opted for the Cantril Self-Anchoring Striving Scale, a type of well-being assessment that requires the respondent to reflect on their lives⁶. Another commonly used method is the Beck Depression Inventory and Beck Anxiety Scale; both are self-reported inventories that rate the severity of depression or anxiety on a numbered scale⁷. Similar to the Beck scales, the Patient Health Questionnaire-9 is a self-reported questionnaire that was created based on the categories of DSM-V. All the above methods can be used to assess the severity of depression and the individual's responsiveness to treatment.

3 Mediterranean diet: Health Benefits

Considered one of the healthiest diets by leading health experts, the Mediterranean Diet (MD) is a dietary plan that consists mainly of fruits, vegetables, nuts, olive oil, white

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meats, fish, and whole grains. The diet also includes seafood, poultry, and red wine, all of which are consumed in moderation⁸. MD was first defined by physiologist Ancel Keys in the 60s as a dietary plan that is low in saturated oil and high in fat from vegetable oil after he observed significantly low rates of coronary heart diseases in the Mediterranean areas⁹.

Nutritionists point out that MD consists of a high amount of Omega-3 fatty acids, a type of polyunsaturated fatty acid that is vital for overall health and calms inflammation. The American College of Cardiology (ACC) acknowledges the health benefits of Omega-3 and recommends consuming fish twice per week as prevention against cardiovascular diseases¹⁰. Some research has even claimed that regular consumption of fish, a primary source of Omega-3, can reduce symptoms of depression¹¹.

Other studies on MD have shown that greater consumption of fruit and vegetables, a major component of the diet, is beneficial to the overall health of an individual⁸. MD is most notable for its high concentration of unsaturated fats, fiber, and good protein¹⁰. Fiber from whole grains, barley, and oats helps regulate our gut microbiome, which controls our digestion and immune system. Clinical studies on the nutritional makeup of MD pointed out that unsaturated fats from plants, such as vegetable oil and nuts, are beneficial for metabolic functioning¹². Furthermore, the consumption of antioxidant-rich foods lowers the risk for cardiovascular diseases¹².

Health experts place an increasing emphasis on the importance of diet for the prevention of non-communicable diseases. Overall, it is unclear if essential fatty acids, fiber, or other components of MD are beneficial for health singularly or in aggregate, but numerous studies have established a correlation between the diet and risk factors for diseases. Diet plays a key role when it comes to our mental health. In fact, diet is so essential that it inspired the field of nutritional psychiatry, which delves into the complex relationship between the mind and body. The consensus of health experts and nutritional psychiatrists is that what we eat affects not just our physical health, but our mental health as well. Many studies have pointed out that people with mental illness have poor diet and lifestyle that are detrimental to their overall wellbeing^{11 13 14 15}. Researchers reported similar risk factors between depression and cardiovascular diseases, such as low levels of omega-3 unsaturated fatty acids, poor diets, and inflammation¹¹. Thus, an investigation into the link between MD, one of the healthiest dietary models, and depression is essential to form a comprehensive understanding of our food consumption and mental wellbeing.

4 Relationship between MD and depression

10 research papers published up to June 2022 available on Google Scholar were accessed through the search terms Mediterranean diet and depression/depressive symptoms/mental health/wellbeing. The most recent original studies in the past five years were selected. Articles were excluded for the following reasons: unrelated to search

terms, not published in English, or did not utilize a depression rating scale.

The cross-sectional studies included 152 to 49,261 men and women aged more than 18 years. Three studies were reported from Australia, two from Spain, and one each from Greece, Turkey, Sweden, the United States, and Iran.

Findings from all seven cross-sectional studies reported a significant negative association between adherence to MD, measured through different assessment methods (MEDAS, MedDietScore, aMED), and risk of depression.

Overall, there is a consensus on the health benefits of adhering to the Mediterranean Diet, including lowered risk of cardiovascular diseases and other non-communicable diseases¹⁵. All papers acknowledge the important role diet plays in our physical and mental wellbeing and have made adherence to MD and risk of depression the main assessment focus of their cross-sectional or cohort studies.

Many studies with different designs have investigated the relationship between MD adherence and risk of depression. Though all studies are of high quality, there are some potential limitations that must be considered. Some studies that reported a significant association between adherence to MD and risk of depression lack a clear criterion for the diagnosis of depression. In a 2017 study, Parletta et al. (2017) recruited participants with self-diagnosed depression or self-reported depressive symptoms for their study, which undermines the validity of the experiment¹¹. In a report by Arias-de la Torre et al. (2020) on the accuracy of self-reported depression, researchers determined that self-reported depression, though a quick method of obtaining data through cohorts and surveys, tends to overestimate the prevalence of the mental disorder¹⁶. Thus, self-reported diagnoses may be drastically different from diagnoses from an actual mental health expert and utilizing clinical assessments or scales are the most optimal.

4.1 Cross-Sectional Studies vs. Cohort Studies

Some cross-sectional studies reported a significant relationship between adherence to the diet and reduction of depressive symptoms¹³. However, due to the fact that cross-sectional studies are observational and descriptive by nature, they cannot be used to determine the causal relationship between adherence to MD and the risk of depression. Nevertheless, cross-sectional studies offer a snapshot view of the correlation between our diets and mental wellness and point the direction for future studies.

In comparison to cross-sectional studies, which measure both the outcome and the exposure at the same time to determine the prevalence of the former or the latter, cohort studies are better for establishing the causality between MD and risk of depression since it gathers data in a sequence of events. Similar to cross-sectional studies, the cohort studies concluded that there is a significant association but not causation between adherence to MD and risk of depression^{15 17}. In order to investigate causality, randomized clinical trials is the most optimal method. It is important to note that confounding variables may play a

role in the outcome of the study. For instance, a cohort study on MD adherence and depressive symptoms in the elderly Greek population by Mantzorou et al. (2020) failed to account for the level of physical activity and anthropomorphic measurements¹⁷; thus, a causal relationship cannot be made since confounding variables may be a potential source of limitation. In addition, cohort studies are time-consuming and require follow-ups with a large number of subjects, some of which might eventually withdraw from the study, resulting in a loss of data¹⁸.

Many studies have pointed out that adherence to the diet is correlated with better subjective well-being^{11 19}. Some cohort studies on adherence to the Mediterranean Dietary Pattern (MDP) have shown that there is a significant inverse correlation between adherence to the diet and the development of depressive symptoms^{15 19 20}. The conclusion reached by these studies is in line with a randomized clinical trial by Sanchez et al. (2019)²¹. However, these findings differed from the results of a meta-analysis that explored the same relationship. A meta-analysis by Shafiei et al found no significant association between adherence to MD and risk of depression in cohort studies, but a significant inverse association between the two in cross-sectional studies²². The difference in findings can be attributed to the fact that Shafiei et al. (2019) excluded any clinical trials and studies that focused on specific components of the diet in the meta-analysis, thereby ruling out any studies that did not fit their criteria. Furthermore, Shafiei et al. (2019) addressed a potential limitation, stating that some studies used for the meta-analysis may have misclassified patients due to biased cutoff points used in food frequency questionnaires to measure adherence to MD²². Given the shortcomings of this meta-analysis, studies that reported a significant negative association between adherence to MD and risk of depression should still be acknowledged.

4.2 Which chemical component in MD improves depression?

Several studies focused on investigating the effect of a specific component of MD, such as polyphenols, extra-virgin olive oil, fish, and Omega-3. A systematic literature review of the effect of polyphenols on alleviating symptoms of depression reported that there is a statistically significant positive effect of consuming the micronutrient in twenty-nine studies²³. Another randomized clinical study that investigated the effectiveness of extra-virgin olive oil, a high-quality oil rich in polyphenols, in preventing the recurrence of depression reported similar findings, including the improvement of the quality of life and alleviation of symptoms of depression²¹. However, few studies have investigated whether components of MD, including what specific chemical, food, micronutrient, or other factor is beneficial for health singularly or in aggregate. Therefore, additional studies are imperative to arrive at a definitive conclusion.

5 Future Direction

Over the past decade, many studies have highlighted the vital role diets play in our physical and mental well-being. Our lifestyle and well-being go hand in hand; numerous reports in the field of nutrition and psychiatry have shed light on the inseparable link between our mind and body. The relationship between diet, nutrition, and depression emerges as a promising field of research that can be further developed through future exploration and analysis.

Though there are well-established research and systematic reviews on the beneficial role of adherence to MD and the risk of depression, studies on the long-term effect of adherence to the diet remain scarce. It is important to consider time as a factor, including how long it takes the adherence to see positive results and the feasibility and effectiveness of long-term adherence.

Furthermore, more research is necessary on determining whether components of MD work at reducing symptoms of depression singularly or in aggregate. More future research on the chemical components of MD that are seemingly protective and the longevity of consistent diet regimens to alleviate depressive symptoms is imperative in order to strengthen current prevention and treatment strategies for mental illness.

In addition, there need to be more studies that have a proportionate number of participants from an age range or sex. In a study conducted in 2021, Ates Özcan et al. (2021) reported a significant negative correlation between adherence to MD and depression scores and sleep quality¹³. However, this finding was reached through analysis of data from male participants of ages 18-24, which constituted the majority of the population in the study¹³. The lack of true representation of male and female participants and a disproportionate number of participants from a particular age group may impact the results.

6 Conclusion

This systematic review revealed mostly a significant association between adherence to MD and risk of depression. MD is considered a high-quality dietary plan that may be an effective intervention for preventing or reducing symptoms of depression. Many studies have pointed out that adherence to the diet is correlated with better subjective well-being, as well as improved mental health. This review synthesized both observational and experimental designs from the most recent research and identified the significant role diet plays in our mental well-being. Further exploration of the mind-body connection, especially diet and well-being, can yield promising results. Future research is necessary to determine the long-term results and effectiveness of adherence to MD on depression to facilitate current treatment methods.

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