

# The Role of Dietary Patterns in Mood Disorders: Prospective Research in Youth Populations

**Abstract:** *Childhood mood disorders, including depression and bipolar spectrum disorders, represent serious public health concerns and often extend into adulthood. Due to increasing rates of a mood disorder diagnosis, and its accompanying risk of suicide, identification and management in childhood and adolescence is critical. Yet, fully effective and safe treatment options are lacking for child-onset mood disorders. Research investigating relationships between nutrition and psychiatry is a plausible avenue to improve prevention and treatment options. Epidemiological and observational evidence exists to support a protective effect of the Mediterranean diet in mood disorder prevalence and future diagnosis. To date, the majority of research has been conducted in adult populations. Future research is needed to examine if similar dietary relationships exist within a youth mood disorder population. Additionally, increased homogeneity in assessment methods of mood disorder symptoms and dietary patterns is needed; specifically, to determine more collective conclusions via meta-analyses. Results from youth studies could be used to formulate future randomized controlled trials, health promotion programs or clinical*

*interventions, via diet or supplement interventions, for alternative mood disorder treatment or prevention purposes.*

**Keywords:** mood disorders; dietary patterns; youth

Nutritional psychiatry is an emerging field of study, produced as a consequence of the increasing prevalence of psychiatric

comorbid disorders.<sup>4</sup> The prevalence, duration, and treatment of mood disorders, have been examined in the context of nutrient intake and eating patterns in primarily adult populations.<sup>5-13</sup> Limited research exists in youth populations exploring similar relationships and whether findings can be translated into appropriate prevention and treatment options.<sup>14-17</sup>

Consequences from current treatment options have produced an increased public demand for integrative forms of

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disorders and their significant public health burden.<sup>1</sup> Current psychopharmacological treatments for mood disorders, particularly depressive and bipolar spectrum disorders, have limited efficacy and risk of adverse side effects.<sup>2,3</sup> Diagnosis and management of mood disorders in adolescence is critical given the potential trajectory of symptoms into adulthood and the increased risk of developing additional

treatment for these disorders.<sup>18</sup> These forms of treatment range from lifestyle changes via exercise, meditation, or acupuncture, to manipulation in dietary patterns and nutritional status. Nutritional intervention, via dietary modification as well as macro- or micronutrient supplementation, is an emerging field of interest in treatment research for psychiatric disorders. Genetic differences in metabolism of specific micronutrients,

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as well as underlying micronutrient deficiencies and/or insufficiencies, may play a key role in the development and progression of symptoms.<sup>19-21</sup>

Investigating these underlying differences as well as their roles in causality, morbidity, and mortality, may lead to alternative and complementary methods for treatment or, potentially, prevention of childhood onset of mood disorders. Future research exploring a personalized-nutrition approach for the mood disorder adolescent patient using both dietary pattern and/or micronutrient supplementation may be warranted.

### Summary of Habitual Dietary Patterns Research

Studies investigating the relationship between nutrition and mood disorders can be characterized into 2 categories: habitual diet pattern analysis and micronutrient intake/status analysis. Research assessing habitual diet pattern analysis has included epidemiological, observational, and prospective designs.<sup>22</sup> Epidemiological evidence includes incidence/prevalence of mental health disorder diagnoses, and has demonstrated the global severity of psychological symptoms are greater among individuals with diets high in fat and low in complex carbohydrates.<sup>23,24</sup> Age-standardized suicide rates, which may reflect depression rates, tend to be lowest in Mediterranean countries.<sup>25</sup> Additionally, global trends have led to scientific enquiries about relationships between dietary patterns and mental health outcomes.

Dietary pattern studies explore variation in nutrition intake and how foods are consumed in combination, where the joint effect of multiple nutrients can be considered.<sup>26</sup> Analysis of dietary patterns also addresses the synergism of nutrients and the characterization of common eating behaviors.<sup>16,27</sup> Additionally, a dietary pattern study approach produces results that are more feasible and clear to translate to the public through nutrition education and intervention.<sup>26</sup> To date,

studies typically characterize dietary patterns in one of two ways:

1. The use of validated and predefined summary indices of overall diet quality (eg, Healthy Eating Index, or Diet Quality Index) calculated based on nutritional elements or constructs (total fruit, whole fruit; total vegetables, dark green and orange vegetables and legumes; total grains, whole grains; milk, meat and beans; oils, saturated fat; sodium; calories from solid fat, alcohol, and sugar; cholesterol, calcium, iron, etc) derived from an individual's reported dietary intake and combined into a single score.<sup>28,29</sup> These scores are ranked based on predetermined cutoff points for healthy and unhealthy dietary patterns and are used to measure diet variety, moderation, and balance, as well as diet quality based on national standards and guidelines (eg, Dietary Guidelines for Americans).<sup>16</sup>
2. An "investigator defined" index quality, such as a Mediterranean diet pattern, traditional diet pattern, Western diet pattern, or modern diet pattern. Since there is no single, universally accepted diet quality index, each research team defines diet quality categories by selecting nutritional index elements considered most important to the outcome of interest and that accurately captures and/or reflects the cultural dietary patterns of the study population.<sup>29</sup> These dietary patterns are often developed via factor analysis from results of a Food Frequency Questionnaire (FFQ) administered to the study population. A Mediterranean dietary pattern usually consists of a diet with a high ratio of monounsaturated to saturated fatty acids (usually via olive oil); high intakes of legumes and vegetables; high fish intake; low intake of meat and meat products; moderate grain intake; low intake of milk and dairy products; and moderate alcohol consumption in adult studies (primarily of red wine).<sup>25</sup> A traditional dietary pattern, often called a healthy

dietary pattern, usually is reflective of the traditional cultural diet of the study population. This dietary pattern is typically characterized by balanced intakes of vegetables, fruits, beef, lamb, fish, and whole-grain foods.<sup>28</sup> A Western dietary pattern, often thought of as an unhealthy dietary pattern, is typically composed of processed foods such as pizza, meat pies, lunch meats, chips, hamburgers, white bread, added sugar and high milk, dairy, and beer intake in adult studies.<sup>28</sup> A modern dietary pattern, most similar to a vegetarian dietary pattern, usually consists of foods such as fruits and salads, fish, tofu, beans, nuts, yogurt, and red wine in adult studies.<sup>28</sup>

Mood disorder data in dietary studies have been collected in a variety of formats from psychological and behavioral measurements such as the Child Behavior Checklist, the Pediatric Quality of Life inventory, the Center for Epidemiologic Studies Depression Scale (CES-D), structured clinical interviews, or self-reported physician-made diagnosis.<sup>6,8,15,25,28</sup> A variety of confounders such as poverty, socioeconomic status, and food insecurity are known factors related to mood disorders, thus many of these are accounted for in the dietary pattern-mood disorder disease relationships.<sup>28,29</sup>

Few studies have included a prospective study design to measure direction of relationships between dietary patterns and mental health or to investigate the possibility of reverse causality.<sup>20,28</sup> The reverse causality theory hypothesizes that dietary patterns in poorer mental health populations are directly influenced by the psychological disorder, instead of the reverse standpoint that psychological disorders are being mediated or caused directly by dietary patterns.<sup>20,28</sup> Since appetite changes are a common feature in many mood disorders, and are mediated through both symptom severity and use of antipsychotics or antidepressants, this increases the difficulty of accurately accounting for the directionality of a

nutrition and mental health relationship.<sup>20</sup>

Adult and adolescent studies have found consistent inverse relationships between Mediterranean dietary patterns and mood disorder symptoms or diagnosis.<sup>7,25,27</sup> However, there have been inconsistent results in finding a positive relationship between adherence to a Western dietary pattern and mood disorder symptoms or diagnosis.<sup>22</sup> These results suggest that meeting the intake requirement for specific healthy food groups might be sufficient to provide beneficial effects on mental health.<sup>16</sup> In studies that had inconsistent results on the relationships between dietary patterns and mental health, associations were often found after adjusting for overall energy intake. This adjustment further emphasizes the hypothesis that the *absolute amount* of specific nutrients in the diet may be more relevant to mental health than their quantity as a *proportion* of the overall diet.<sup>20,28</sup>

From an intervention standpoint, this may mean that promoting the incorporation of nutrient supplementation, such as those found in a Mediterranean diet (ie, omega-3 fatty acids), may be more essential than encouraging a balance of healthy and unhealthy foods in the diet. Even when poverty, food insecurity, and low income were controlled for in existing research, a strong relationship between specific nutritional eating pattern and mental health status remained.<sup>20,30</sup>

Prospective cohort studies have shown a dose-response relationship between Mediterranean diet patterns and mood disorder symptoms or diagnosis.<sup>20,25,28</sup> Many of these studies found a protective effect of a healthy dietary pattern against future diagnosis of a mood disorder.<sup>16,27</sup> Among children, a healthy diet pattern has been found to be a strong predictor of higher scores on the Pediatric Quality of Life Inventory (PedQL).<sup>20</sup>

Until recently, dietary patterns have only been explored in the context of correlations in epidemiological, cross-sectional, and longitudinal studies. The first randomized controlled study exploring alterations in whole-diet

approaches was just completed in Australia, titled the SMILES study. Results from the study found improvements in severity of mean depressive episodes in adults who adhered to the Mediterranean diet pattern prescription.<sup>31</sup> Another multisite randomized controlled trial using a whole-food approach is the MoodFOOD study in overweight adults, which employs the use of micronutrient supplementation and a whole-food hamper (basket with food) as a depression intervention.<sup>32</sup>

### Implications for the Field of Nutritional Psychiatry

The emerging field of nutritional psychiatry originates from substantial evidence from epidemiological, cross-sectional, longitudinal studies, and clinical trials examining the presence and magnitude of relationships between dietary patterns, micronutrients, and mood. Recent studies have extended this umbrella of research to investigate the effects of obesogenic mechanisms and gut-microbiota interactions in the development and progression of mood disorders.<sup>33-35</sup> Research in adolescent populations is increasing; however, the majority of longitudinal studies and clinical trials continue to be explored primarily within an adult population.

### Variation in Mood Disorders and Diet Pattern Measures

Assessment of symptom severity or treatment response time could be a critical factor to consider in assessing relationships between nutrition and mood disorders. There is significant variability in the identification of depression symptoms in current literature, ranging from self-report questionnaires to identify presence of depression/manic symptoms; to clinical interviews by a licensed practitioner for diagnosis; and recruitment based on a diagnosed chronic mood disorder that has spanned for several years. It is possible that the presence or strength of relationships between nutrition and mood disorders are dependent on the severity, subtype, or duration of

symptoms.<sup>12</sup> Thus, increased homogeneity in symptom measurements are encouraged, if possible electing to pursue recruitment from a population that has been assessed by a licensed practitioner or recruited based on a clinical diagnosis.

Future research employing an assessment or intervention with dietary patterns or whole food approaches should be selective with their nutrition assessment tools, as well as the seasonality in which they are observing or altering dietary patterns.<sup>21</sup> A variety of nutrition assessment tools as well as statistical methods have been employed to assess dietary intake patterns, which makes consolidating results in the field challenging due to heterogeneity.<sup>1</sup> Short form FFQs, adolescent/adult comprehensive FFQs, 3-day food diaries, 24-hour recalls, and original assessment tools developed by investigators, each have been used in the collection of dietary information. Additionally, dietary intake patterns derived from factor analysis, diet quality scores, principle component analysis, investigator defined patterns, and regression analysis have been used to explore associations in dietary intake.

### Future Intervention Implications

To quantify or assess the direction of relationships between nutrition and mood disorders, it will be essential to promote the use of homogeneous nutrient assessment methods so that systematic reviews can detect more robust associations.<sup>21</sup> The majority of research in the field of nutritional psychiatry has been correlational in nature.<sup>22</sup> There is a need for randomized controlled trials to address the direction and magnitude of associations identified from epidemiological, observational, and longitudinal research.<sup>1,18</sup>

In summary, studies to date suggest the need for more rigorous large-scale randomized control trials to determine their benefit. Given the clinically significant negative side effects that are seen in the current psychotropic medications, as well as the unappealing

risk: benefit ratio and unknown long-term effects, it is critical to explore alternative avenues for treatment. Public interest and demand for a nutrition-based treatment plan is rapidly increasing, in part encouraged by the growth of research supporting the feasibility and benefits of nutrition-based interventions in the child and adolescent mood disorder population. Future research should explore plans for developing and implementing a personalized nutrition treatment approach for the mood disorder patient from either a diet and nutrient supplementation perspective, as well as its outcomes, for comparison to current standard of care.

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Not applicable, because this article does not contain any studies with human or animal subjects.

### Informed Consent

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### Trial Registration

Not applicable, because this article does not contain any clinical trials. [AJLM](#)

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