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MASTER THESIS

Dietary patterns and depression in adults: A review of Mediterranean and DASH diet evidence

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I. Abstract

Major Depressive Disorder (MDD) is a common mental health disorder and a major contributor to global disability. Although pharmacological and psychological treatments are widely used, a considerable proportion of patients do not achieve adequate clinical improvement. Increasing evidence suggests that nutrition may influence depressive symptoms through mechanisms related to inflammation, oxidative stress, and the gut-brain axis. The aim of this thesis was to evaluate the relationship between nutrition and depression in adults, with particular focus on specific nutrients, including vitamin D, omega-3 fatty acids, and dietary fiber, as well as dietary patterns such as the Mediterranean and DASH diets. A narrative review was conducted using PubMed and Google Scholar databases to identify studies published between 2015 and 2025. Following the PRISMA guidelines, studies involving adult populations were screened according to predefined inclusion and exclusion criteria. A total of 24 studies, including randomized controlled trials, cohort studies, systematic reviews, and meta-analyses, were included in the final synthesis.

The findings suggest that adherence to healthy dietary patterns, particularly the Mediterranean diet, is associated with reduced depressive symptoms. Omega-3 fatty acids and vitamin D supplementation demonstrated beneficial effects in some adult populations, especially among individuals with inflammatory or metabolic disturbances. In contrast, higher consumption of ultra-processed foods was associated with poorer mental health outcomes. Proposed biological mechanisms included modulation of inflammation, oxidative stress, and gut microbiota composition. Overall, the evidence indicates that nutritional strategies may serve as useful adjunctive approaches in the management of depression. Further high-quality clinical studies are needed to establish standardized nutritional recommendations for adults with depressive disorders.

1. INTRODUCTION

1.1. The Role of Nutrition in Mental Health

In recent years, the role of nutrition in mental health has gained significant attention. Dietary patterns, particularly the Mediterranean and Dietary Approaches to Stop Hypertension (DASH) diets, are increasingly recognized for their potential to influence psychiatric outcomes. Nutritional psychiatry investigates how food quality and specific nutrients can prevent or manage mental health conditions. While traditional approaches often focused on individual nutrient deficiencies, contemporary research emphasizes the profound impact of overall dietary patterns on brain function, emotional regulation, and psychological well-being. Consequently, diet has emerged as a critical entry point for understanding and modifying mental health trajectories.

1.2. Major Depressive Disorder (MDD) as a Primary Clinical Outcome

As the focus on nutritional psychiatry grows, Major Depressive Disorder (MDD) has become a central outcome of interest. MDD is a prevalent psychiatric condition and a primary contributor to global disability (World Health Organization, 2023). It is clinically characterized by persistent low mood, anhedonia, fatigue, sleep and appetite disturbances, impaired cognitive function, and recurrent suicidal ideation (Adan et al., 2019). According to the World Health Organization (2023), depression affects approximately 280 million individuals worldwide.

1.3. Current Treatment Landscape and Limitations

The current standard of care for MDD primarily relies on pharmacotherapy, psychotherapy, or a combination of both. Antidepressant medications, particularly selective serotonin reuptake inhibitors (SSRIs), alongside psychological interventions such as cognitive behavioral therapy (CBT), represent the most common and empirically supported clinical approaches (Staudacher et al., 2025).

However, conventional treatments demonstrate significant limitations. A considerable proportion of patients do not achieve full remission, with many experiencing persistent symptoms despite adequate standard therapy (Marx et al., 2021). Furthermore, pharmacological interventions are frequently associated with adverse side effects, including weight gain, gastrointestinal distress, and sleep disturbances, which can compromise long-term treatment adherence (Adan et al., 2019). These clinical challenges have catalyzed interest in modifiable lifestyle factors, particularly nutrition, as complementary approaches to optimize mental health outcomes and support standard psychiatric care (Apostolakopoulou et al., 2024; Marx et al., 2021).

1.4. The Emergence of Nutritional Psychiatry

In recent years, increasing attention has been given to the relationship between nutrition and mental health. This area of research, often referred to as nutritional psychiatry, examines how dietary factors may influence psychiatric disorders, including depression (Adan et al., 2019).

Earlier research mainly focused on the effects of individual nutrient deficiencies on brain function. More recent studies have investigated the impact of overall dietary patterns and diet quality on mental health outcomes. Evidence from observational studies suggests that dietary patterns characterized by high intake of processed foods, refined sugars, and saturated fats are associated with a higher risk of depressive symptoms. In contrast, diets rich in fruits, vegetables, whole grains, legumes, and fish have been associated with better mental health outcomes (Apostolakopoulou et al., 2024).

Several biological mechanisms have been proposed to explain these associations, including inflammation, oxidative stress, impaired neuroplasticity, and alteration in the gut microbiota (Marx et al., 2021; Bear et al., 2020). Although the evidence is still evolving, nutritional psychiatry has become an important area of interest in both research and clinical practice.

1.5. Key Nutrients and Dietary Patterns

Several nutritional factors have been investigated for their potential role in depression management and prevention. Among these, vitamin D, omega-3, fatty acids, and dietary fiber have received considerable attention in recent years.

- Vitamin D has been associated with brain function, immune regulation, and inflammatory processes. Several studies have reported a higher prevalence of vitamin D deficiency among individuals with depressive symptoms, although the effectiveness of supplementation remains variable across populations (Kaviani et al., 2022; Mikola et al., 2023).
- Omega-3 fatty acids, particularly eicosatetraenoic acid (EPA), are involved in neuronal membrane function and anti-inflammatory pathways. Meta-analyses have suggested that omega-3 supplementation may contribute to reductions in depressive symptoms, especially in individuals with inflammatory or metabolic disturbances (Chang et al., 2024; Wu et al., 2023).
- In addition to individual nutrients, dietary patterns have also been examined. The Mediterranean Diet, characterized by high intake of fruits, vegetables, whole grains, legumes, olive oil, and fish, has shown consistent associations with improved mental health outcomes (Jacka et al., 2017; Parletta et al., 2019). In contrast, dietary patterns high in processed foods and refined sugars have been associated with increased risk of depression (Lane et al., 2022; Ejtahed et al., 2024).

Although growing evidence supports a relationship between nutrition and depression, the integration of nutritional approaches into routine mental health care remains limited (Adan et al., 2019). Existing studies report variable findings regarding the effectiveness of dietary interventions and nutritional supplementation, partly due to differences in study design, population characteristics, and intervention duration (Mikola et al., 2023; Staudacher et al., 2025).

In addition, many studies focus on isolated nutrients rather than overall dietary patterns, making it difficult to determine which nutritional strategies may be most beneficial in clinical practice (Apostolakopoulou et al., 2024). The biological mechanisms linking nutrition and depression, including inflammation and gut-brain interaction, also require further investigation (Bear et al., 2020; Marx et al., 2021).

Therefore, a critical evaluation of current evidence is needed to better understand the potential role of nutrition in the prevention and management of depression in adults.

1.6. Significance of the Study

Depression represents a significant public health challenge and continues to impose substantial social and economic burdens worldwide (WHO, 2023). Given the limitations of current treatment approaches, there is increasing interest in complementary strategies that may support mental health outcomes (Adan et al., 2019; Staudacher et al., 2025).

This study is important because it synthesizes current evidence regarding the relationship between nutrition and depression in adults. By examining both dietary patterns and specific nutrients, the thesis aims to provide a clearer understanding of how nutritional factors may contribute to depression prevention and management.

The findings may also contribute to the growing field of nutritional psychiatry and support future research on integrating nutritional assessment into mental health care (Adan et al., 2019).

2. OBJECTIVE OF THE THESIS

The aim of this thesis is to evaluate the relationship between nutrition and mental health outcomes—primarily depression, alongside secondary outcomes of anxiety and stress—in adult populations, with particular focus on dietary patterns and selected nutrients, including vitamin D, omega-3 fatty acids, and dietary fiber.

The study addresses the following research questions:

- What is the current evidence regarding the association between specific nutrients and symptoms of depression, anxiety, and stress in adults?
- How do dietary patterns, particularly the Mediterranean and DASH diet, influence depression risk and symptom severity?
- What biological mechanisms—such as inflammation, gut-brain axis modulation, or neuroendocrine pathways—are proposed to mediate the effects of nutrition on depression?
- What are the methodological limitations and knowledge gaps in the existing literature, and how can future research better address the nutritional needs of adults with depression?

3. MATERIALS AND METHODS

3.1. Search Strategy

A literature search was conducted using the PubMed and Google Scholar databases to identify studies investigating the relationship between nutrition and depression in adults. The search included articles published between January 2015 and October 2025.

Search terms included combinations of keywords related to nutrition, dietary patterns, nutrients, and depression. The main keywords used were: “depression”, “anxiety”, “stress”, “major depressive disorder”, “nutrition”, “mediterranean diet”, “DASH diet”, “omega-3 fatty acids”, “vitamin D”, “fiber”, “probiotics” and “ultra-processed foods”

References lists of relevant reviews and meta-analyses were also screened to identify additional eligible studies.

3.2. Inclusion and Exclusion Criteria

Studies were selected according to predefined inclusion and exclusion criteria.

Inclusion Criteria:

- Adult participations aged >18 years and older
- Randomized controlled trials, cohort studies, systematic reviews, and meta-analyses
- Studies investigating dietary patterns or nutritional factors in relation to depression
- Depression diagnosis or depressive symptoms assessed using validated scales
- Articles published in English between 2015 and 2025

Exclusion Criteria:

- Studies involving children or adolescents
- Care reports, editorials, and qualitative studies
- Studies without validated depression outcomes measures
- Non-English publications
- Studies focusing primarily on psychiatric disorders other than depression

3.3. Data Extraction and Synthesis

The study selection process followed the PRISMA guidelines. Titles and abstracts were screened according to the eligibility criteria, followed by full-text assessment of potentially relevant articles. Due to the broad scope of nutritional psychiatry and to capture a comprehensive overview of the current landscape, this study was structured as a systematic review of mixed evidence. It deliberately incorporates both primary research (e.g., randomized controlled trials, longitudinal cohorts) and secondary literature (e.g., narrative reviews, systematic reviews, and meta-analyses) to provide a holistic synthesis of the available data.

The following information was extracted from the included studies:

Author and year of publication, Study design and sample size, Population characteristics (age, sex, health status), Type of nutritional intervention or dietary pattern, Depression assessment method, Main finding and reported outcomes

The findings were synthesized narratively and organized into thematic categories, including:

- Specific nutrients and depression
- Dietary patterns and depression

- Biological mechanisms linking nutrition and depression

3.4. Quality Assessment

The methodological quality of the included studies was evaluated using established appraisal tools according to study design. The Cochrane Risk of Bias tool was used for randomized controlled trials, the Newcastle-Ottawa scale (NOS) for observational studies, and AMSTAR-2 for systematic reviews and meta-analyses.

Studies were categorized as having low, moderate, or high risk of bias based on factors such as study design, sample size, blinding, and outcome assessment. This assessment was used to support the interpretation of the finding and identify potential methodological limitation within the included literature.

4. RESULTS

4.1. Literature Search Results

The database search identified 1,200 records. After removal of 250 duplicates, 950 records remained for title and abstract screening. Of these, 830 records were excluded based on predefined eligibility criteria. Full-text assessment was conducted for 120 articles, of which 96 were excluded due to reasons including inappropriate study design, non-adult population, or lack of relevance to the research question. Finally, 24 studies were included in the qualitative synthesis. The study selection process is presented in the PRISMA 2020 flow diagram (Figure 1)

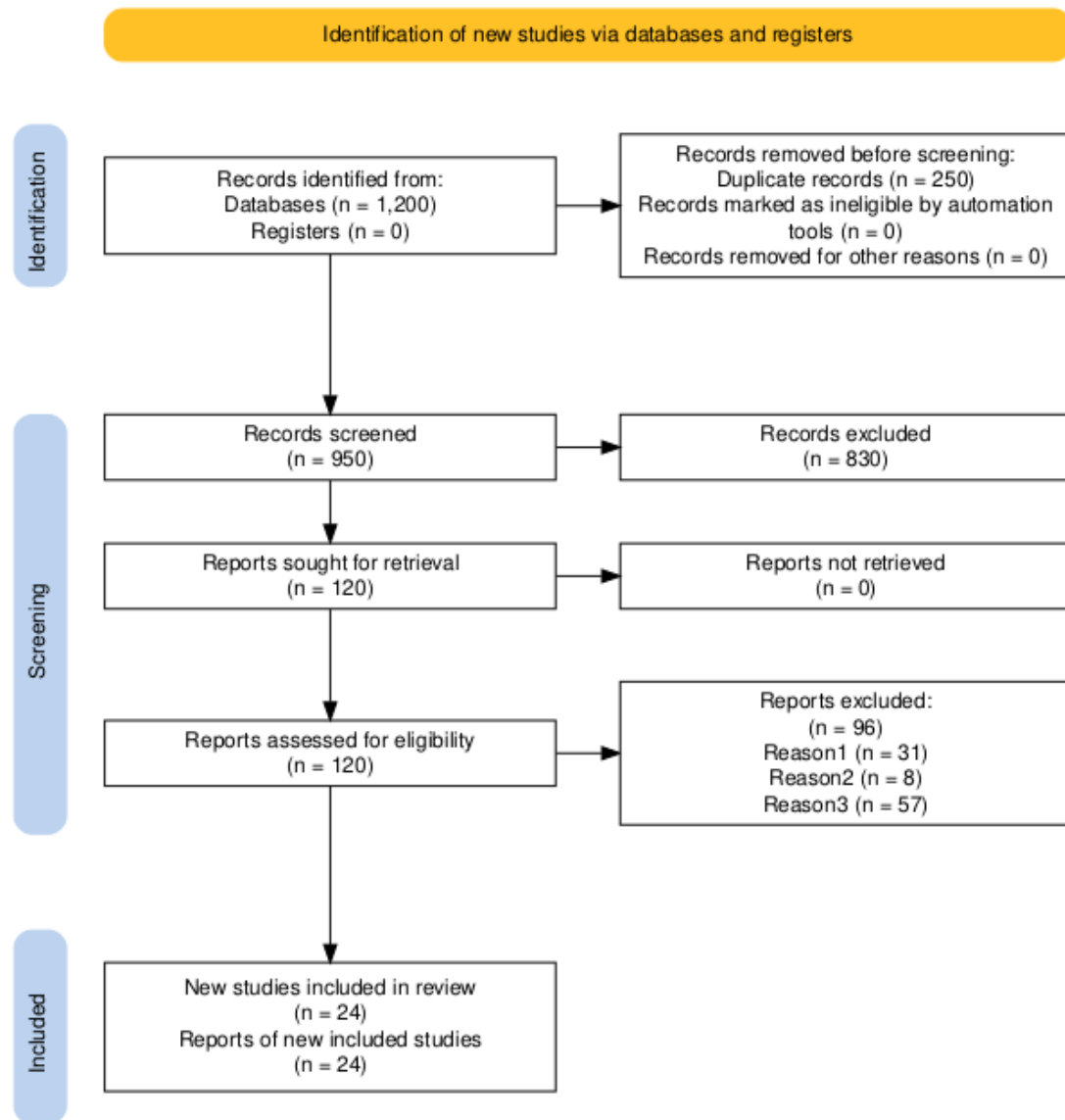


Figure 1. PRISMA Flow Diagram of Study Selection process

4.2. Characteristics of Included Studies

The characteristics of the 24 included studies are summarized in table 1. The included evidence consisted of randomized controlled trials (RCTs), systematic reviews, meta-analyses, and observational studies conducted in adult populations. The publication years ranged from 2015 to 2025. Study sample sizes varied substantially, from small clinical trials involving fewer than 50 participants to large population-based studies including hundreds of thousands of participants.

The included studies investigated different nutritional factors, including dietary patterns (mainly Mediterranean and DASH diets), omega-3 fatty acids, vitamin D, dietary fiber, gut microbiota-related interventions, and ultra-processed food consumption. Most studies evaluated depressive symptoms or depression risk using validated assessment tools or clinical diagnostic criteria.

A detailed summary of study design, population characteristics, intervention/exposure, and main findings is presented in Table 1.

Table 1. Characteristics of the included studies evaluating the association between nutrition and depression in adults

Author	Design	Sample Size	Male/Female	Intervention	Main Findings
Apostolakopoulou et al. (2023)	Narrative review	N/A	Mixed population	Mediterranean diet, DASH, and vegetarian diet	Healthy dietary patterns were associated with lower risk of depression, whereas evidence for vegetarian diets remained inconsistent
Parletta et al. (2019)	RCT	152 (intervention:75; control:77)	47/105	Mediterranean diet supplemented with fish oil	Reduced depressive symptoms and improved quality of life
Jacka et al. (2017)	RCT	67 (intervention:33; control:34)	19/48	Dietary improvement program	Greater reduction in depressive symptoms compared with social support control
Ejtahed et al. (2024)	Systematic review and meta-analysis	159,885	Mixed population	Junk food and ultra-processed food consumption	Higher junk food consumption was associated with increased risk of depression and psychological stress
Marx et al. (2021)	Review article	N/A	N/A	Dietary patterns and biological mechanisms related to depression	Diet may influence depression through inflammation, oxidative stress, gut microbiota, HPA axis, neurogenesis, and BDNF pathways
Staudacher et al. (2025)	Review article	N/A	N/A	Dietary interventions and healthy dietary patterns	Healthy dietary patterns, including Mediterranean and DASH diets, were associated with lower depressive symptoms; potential mechanisms involved inflammation, oxidative stress, gut microbiota, and HPA axis modulation

Molero et al. (2025)	Systematic review and meta-analysis	>700,000	Mixed populations	Diet quality and dietary pattern	Mediterranean diet adherence was associated with lower depressive symptoms, although overall evidence quality was considered low and heterogeneous
Li et al. (2017)	Meta-analysis	17 epidemiological studies	Mixed populations	Dietary magnesium and calcium intake	Moderate magnesium intake was associated with lower risk of depression; evidence for calcium intake was less consistent
Choi et al. (2022)	RCT	40	20/20	Flavonoid-rich orange juice intervention for 8 weeks	Flavonoid-rich orange juice improved depressive symptoms and increased BDNF levels while modulating gut microbiota-related biomarkers
Kaviani et al. (2022)	Double-blind randomized clinical trial	56	50/6	Vitamin D supplementation (50,000 IU cholecalciferol every 2 weeks for 8 weeks)	Vitamin D supplementation significantly reduced depressive symptoms and increased serum 25(OH)D levels, although inflammatory biomarkers did not significantly change
Dietch et al. (2023)	Systematic review	389	Mixed populations (mood and anxiety disorders)	Low-carbohydrate and ketogenic diets	Ketogenic and low-carbohydrate diets showed possible beneficial effects on mood and anxiety symptoms, although evidence quality was low and heterogeneous
Aslam et al. (2024)	Systematic review and meta-analysis	181,405	Mixed populations (depressive and anxiety symptoms)	Dietary fiber intake and fiber supplementation	Higher dietary fiber intake was associated with lower depressive symptoms in observational studies, although RCTs did not demonstrate significant benefits of fiber supplementation

Pourmotabbed et al. (2020)	Systematic review and meta-analysis	372,143	Mixed genders (from various countries)	Food insecurity	Food insecurity was significantly associated with increased risk of depression and stress in adults
Moabedi et al. (2024)	Systematic review and meta-analysis of randomized clinical trials	325	Mixed adults with depressive disorders	Magnesium supplementation	Magnesium supplementation significantly reduced depression scores in adults with depressive disorders
Morkl et al. (2025)	RCT	86 (intervention:43; control:43)	25/61	Multi-species probiotic supplementation	Probiotic supplementation improved vagal nerve function, sleep parameters, and gut microbiota composition in patients with major depression
Fish-williamson et al. (2024)	Systematic review, meta-analysis, and meta-regression	792,055	Female	Dietary factors and sugar-sweetened beverage consumption	Higher sugar-sweetened beverage consumption was associated with increased prevalence of postpartum depression across countries
Adan et al. (2019)	Narrative review	N/A	Mixed populations with mental health disorders	Nutrition and dietary patterns in mental health	Poor dietary quality may contribute to mood disorders, while balanced dietary patterns may support mental well-being through multiple biological mechanisms
Chang et al. (2024)	Systematic review and meta-analysis	517	Mixed populations (elderly with dementia or mild cognitive disorders)	Omega-3 fatty acids supplementation	Omega-3 supplementation showed limited overall effects on depressive symptoms, although DHA and low-dose EPA demonstrated potential benefits in patients with mild cognitive impairment

Wu et al. (2024)	Review articles	N/A	Mixed populations (patients with depression and metabolic dysregulation)	Omega-3 fatty acids	Omega-3 fatty acids may improve depressive symptoms in individuals with obesity and metabolic dysfunction through anti-inflammatory mechanisms
Castro et al. (2023)	Longitudinal cohort analysis	941	Mixed populations (overweight European adults mild depression)	Sugar-sweetened soft drink	Daily sugar-sweetened soft drink consumption was associated with higher anxiety and showed trends toward increased depressive symptoms
Mikola et al. (2022)	Systematic review and meta-analysis of randomized controlled trials	53,235	Mixed populations	Vitamin D supplementation	Vitamin D supplementation was associated with a reduction in depressive symptoms, particularly at doses>2000 IU/day, although substantial heterogeneity was reported across studies
Bear et al. (2020)	narrative review	N/A	Mixed population	Study on diet, gut microbiota, depression, and anxiety	The gut microbiota may play a central role in the relationship between diet and mental health through the microbiome-gut-brain axis, potentially influencing depression and anxiety outcomes
Lane et al. (2022)	Systematic review and meta-analysis of observational studies	385,541	Mixed populations	Ultra-processed food	Higher ultra-processed food consumption was associated with increased odds of depressive and anxiety symptoms and a greater risk of subsequent depression
Asad et al. (2025)	Systematic review and meta-analysis of RCTs	1401	Mixed populations	Prebiotic, probiotic, and synbiotic interventions	Probiotics demonstrated a significant reduction in depression symptoms and a moderate reduction in anxiety symptoms, while prebiotics did not show a significant effect on depression

4.3. Main Findings about Nutritional Components and Dietary Patterns

4.3.1. Mediterranean and DASH Diet

A total of four included studies evaluated the association between healthy dietary patterns and depression outcomes, with a particular focus on the Mediterranean diet and the Dietary Approaches to Stop Hypertension (DASH) diet (Apostolakopoulou et al., 2024; Jacka et al., 2017; Molero et al., 2025; Parletta et al., 2019). Among these, four studies investigated the Mediterranean diet, while two studies also examined the DASH diet (Apostolakopoulou et al., 2024; Staudacher et al., 2025).

Overall, higher adherence to the Mediterranean dietary pattern was consistently associated with lower depressive symptoms and a reduced risk of depression. A recent meta-analysis of prospective studies reported that adherence to the Mediterranean diet was associated with fewer depressive symptoms (OR = 0.91, 95% CI: 0.88–0.96), although the strength of evidence was considered limited due to potential confounding factors and heterogeneity between studies (Molero et al., 2025).

Studies evaluating the DASH diet also suggested a beneficial association with mental health outcomes, mainly through higher intake of fruits, vegetables, whole grains, nuts, and lower consumption of processed foods (Apostolakopoulou et al., 2024; Staudacher et al., 2025). However, the available evidence remains less extensive compared with the Mediterranean diet.

4.3.2. Omega-3 Fatty Acids

Two included studies evaluated the role of omega-3 fatty acids in relation to depression outcomes (Chang et al., 2024; Wu et al., 2023). A systematic review and meta-analysis of randomized controlled trials investigated the effects of omega-3 supplementation on depressive symptoms in elderly individuals and patients with dementia (Chang et al., 2024). Overall, omega-3 supplementation showed a non-significant overall effect on depressive symptoms ($SMD = -0.247$, $p = 0.039$) (Chang et al., 2024). In addition, low-dose EPA supplementation showed a significant beneficial effect ($SMD = -0.953$, 95% CI: -1.534 to -0.373) (Chang et al., 2024).

Another review highlighted the potential role of omega-3 fatty acids in individuals with depression accompanied by obesity or metabolic dysregulation (Wu et al., 2023). The proposed mechanisms include reduction of chronic low-grade inflammation and modulation of inflammatory biomarkers, particularly in individuals with elevated inflammatory status (Wu et al., 2023).

Overall, omega-3 fatty acids may have potential benefits for depressive symptoms in specific populations; however, the effects appear to vary depending on dosage, type of fatty acid, and patient characteristics.

4.3.3. Vitamin D

Two included studies evaluated the effect of vitamin D on depression outcomes (Kaviani et al., 2022; Mikola et al., 2023). A randomized controlled trial investigated vitamin D supplementation in patients with mild to moderate depression and reported that 8 weeks of vitamin D supplementation significantly reduced depressive symptoms compared with placebo, as measured by the Beck Depression Inventory-II (BDI-II) (Kaviani et al., 2022). However, no significant changes were observed in the assessed inflammatory biomarkers, suggesting that the improvement in depressive symptoms was independent of the measured inflammatory markers (Kaviani et al., 2022).

A systematic review and meta-analysis of 41 randomized controlled trials including 53,235

participants also reported a significant overall effect of vitamin D supplementation on reducing depressive symptoms (Hedges' $g = -0.317$, 95% CI: -0.405 to -0.230) (Mikola et al., 2023). However, substantial heterogeneity was observed among studies ($I^2 = 88.16\%$), and the certainty of evidence was considered very low (Mikola et al., 2023).

Overall, vitamin D supplementation may have beneficial effects on depressive symptoms, although the variability among studies highlights the need for further high-quality clinical trials.

4.3.4. Fiber Intake and Gut Microbiota

Two included studies evaluated the relationship between dietary fiber, gut microbiota, and depression-related outcomes (Aslam et al., 2024; Bear et al., 2020). A systematic review and meta-analysis investigating fiber intake and fiber interventions included observational studies and randomized controlled trials (Aslam et al., 2024). The observational evidence suggested an inverse association between higher fiber intake and depressive symptoms. In longitudinal studies, higher fiber intake was associated with reduced depressive outcomes ($d = -0.07$, 95% CI: -0.11 to -0.04) (Aslam et al., 2024). However, randomized controlled trials did not demonstrate a significant effect of fiber supplementation compared with placebo on depressive symptoms ($d = -0.47$, 95% CI: -1.26 to 0.31) (Aslam et al., 2024).

A narrative review highlighted the potential role of the microbiome–gut–brain axis as a mechanism linking diet and mental health (Bear et al., 2020). Dietary patterns rich in fiber may influence gut microbiota composition, which could affect inflammation, immune regulation, and brain function (Bear et al., 2020). However, the evidence remains emerging and requires further investigation in clinical populations.

Overall, current findings suggest that dietary fiber and gut microbiota may contribute to the relationship between nutrition and depression, although evidence from intervention studies remains limited.

4.3.5. Ultra-Processed Foods

One included systematic review and meta-analysis evaluated the association between ultra-processed food (UPF) consumption and mental health outcomes (Lane et al., 2022). The review included 17 observational studies with a total of 385,541 participants and examined the relationship between UPF intake and depressive and anxiety symptoms (Lane et al., 2022).

Higher consumption of ultra-processed foods was associated with increased odds of adverse mental health outcomes. The meta-analysis reported that greater UPF consumption was associated with higher odds of common mental disorder symptoms (OR = 1.53, 95% CI: 1.43–1.63) (Lane et al., 2022). Similar associations were observed for depressive symptoms (OR = 1.44, 95% CI: 1.14–1.82) and anxiety symptoms (OR = 1.48, 95% CI: 1.37–1.59). Furthermore, prospective evidence suggested that higher UPF intake was associated with an increased risk of subsequent depression (HR = 1.22, 95% CI: 1.16–1.28) (Lane et al., 2022).

Overall, the findings suggest that higher consumption of ultra-processed foods is associated with poorer mental health outcomes; however, further prospective and experimental studies are needed to clarify causal relationships.

4.3.6. Other Nutritional Interventions

Additional nutritional interventions were also investigated in individual studies.

A randomized controlled trial evaluating flavonoid-rich orange juice supplementation in young adults with major depressive disorder reported improvement in depressive symptoms following the intervention (Choi et al., 2022). Furthermore, the role of prebiotics and probiotics was evaluated in a comprehensive systematic review and meta-analysis of 23 randomized controlled trials involving 1,401 participants.

The findings demonstrated that probiotic interventions significantly reduced depressive symptoms and moderately reduced anxiety, whereas prebiotics did not show a significant effect (Asad et al.,

2025). Other reviewed studies explored specific multi-species probiotics, calcium, and magnesium intake (Li et al., 2017; Moabedi et al., 2023; Mörkl et al., 2025).

4.4. Quality Assessment of Included Studies

The methodological quality of the included studies was evaluated using appropriate assessment tools based on the study design. To standardize the reporting of quality across different study types, the results from each tool were converted into an overall quality rating of High, Medium, or Low according to the following criteria:

- Randomized Controlled Trials (RCTs): Evaluated using the Cochrane Risk of Bias tool. Studies with a low risk of bias across all or most domains were classified as High quality. Studies with some concerns or unclear risk of bias in multiple domains were rated as medium quality. Studies with a high risk of bias in critical domains were considered low quality.
- Observational Studies (Cohort/Cross-sectional): Evaluated using the Newcastle-Ottawa Scale (NOS), which assigns a maximum of 9 stars. Studies scoring 7–9 were classified as High quality, 4–6 as medium quality, and 0–3 as Low quality.
- Systematic Reviews and Meta-Analyses: Evaluated using the AMSTAR-2 tool. Studies with high or moderate confidence in the results were classified as High quality. Those with low confidence were rated as Medium, and those with critically low confidence were rated as Low quality.

Overall, the majority of the included studies demonstrated medium to high methodological quality. However, common limitations across the evidence base included reliance on self-reported dietary questionnaires, short follow-up periods in several RCTs, and high heterogeneity in some meta-analyses. The results of the quality assessment for all included primary studies and systematic reviews are summarized in Table 2.

Study	Study Design	Assessment tool	Overall Quality Rating
Apostolakopoulou et al. (2023)	Narrative Review	Not Applicable	N/A
Parletta et al. (2019)	RCT	Cochrane Risk of Bias	High
Jacka et al. (2017)	RCT	Cochrane Risk of Bias	High
Ejtahed et al. (2024)	Systematic Review & Meta-analysis	AMSTAR-2	High
Marx et al. (2021)	Narrative Review	Not Applicable	N/A
Staudacher et al. (2025)	Narrative Review	Not Applicable	N/A
Molero et al. (2025)	Systematic Review & Meta-analysis	AMSTAR-2	High
Li et al. (2017)	Meta-analysis	AMSTAR-2	Medium
Choi et al. (2022)	RCT	Cochrane Risk of Bias	Medium
Kaviani et al. (2022)	RCT	Cochrane Risk of Bias	Medium
Dietch et al. (2023)	Systematic Review	AMSTAR-2	Low
Aslam et al. (2024)	Systematic Review & Meta-analysis	AMSTAR-2	High
Pourmotabbed et al. (2020)	Systematic Review & Meta-analysis	AMSTAR-2	High
Moabedi et al. (2024)	Systematic Review & Meta-analysis	AMSTAR-2	High
Morkl et al. (2025)	RCT	Cochrane Risk of Bias	High
Fish-williamson et al. (2024)	Systematic Review & Meta-analysis	AMSTAR-2	High
Adan et al. (2019)	Narrative Review	Not Applicable	N/A
Chang et al. (2024)	Systematic Review & Meta-analysis	AMSTAR-2	Medium
Wu et al. (2024)	Narrative Review	Not Applicable	N/A
Castro et al. (2023)	Longitudinal Cohort	Newcastle-Ottawa Scale (NOS)	High

Mikola et al. (2022)	Systematic Review & Meta-analysis	AMSTAR-2	Medium
Bear et al. (2020)	Narrative Review	Not Applicable	N/A
Lane et al. (2022)	Systematic Review & Meta-analysis	AMSTAR-2	High
Asad et al. (2025)	Systematic Review & Meta-analysis	AMSTAR-2	High

Table 2: Quality Assessment of Included Studies

5. DISCUSSION

5.1. Overview of Findings

This thesis reviewed current evidence regarding the relationship between nutrition and depression in adult populations, with particular focus on dietary patterns, omega-3 fatty acids, vitamin D, dietary fiber, and ultra-processed foods. Overall, the findings suggested that healthier dietary patterns, especially the Mediterranean diet, were generally associated with lower depressive symptoms and improved mental health outcomes.

The reviewed literature also indicated that selected nutritional interventions, including omega-3 fatty acids and vitamin D supplementation, may provide benefits for certain patient populations. In contrast, higher consumption of ultra-processed foods was consistently associated with poorer mental health outcomes. Evidence regarding fiber supplementation and gut microbiota-related interventions was more heterogeneous, although observational studies suggested potential associations with improved mental health.

5.2. Mediterranean Diet and Dietary Pattern

The findings of this review suggest that adherence to healthy dietary patterns, particularly the Mediterranean diet, is associated with lower depressive symptoms and improved mental health outcomes in adult populations (Molero et al., 2025; Staudacher et al., 2025). These findings are consistent with previous research in nutritional psychiatry, which has repeatedly identified the Mediterranean diet as one of the dietary patterns most strongly associated with mental health benefits (Adan et al., 2019).

Several included studies reported that Mediterranean-style dietary interventions were associated with reductions in depressive symptoms (Jacka et al., 2017; Parletta et al., 2019). Similar

associations were also observed for the DASH diet, although the evidence was less extensive (Apostolakopoulou et al., 2024). Both dietary patterns are characterized by high consumption of fruits, vegetables, legumes, whole grains, nuts, and fish, alongside lower intake of processed foods and saturated fats (Apostolakopoulou et al., 2024; Staudacher et al., 2025)

The beneficial effects of these dietary patterns may be partially explained by their anti-inflammatory and antioxidant properties (Marx et al., 2021). Chronic low-grade inflammation and oxidative stress have been increasingly implicated in the pathophysiology of depression (Marx et al., 2021). Diets rich in polyphenols, fiber, omega-3 fatty acids, and vitamins may help modulate inflammatory pathways and support neurobiological processes related to mood regulation (Staudacher et al., 2025; Wu et al., 2023).

In addition, healthy dietary patterns may positively influence gut microbiota composition and function (Bear et al., 2020). Emerging evidence suggests that the microbiome–gut–brain axis plays an important role in emotional regulation, stress response, and neurotransmitter production, potentially contributing to the observed associations between diet quality and depressive symptoms (Bear et al., 2020; Morkl et al., 2025)

The findings of this review highlighted the potential importance of the microbiome–gut–brain axis in the relationship between nutrition and depression (Bear et al., 2020). Several reviewed studies suggested that dietary components such as fiber, fruits, vegetables, and fermented foods may influence gut microbiota composition, which in turn may affect emotional regulation and mental health outcomes (Bear et al., 2020; Morkl et al., 2025).

Observational studies included in the review reported associations between higher dietary fiber intake and lower depressive symptoms (Aslam et al., 2024). However, evidence from randomized controlled trials evaluating fiber supplementation remained inconsistent (Aslam et al., 2024). These mixed findings may reflect differences in fiber type, supplementation protocols, study duration, and participant characteristics (Aslam et al., 2024). In addition, many intervention studies included relatively small sample sizes and short follow-up periods (Morkl et al., 2025).

Potential biological mechanisms linking nutrition and depression include modulation of inflammatory pathways, reduction of oxidative stress, regulation of hypothalamic–pituitary–adrenal (HPA) axis activity, and alterations in neurotransmitter production (Marx et al., 2021; Staudacher et al., 2025). Gut microbiota may also influence the synthesis of short-chain fatty acids and neuroactive compounds that are involved in brain signaling and mood regulation (Bear et al., 2020).

Despite increasing interest in nutritional psychiatry and gut microbiota research, the relationship between diet, microbiota composition, and depression remains complex and likely bidirectional (Bear et al., 2020). Individuals experiencing depression may adopt poorer dietary habits, while unhealthy dietary patterns may simultaneously contribute to worsening mental health outcomes (Adan et al., 2019).

5.3. Omega-3 Fatty Acids and Vitamin D

The reviewed studies suggested that omega-3 fatty acids and vitamin D supplementation may contribute to improvements in depressive symptoms in selected adult populations (Chang et al., 2024; Kaviani et al., 2022; Mikola et al., 2023; Wu et al., 2023). However, the findings were not entirely consistent across all studies and appeared to vary according to participant characteristics, baseline nutritional status, dosage, and study duration (Mikola et al., 2023; Wu et al., 2023).

Evidence regarding omega-3 fatty acids indicated that certain subgroups, particularly individuals with metabolic dysfunction, obesity, or mild cognitive impairment, may experience greater benefits from supplementation (Chang et al., 2024; Wu et al., 2023). Several studies emphasized the potential role of EPA and DHA in reducing inflammatory activity and supporting neuronal membrane function (Chang et al., 2024; Wu et al., 2023). These findings are consistent with previous evidence suggesting that chronic inflammation may contribute to the development and persistence of depressive symptoms (Marx et al., 2021).

Similarly, vitamin D supplementation was associated with reductions in depressive symptom severity in several randomized controlled trials and meta-analyses (Kaviani et al., 2022; Mikola et al., 2023). The potential mechanisms underlying these effects may involve regulation of inflammatory pathways, neuroimmune activity, and neurotransmitter synthesis (Kaviani et al., 2022; Mikola et al., 2023). Nevertheless, some studies reported substantial heterogeneity and inconsistent findings, indicating that vitamin D supplementation may not be equally effective across all populations (Mikola et al., 2023).

The variability observed across omega-3 and vitamin D studies may reflect differences in supplementation protocols, participant health status, and severity of depression (Wu et al., 2023; Mikola et al., 2023). Consequently, while these nutritional interventions appear promising as adjunctive approaches, further large-scale and long-term randomized trials are required to clarify their clinical effectiveness.

5.4. Ultra-Processed Foods and Mental Health

The reviewed evidence consistently suggested an association between higher consumption of ultra-processed foods and poorer mental health outcomes, including depressive and anxiety symptoms (Ejtahed et al., 2024; Lane et al., 2022). Multiple observational studies and meta-analyses reported that diets characterized by high intake of processed foods, sugar-sweetened beverages, and unhealthy snacks were associated with increased risk of depression (Ejtahed et al., 2024; Lane et al., 2022; Castro et al., 2023; Fish-Williamson & Hahn-Holbrook., 2023).

Several mechanisms may explain these associations. Ultra-processed foods are often characterized by high levels of refined sugars, saturated fats, additives, and low nutritional quality, which may contribute to systemic inflammation, oxidative stress, and metabolic dysfunction (Marx et al., 2021). These biological alterations have been increasingly associated with the pathophysiology of depression (Marx et al., 2021).

In addition, diets rich in ultra-processed foods may negatively affect gut microbiota diversity and function, potentially disrupting microbiome–gut–brain communication pathways (Bear et al., 2020). Nutrient-poor dietary patterns may also reduce intake of essential vitamins, minerals, antioxidants, and omega-3 fatty acids that support brain health and emotional regulation (Adan et al., 2019).

Although the included studies consistently reported associations between ultra-processed food consumption and depressive symptoms, most evidence originated from observational research (Ejtahed et al., 2024; Lane et al., 2022). Therefore, causal relationships cannot be definitively established, and further prospective and interventional studies are needed to better understand the long-term effects of ultra-processed dietary patterns on mental health.

5.5. Strengths and Limitations

The thesis has several strengths. First, it included a broad range of contemporary studies published between 2015 and 2025, including randomized controlled trials, systematic reviews, meta-analyses, and observational studies. This allowed for a comprehensive overview of current evidence regarding the relationship between nutrition and depression. In addition, the review evaluated multiple nutritional components and dietary patterns, providing a broader understanding of nutritional psychiatry and its potential role in mental health management (Adan et al., 2019; Marx et al., 2021; Apostolakopoulou, 2024).

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However, several limitations should also be acknowledged. Many included studies relied on self-reported dietary intake, which may increase the risk of recall bias and measurement inaccuracies. Considerable heterogeneity was also observed across studies regarding study design, population characteristics, dietary assessment methods, intervention duration, and depression assessment tools (Molero et al., 2025; Mikola et al., 2022). Furthermore, a substantial proportion of the

available evidence originated from observational studies, limiting the ability to establish causal relationships between dietary factors and depression (Lane et al., 2022; Ejtahed et al., 2024).

Another limitation relates to variability in nutritional interventions, including differences in supplement dosage, adherence, and baseline nutritional status of participants. Some randomized controlled trials also included relatively small sample sizes and short follow-up periods, which may reduce the generalizability of findings (Kaviani et al., 2022; Chang et al., 2024).

In addition, while evidence supports the potential benefits of certain interventions, such as probiotic supplementation, further high-quality clinical trials are needed to determine optimal strains, dosages, and long-term efficacy (Mörkl et al., 2025; Asad et al., 2025).

Despite these limitations, the overall evidence supports the potential importance of nutrition as part of an integrated approach to mental health care.

An additional limitation relates to the scope of the dietary patterns identified. Although evaluating the DASH diet was a predefined objective of this thesis, the literature search yielded a very limited number of primary studies explicitly investigating its direct impact on depression compared to the Mediterranean diet. This scarcity restricts the ability to draw robust conclusions regarding the DASH diet's efficacy for mental health outcomes in this specific context.

5.6. Future Directions

Future research should focus on conducting larger and longer-term randomized controlled trials to clarify the effectiveness of specific dietary interventions and nutritional supplements in the prevention and management of depression. Greater standardization of dietary assessment tools and depression outcome measures may also improve comparability across studies (Molero et al., 2025; Mikola et al., 2022).

Further investigation is needed to better understand the biological mechanisms linking nutrition

and mental health, particularly the role of inflammation, oxidative stress, neuroplasticity, and the microbiome–gut–brain axis (Marx et al., 2021; Bear et al., 2020). Personalized nutrition approaches based on metabolic status, inflammatory biomarkers, and individual patient characteristics may also represent a promising direction for future clinical research, especially in patients with obesity, metabolic dysfunction, or chronic inflammation (Wu et al., 2024)

In addition, future studies should evaluate the long-term sustainability and clinical applicability of dietary interventions in diverse populations. Integrating nutritional assessment and dietary counseling into mental health care settings may contribute to more comprehensive and multidisciplinary treatment approaches for depression (Moabedi et al., 2023; Chang et al., 2024).

6. CONCLUSIONS

This thesis examined current evidence regarding the relationship between nutrition and depression in adult populations, with particular focus on dietary patterns, omega-3 fatty acids, vitamin D, dietary fiber, gut microbiota, and ultra-processed foods. Overall, the findings suggested that healthier dietary patterns, especially the Mediterranean diet, were generally associated with lower depressive symptoms and improved mental health outcomes.

The thesis results indicated that selected nutritional interventions, including omega-3 fatty acids and vitamin D supplementation, may provide benefits for some individuals, particularly those with inflammatory or metabolic dysregulation. In contrast, higher consumption of ultra-processed foods was consistently associated with poorer mental health outcomes. Although evidence regarding fiber supplementation and gut microbiota interventions remains heterogeneous, these areas continue to represent promising fields for future research.

Taken together, the findings support the potential role of nutrition as an adjunctive strategy in the prevention and management of depression. Integrating nutritional assessment and dietary guidance into mental health care may contribute to more comprehensive and multidisciplinary treatment approaches. However, further large-scale and long-term randomized controlled trials are needed to strengthen the current evidence base and clarify the mechanisms linking nutrition and mental health.

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