

**Effect of Mediterranean diet on mental health outcomes: A systematic review**

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**Abstract**

Growing evidence has linked both the onset and symptoms of various mental disorders to lifestyle factors such as diet, exercise and sleep. The link between diet and mental health in particular in depressive disorders has gained interest in recent years. Previous reviews assessing the link between the Mediterranean diet (MedDiet) and mental health predominantly focused on depression, whilst others failed to integrate a summary of possible underlying mechanisms related to a link between MedDiet and mental health to complement their findings. In the present review, we provide a comprehensive synthesis of evidence on the MedDiet and diverse mental health outcomes complemented by narration of potential mechanisms involved. A literature search was conducted across MEDLINE, PsycINFO, Scopus, Cochrane library, Google scholar, CINAHL and Embase database. A total of 10,249 articles were found through the primary literature search and 104 articles (88 observational and 16 interventional studies) were eligible for inclusion. The Mediterranean diet (MedDiet) has been associated with favourable mental health outcomes in adult populations, including reduced depressive and anxiety symptoms, lower perceived stress, and improved quality of life and overall well-being, both in healthy individuals and those with comorbidities, across diverse geographical settings. Mechanisms involved include anti-oxidant, anti-inflammatory potential of MedDiet and its effect on gut microbiota. Further research is warranted to rigorously establish causal inferences and to guide the optimal incorporation of Mediterranean diet principles into comprehensive prevention and treatment strategies aimed at improving mental health outcomes.

**Key words:** Mental health, depression, Mediterranean diet, stress, mental well-being, anxiety

## 1. Introduction

Globally, one in eight individuals lives with a mental disorder, with anxiety and depressive disorders being the most common (1). As a result of the COVID-19 pandemic, the number of people who experience anxiety and depressive illnesses has significantly increased (1, 2). Appropriate treatments and interventions are difficult to access due to high demand; highlighting the need for new effective interventions to reduce the disease burden.

Psychotherapy, medications, and lifestyle modifications are the primary treatments for mental disorders (3, 4). Mood disorders are chronic and often require lifelong treatment. Long-term antidepressant therapy is typically necessary for depression, however, up to 50% of individuals with depression may experience adverse effects or inadequate response to initial antidepressant treatments (3). As a result, there is a growing interest in safe, low-cost, and non-pharmacological preventive and therapeutic options. Lifestyle factors such as diet, physical activity, and sleep have been linked to the onset and symptoms of various mental illnesses (5-8). Specifically, the relationship between diet and mental illnesses, particularly in depressive disorders, has gained significant attention in recent years. However, many studies have focused on the consumption of individual nutrients or food groups rather than considering overall dietary patterns or styles (9, 10). Although scarce, there are previous studies that tried to assess the relationship between MedDiet pattern and mental health outcomes including depression and anxiety (11-13). The term 'depression' refers to both depressive symptoms and clinical diagnosis in this review.

The Mediterranean diet (MedDiet) is a traditional diet characterized by high intake of plant foods (fruit, vegetables, cereals, nuts, and legumes), fermented dairy foods (principally yoghurt and cheese), considerable use of extra virgin olive oil as the main source of fat, low-to-moderate consumption of fish, poultry and eggs, low intake of red meat, and a moderate wine consumption (14). This largely plant-based dietary pattern encourages the intake of seasonal and local produce. In addition, the MedDiet is known for its high-quality fat content mainly of plant origin (such as olive oil and nuts); healthy fats in MedDiet make it more palatable and widely acceptable as evidenced by many studies across various population groups (15-17).

There are several methods to define a dietary pattern or style including general descriptions, dietary pyramids, a priori scoring systems, posteriori dietary pattern formations, or by food and

nutrient content (14, 18-20). Of these, a priori scoring systems are the most popular as they simplify the analysis of adherence to a diet in relation to primary outcomes (21). A commonly utilized scoring of MedDiet is the MedDiet Score (MDS) (22), which includes nine components. One point is assigned for intakes of each 'healthy foods' above the sex-specific median (vegetables, fruits/nuts, legumes, fish/seafood, cereals and monounsaturated to saturated lipid ratio), and one point each is assigned for intakes below median for meat and dairy products; for alcoholic beverages, one point is assigned for moderate intake (19).

There have been consistent reports of the health benefits of the MedDiet for several diseases, including cardiovascular diseases, type 2 diabetes, metabolic syndrome, obesity, certain types of cancers, and mental health (23-25). Moreover, individual foods and components of the MedDiet (e.g. extra-virgin olive oil and nuts) have well-documented health benefits, but in recent years special attention has been given to the overall combination of foods, expressed as a MedDiet dietary pattern, which is strongly related to health likely due to the synergistic effects of different components (26, 27).

Previous reviews assessing the link between MedDiet and mental health lack comprehensiveness, where majority of studies primarily focus on depression only rather than overall mental health (28, 29). In addition, studies fail to address the underlying mechanisms by which the MedDiet might impact mental health (25). Therefore, we aimed 1. To systematically review the evidence for an effect of MedDiet on mental health outcomes including depression, anxiety, stress, mental well-being and quality of life, and we have also summarised possible underlying mechanisms of action to complement the systematic review findings.

## 2. Methods

### 2.1 Study protocol and registration

A protocol for this review was registered *a priori* on Open Science Framework (OSF) (Registration number: <https://doi.org/10.17605/OSF.IO/E5ZSB>). The reporting of this review followed the PRISMA statement: an updated guideline for reporting systematic reviews (30). See supplementary file 2.

### 2.2 Search strategy

A comprehensive literature search was conducted across MEDLINE, PsycINFO, Scopus, the Cochrane Library, Google Scholar, CINAHL, and Embase up to July 2025. The following keywords were used in the primary searches: “Mediterranean diet” OR “Mediterranean lifestyle” OR “Mediterranean-lifestyle” OR “Mediterranean life-style” OR “Mediterranean eating” OR “Mediterranean dish” OR “Diet, Mediterranean” AND "stress" OR "anxiety" OR "anxi\*" OR "depress\*" OR "distress\*" OR "happiness" OR "mental health" OR "mood" OR "psychological disorder" OR "psycholog\*" OR "wellbeing" OR "well-being" OR "wellness" OR "health" OR “quality of life” OR “mental state” OR “Psychological Well-Being” OR “mood disorder” OR “anxiety disorder”.

Broad search terms were used intentionally to capture the maximum number of relevant articles. There were no limits in terms of study settings and time frame. In addition, manual search of reference lists of included studies was performed to identify additional studies which may have been missed. In this review we tried to capture all the MedDiet score and MedDiet adherence measurement scales.

### 2.3 Study selection

Inclusion: 1) All the study designs, 2) Articles written in English language, 3) No limit on date of publication 4. Studies conducted on adults 5. Only studies that investigated the effect of MedDiet on depression, anxiety, stress, mental well-being and quality of life were eligible for inclusion.

Exclusion criteria: 1) Incomplete reporting of the main results including the study's outcomes, 2) Grey literature, non-peer-reviewed publications, conference abstracts, 3) Inadequate or otherwise

incomplete methods reporting (i.e., vague /incomplete/inadequate details of definitions, sample, materials and/or procedure,

Review management software (Covidence (<https://www.covidence.org/>); Veritas Health Innovation Ltd.) was used to manage searches and subsequent screening. Following removal of duplicated papers, title and abstract screening was performed for all the identified studies by two independent reviewers (R.K and J.F), and then a full-text review was performed.

Descriptive information was extracted from all articles including authors and year of publication, study design, study method, population and an intervention/ exposure description, key findings and outcomes measured.

**Quality assessment:** The quality of all included studies in this review was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist (31) for cross-sectional analyses, cohort studies, case-control and randomised controlled trials. The JBI Critical Appraisal Checklist was used because it offers tailored tools for various study designs essential in nutrition research with its methodological diversity while comprehensively assessing internal validity, risk of bias, and the appropriateness of study conduct and reporting. The quality assessment was used to help evaluate the quality of evidence but not to exclude any studies. The primary researcher has undertaken the assessment.

### 3. Findings

#### 3.1 Study selection

The process of study selection is shown in Figure 1. The primary literature search yielded 10,249 studies, and an additional 55 were identified in the updated search. A total of 3623 duplicates were removed and 6626 articles were assessed by title and abstract. Of these, 512 were eligible for full-text review of which 408 records were excluded. Thus, a total of 104 studies were eligible for inclusion in this review.

Majority of the studies included are cross sectional (n=63), followed by cohort study (n=24), randomised controlled trial (n=16) and case-control (n=1).

The included studies were conducted across 22 different countries, with two additional studies involving participants from multiple countries. Iran and Spain contributed the highest number of studies (n=16 each), followed by Australia (n=12), Italy (n=11), Greece (n=9), USA (n=8), Turkey (n=5), the United Kingdom (n=4), China (n=3), the Netherlands (n=3), Croatia (n=2), France (n=2), Ireland (n=2), and one study each from Chile, Brazil, Israel, Canada, Switzerland, Sweden, the United Arab Emirates, Saudi Arabia, and Portugal. The ages of the participants varied widely, ranging from 18 to 97 years, reflecting a broad representation across the adult lifespan (32, 33). The majority of studies included participants from the general population who exhibited depressive symptoms but did not necessarily have a formal clinical diagnosis. Only a limited number of studies used clinically diagnosis as the primary outcome measure (11-13, 34-38). See Tables 1 and 2.

### **Quality of studies**

Generally the quality of cross sectional studies meet  $\geq 75\%$  of the criteria for almost all of the included studies. However, failure to use appropriate statistical analysis was noted (39-41). All cohort, case control and randomised controlled trial (RCT) studies showed good overall quality meeting  $\geq 75\%$  of the criteria. In the RCT studies, masking of the dietary intervention was not possible due to the nature of the intervention; hence all of the studies were open label RCTs. See supplementary file 3.

### **3.2 Tools used for assessment of Mediterranean diet**

Although diverse definitions and scoring tools were used to assess adherence to the MedDiet across studies, a relatively consistent inverse association with depression was observed (42-44) suggesting that core dietary components characteristic of the MedDiet may drive these beneficial effects. Some of the scoring and definitions used include MedDiet score (42, 43, 45, 46), alternative MedDiet (aMed) (47), MedDiet pattern (44), Medi Lite (48), MIND (Mediterranean-DASH Intervention for Neurodegenerative Delay) (49-51), MEDAS (MedDiet adherence score) (34) and MedDiet supplemented with various food items (Modified Med diet) (11, 13). Modified versions of the MedDiet, such as the MIND diet and locally adapted scoring systems like the Brazilian MedDiet pattern (52) and the Israeli MedDiet screener (I-MEDAS) (53) have also been

employed in several studies investigating the association between the MedDiet and mental health outcomes.

### **3.3 Depression**

The link between depression and MedDiet has been reported by various authors in diverse study settings and geographical locations (Table 1).

#### **3.3.1. Observational studies.**

Cross-sectional and cohort studies have been predominantly used to assess the relationship between MedDiet and depression. There are mixed results from cross-sectional studies with a majority highlighting that high MedDiet score is associated with a reduction of depressive symptoms in a range of populations

Several studies assessing cross-sectional associations between adherence to MedDiet and depressive symptoms found that higher adherence was associated with fewer depressive symptoms (32, 33, 39, 44, 48, 54-73). Similarly, some studies reported that poor adherence to the MedDiet was linked with more pronounced depressive symptoms (74, 75). In contrast, other studies found no significant association between MedDiet adherence and depressive symptom (40, 45, 76, 77). Twenty seven out of 31 studies reported statistically significant association, while four studies found no association between MedDiet and depressive symptoms.

Studies reported strong longitudinal associations between higher MedDiet scores and a reduced risk of both depression and recurrent depressive episodes, despite the use of diverse tools to assess diet adherence and depressive symptoms (36, 38, 42, 50, 54, 78-86). In addition, individual food components characteristic of the MedDiet have been independently associated with lower levels of depression. Specifically, higher daily consumption of vegetables, fruits, olive oil, and traditional sauces containing olive oil, tomato, and garlic was linked to reduced depressive symptoms (44). All fifteen cohort studies reported a significant association of MedDiet with reduced depressive symptoms.

### 3.3.2. Interventional studies.

Nine out of 11 interventional studies reported a significant reduction in depressive symptoms while two studies reported no significant change in depressive symptom. Compared to alternative or usual dietary patterns, MedDiet interventions were associated with reductions in depressive symptoms (12, 34, 47). While significant within-group improvements were observed from baseline in some MedDiet intervention groups, these changes were not always statistically significant when compared to control groups (87). Additionally, an intervention combining the MedDiet with exercise demonstrated greater reductions in depressive symptoms in the intervention group relative to the control group (88).

The multi-centre PREDIMED trial compared a low-fat diet with two enhanced MedDiets (MedDiet plus extra virgin olive oil (EVOO) and MedDiet plus nuts). No significant reduction in depressive symptoms was observed in both groups. However, when the samples were restricted to those with type 2 diabetes, a significant reduction in the incidence of depression diagnosed by physicians, was noted in the MedDiet supplemented with nuts group (13).

Beyond depression prevention, the SMILES trial demonstrated remission of depression through a MedDiet intervention. This trial compared a modified MedDiet based on the Australian Dietary Guidelines and the Dietary Guidelines for Adults in Greece with a befriending social support control, where trained personnel engaged participants with neutral topics such as sports, news, or music. Among individuals with clinical depression, the intervention group experienced a significant reduction in depressive symptoms compared to controls, with approximately one-third achieving remission (11).

Compared to standard care, MedDiet interventions have been shown to significantly reduce depression scores (89). Specifically, individuals with polycystic ovarian syndrome (PCOS) experienced reduced depressive symptoms when following a MedDiet compared to a control diet (90). However, in participants with multiple sclerosis, the MedDiet did not lead to a significant reduction in depression scores when compared to a traditional Persian diet, suggesting possible condition-specific differences in response (91). Additionally, among individuals with irritable bowel syndrome, adherence to a MedDiet resulted in a notable decrease in depressive symptoms compared to their habitual dietary patterns (92). These findings highlight the potential mental

health benefits of the MedDiet across various clinical populations, while also indicating the need for further research on its efficacy in different health conditions.

### 3.4 Anxiety

#### **Observational findings:**

Strong inverse cross-sectional associations between the MedDiet scores with anxiety were observed in a significant number of studies (32, 39, 48, 49, 53, 60, 64, 65, 67, 68, 70, 73, 93-96); whilst others reported no association (45, 76, 97-100) (Table 2). Sixteen out of 22 cross sectional studies show association of MedDiet with reduced anxiety symptom while six studies reported no association.

A case-control study by Torabynasab et al. reported that higher adherence to the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet was associated with lower Generalized Anxiety Disorder (GAD-7) scores (101). Additionally, data from the Netherlands Study of Depression and Anxiety (NESDA) demonstrated a strong association between higher MedDiet scores and reduced anxiety symptoms, as measured by the Beck Anxiety Inventory (BAI) (36).

#### **Interventional studies:**

Four of the five interventional studies reported a reduction in anxiety symptoms following a MedDiet intervention (89, 90, 92, 102), whereas one study found no significant change (103). A three-arm randomized controlled trial comparing MedDiet plus forest bathing, MedDiet alone, and a control group found a significant reduction in anxiety scores, measured by the State and Trait Anxiety Inventory (STAI), in the MedDiet plus forest bathing group compared to the control group. However, no significant difference in anxiety scores was observed between the MedDiet alone group and the control group (103). MedDiet intervention significantly reduced anxiety levels among pregnant women compared to usual care (102). Similarly, MedDiet led to lower anxiety scores when compared to standard care (89). Additionally, MedDiet intervention, relative to a control diet, resulted in reduced anxiety symptoms in individuals with polycystic ovarian syndrome (PCOS) (90). Furthermore, among individuals with irritable bowel syndrome, adherence to a MedDiet was associated with a greater reduction in anxiety symptoms compared

to those following their habitual diet (92). These findings collectively suggest that the MedDiet may offer meaningful benefits in reducing anxiety across diverse populations, supporting its potential role as a complementary strategy in managing anxiety-related symptoms. See (Table 2)

### **3.5 Quality of life (QoL)**

Eight out of 9 cross sectional studies reported a significant association of MedDiet with improved quality of life while one study reported no association. In studies examining cross-sectional associations, higher adherence to the MedDiet was independently associated to significantly improved quality of life scores compared to low adherence groups (41, 55, 63, 104-107). Similarly, another study found that individuals in the lowest quartile of adherence to the MedDiet diet pattern were significantly more likely to experience poorer quality of life (108) highlighting the potential impact of dietary habits on overall well-being. However, another cross sectional study reported no significant association between MedDiet adherence and health related QoL (109).

Cohort studies examining the longitudinal association between MedDiet adherence and quality of life reported significant improvements in overall QoL (110), as well as in specific subdomains such as the physical composite score of QoL (47).

All five interventional studies assessing the effect of MedDiet reported a significantly improved quality of life. A randomized controlled trial evaluating the impact of a MedDiet intervention comprising food hampers and cooking workshops reported a significant improvement in mental health-related quality of life among participants in the MedDiet group compared to those in the control group, who attended social gatherings (12). In addition, MedDiet interventions led to improvements in health-related quality of life compared to usual care (35). Another randomized trial found that a MedDiet intervention produced greater improvements in quality of life than the Irish healthy eating guidelines among participants with rheumatoid arthritis (111). Similarly, in individuals with irritable bowel syndrome, adherence to a MedDiet was associated with improved quality of life compared to those following their habitual diet (92). Furthermore, a 12-week randomized controlled trial in young males demonstrated that adherence to a MedDiet significantly improved overall quality of life compared to the control group (34).

Taken together, these findings consistently support the beneficial impact of the MedDiet on health-related quality of life across a range of populations and health conditions, further highlighting its potential as a complementary approach in health promotion and disease management. See Table 2

### **3.6 Stress and mental wellbeing**

All eight cross sectional studies reported a significant association of MedDiet with reduced stress level. Higher adherence to the MedDiet, when compared to low adherence, was strongly and inversely associated with psychological distress in cross-sectional analyses (48, 64, 70, 71, 73, 96, 100). The individuals in the lowest quartile for the MD pattern had a significantly higher prevalence of a high stress score (108). Similarly, a case control study by Trovato et al also reported greater adherence to MedDiet profile is associated with a reduced perceived stress measured with Psychological Stress Measure (PSM) test (112).

All three cohort studies report significant association of MedDiet with reduced stress level. A strong inverse association of the MedDiet with stress was reported in a large longitudinal study (113). MedDiet intervention significantly reduced perceived stress level among pregnant women when compared with usual care (102). Another study also reported a significant inverse association of perceived stress and mental distress with components of MedDiet (114).

The MedDiet has also been associated with improved mental well-being. In a cross-sectional study, a strong positive association was observed between adherence to the MedDiet and mental well-being scores, as measured by the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)(115). Conversely, two studies reported no significant association between MedDiet adherence and mental well-being (49, 98). These mixed findings suggest that while the MedDiet may support mental well-being, further research is needed to clarify the strength and consistency of this relationship. See Table 2

## **4. Potential mechanisms**

Herein, we provide a narrative overview of the potential mechanisms underlying the relationship between the MedDiet and mental health outcomes to complement and contextualize the findings of the review. The MedDiet has been widely shown to improve mental health outcomes in both

apparently healthy individuals and those with diagnosed mental illness. Its beneficial effects are suggested to be mediated through several key mechanisms, including enhanced antioxidant capacity, reduced systemic inflammation, and improved gut health (116-118).

#### **4.1. Anti-oxidant potential of MedDiet**

The health benefits of a MedDiet have often been linked to nutrients with antioxidant potential, which are mostly found in foods like vegetables, fruits and the characteristic extra virgin olive oil (119). Evidence suggests that reactive oxygen species may be a root cause of most chronic diseases including cardiometabolic and mental diseases (120). Plant-based diets rich in antioxidants have been shown to mitigate some of the negative impact of reactive oxygen species (121).

Although the MedDiet is not strictly vegetarian, it is predominantly plant-based and naturally rich in antioxidants (14). It provides a high intake of micronutrients and bioactive compounds, particularly antioxidant vitamins and polyphenols, largely derived from fruits, vegetables, whole grains, nuts, and extra virgin olive oil (EVOO) (122). Among the key antioxidant vitamins associated with the MedDiet are beta-carotene (a precursor to vitamin A), vitamin C, and vitamin E (123). Dietary antioxidants and polyphenols function as exogenous defenses against oxidative stress and systemic inflammation, two key biological processes implicated in the onset and progression of numerous non-communicable diseases including mental health disorders such as depression (124).

Dietary patterns rich in antioxidants, such as vitamins C and E, have been inversely associated with adverse mental health outcomes, including stress (125). Furthermore, a clinical trial evaluating the effects of antioxidant vitamin supplementation over six weeks reported significant reductions in depression and anxiety scores among participants (126). Notably, baseline levels of vitamins A, C, and E are significantly lower in individuals with generalized anxiety disorder and depression compared with healthy controls.

Neuron cells in our brain have low levels of endogenous antioxidants to match its high metabolic demand, making it more susceptible to redox imbalance (127). Inflammation and issues in neuronal plasticity, which are associated with depression and anxiety, are common during redox

imbalance (128, 129), making the exogenous dietary anti-oxidant intake important for mental health. Hence, diets rich in antioxidant nutrients such as MedDiet are very critical in enhancing the antioxidant potential of our brain.

## **4.2 Anti-inflammatory potential of MedDiet**

Existing evidence from both observational studies and clinical trials reported the anti-inflammatory effect of the MedDiet (130). A meta-analysis of five cross-sectional studies showed significant reductions in C-reactive protein levels (117). Similarly, another meta-analysis of randomized trials found the MedDiet significantly reduced systemic inflammation markers, including IL-6, IL-1 $\beta$ , and C-reactive protein (131).

Evidence on the components of the MedDiet supports its anti-inflammatory effects, with olive oil identified as a key element shown to reduce inflammatory markers. A meta-analysis reported that olive oil significantly lowered C-reactive protein and IL-6 levels, particularly in interventions lasting longer than three months (132-134). Specifically, the phenolic compounds found in olive oil reported to play a significant anti-inflammatory and anti-oxidant role (133, 135). Apart from an increased intake of health-promoting food items, MedDiet is low in red meat, processed/ultra-processed food, refined sugar and alcohol which are all pro-inflammatory (136-138).

A strong association of inflammatory markers and cytokines with mental illnesses, specifically depression, has been well documented. Results from two meta-analyses showed a positive association between circulating inflammatory biomarkers and depression (139, 140). Pro-inflammatory cytokine production interferes with neurotransmitter metabolism and decreases the availability of some precursors including tryptophan (141). Although cortisol reactivity to acute stress is key for survival, repeated activation increases pro-inflammatory cytokines, and may trigger the onset of depression and anxiety (142, 143). In addition, tryptophan also modulates other neurotransmitter synthesis such as dopamine and norepinephrine (144). Lastly, tryptophan and its metabolites (like melatonin) can result in reduction of the inflammation state there by promoting optimal mood state (145, 146).

Low-grade inflammation and endothelial dysfunction can suppress brain-derived neurotrophic factor (BDNF) expression, thereby diminishing its neuroprotective effects and potentially

contributing to neuronal dysfunction (147). Meta-analyses have demonstrated lower BDNF levels in individuals with depression, which tend to increase with antidepressant treatment, underscoring the potential anti-inflammatory role of the MedDiet in supporting mental health (148, 149).

### 4.3 Gut microbiota

Recently, attention has been given to the effect of the MedDiet on the gut microbiota. Specific nutrients, particularly insoluble fiber and protein, have significant effects on gut microbiota structure, function, and secretion (150). Metabolites secreted from the gut have a key role in modulating immune function and several metabolic and inflammatory pathways (150, 151).

Previous studies noted that diets rich in insoluble fibre promote gut health (152). The MedDiet is rich in insoluble fibre, making it particularly beneficial for gut health (151, 153). High adherence to the MedDiet has been associated with favourable changes in gut microbiota specifically, increased levels of *Firmicutes* and *Bacteroidetes* and elevated faecal short-chain fatty acid concentrations (118).

Short-chain fatty acids (SCFAs), produced by gut microbes from undigested fibre, help regulate inflammation (154, 155). Among them, butyrate is particularly noted for its anti-inflammatory effects (156-160). Similarly, beneficial gut bacteria such as *Faecalibacterium prausnitzii* and *Bifidobacterium* are associated with reduced systemic inflammation (161, 162).

Probiotics, living microorganisms, typically yeasts and bacteria are known to promote healthy gut microbiome (163); In this regard, probiotics supplementation was reported to change gut microbial structure, where this changes in microbial structure are found to be associated with reduced anxiety and depression like symptoms (164), further showing the central role of gut microbiome in mental health. However, most of these reports are based on animal studies.

## Discussion

The MedDiet was shown to be associated with improved mental health outcomes, including depressive symptoms, anxiety symptoms, stress, mental well-being and quality of life, in adult population. Possible mechanisms involved include anti-oxidant, anti-inflammatory potential of MedDiet and its effect on gut microbiota.

The association between MedDiet and depressive symptoms is stronger and more consistent in cohort studies, while cross-sectional studies show mixed results. This difference may be due to the inherent limitations of cross-sectional designs in capturing the temporal relationship between exposure (MedDiet) and outcome (depressive symptoms) (165). Similarly, interventional studies comparing the MedDiet with usual care or other diets have shown improvements in depressive symptoms. Notably, the SMILES trial also reported remission of symptoms among individuals with major depression (11).

The findings of this study align with a meta-analysis reporting that MedDiet interventions significantly reduce depressive symptoms in relatively young populations (aged 22 to 53 years) diagnosed with depression (166). Similarly, another systematic review and meta-analysis study reported MedDiet presents the most compelling evidence in reducing the risk of depression than other healthy dietary indices such as healthy eating index (HEI), Alternative HEI (AHEI) and the Dietary Approaches to Stop Hypertension (167-171). However, the abovementioned lack comprehensiveness, primarily focusing on the role of the MedDiet in depressive symptoms.

The association between the MedDiet and depression across diverse settings and populations is generally consistent, though some studies report no association. Variability in measuring both the MedDiet and depression likely contributes to these inconsistencies, possibly due to some of the existing MedDiet scores not fully meeting applicability criteria (172). The term applicability usually refers the concepts regarding demands of the administrator and respondent, alternative forms, interpretability (173). Based on a recent systematic review on evaluation of MedDiet adherence scores, very few scoring measures obtained the best evaluations in terms of applicability (172), whereas the score created by Sotos-Prieto *et al* (174) has recent evidence supporting its reliability.

In addition, a difference in the measurement of depression partly plays a role which may be attributable to the effects of comorbid health conditions that might reflect distinct phenomenological features of depression (175).

A relatively consistent association of MedDiet score with reduced anxiety is reported. Majority of studies are cross sectional whereas very few clinical trial and longitudinal follow up studies are available. MedDiet is also associated with improvement in quality of life, stress and well-being. While the findings suggest a positive role of the MedDiet, the limited number of studies underscores the need for more high-quality research in this area.

**Implications:**

The MedDiet has been widely studied across diverse regions, suggesting its potential adaptability to various populations. However, successful adoption may be challenged by factors such as limited access to fresh, high-quality ingredients (176) and the difficulty of maintaining long-term adherence to specific dietary recommendations (177). Furthermore, the feasibility of adopting the MedDiet across diverse populations warrants further exploration, particularly in light of cultural, socioeconomic, and geographical factors. These findings also highlight the need to investigate how the MedDiet can be effectively integrated into comprehensive treatment and prevention strategies for mental health outcomes. The findings also underscore the growing significance of nutritional psychiatry, an emerging field that emphasizes the role of diet in the prevention and management of mental disorders.

Another implication of the findings is the need for future research to more frequently utilize clinical diagnoses of mental health outcomes. Majority of exiting studies mainly utilised screening tools to assess mental health outcomes. Although widely used screening tools for mood disorders (such as BDI-II and BAI) are well-validated, their self-reported nature may affect the reliability of the data (178, 179). Thus, more studies with clinical diagnosis of mental health outcomes as a primary outcome might provide stronger evidence (178). In addition, high quality clinical trials with longer follow-ups are needed across diverse populations to clearly understand to long term benefits and to robustly establish causal inference to facilitate evidence based policies and strategies.

## 5. Conclusion

The MedDiet has shown promising results in improving mental health by reducing depressive symptoms and enhancing psychological well-being in adult populations. Further research is needed to explore the underlying mechanisms and optimal integration of the MedDiet into comprehensive treatment plans. It's important to note that the efficacy of a MedDiet in combating mental health issues may be subject to integration into wider mental health treatment strategies.

This review highlights a growing body of evidence suggesting that adherence to the MedDiet is associated with favourable mental health outcomes, including reductions in depressive and anxiety symptoms, perceived stress, and improvements in quality of life and overall mental well-being. Notably, while the majority of studies particularly longitudinal and interventional designs support the protective role of the MedDiet, inconsistencies, particularly among cross-sectional studies, point out the influence of context, population characteristics, and methodological heterogeneity such as varied dietary and psychological assessment tools. In addition, the emerging understanding of potential pathways includes antioxidant potential, anti-inflammatory effects, and improved gut health. However, the existing evidences still lack robust causal inference, and many studies remain observational or short-term interventions, with limited exploration of dose-response relationships, differential effects by subgroups (e.g., sex, age, comorbidity status), or long-term sustainability of diet-related changes.

## 6. Acknowledgements

### 6.1 Author Contributions

The authors' contributions were as follows: R.K.: designed research, screened studies, undertook study, extracted and summarized the data, and wrote the paper; JF.: screened data, contributed to editing and revising the manuscript; L.K, K.L, M.L, R.M, S.M, S.B, C.N.O, M.F.C, H.S, R.C, M.T, S.M, L.S, A.T, C.I: contributed to editing and revising the manuscript; B.d.C.: final editing and revising the manuscript. All authors and all authors: provided intellectual input in line with ICMJE criteria for authorship and read and approved the final manuscript.

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**6.3. Conflicts of Interest:** authors declare no conflict of interest

## 6.4 Supporting Information

**Supplementary file 1:** Sample OVID-MEDLINE search strategy.

**Supplementary file 2:** PRISMA checklist

**Supplementary file 3:** JBI study quality appraisal

## References

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**Table 1:** Summary of findings relating to MedDiet and depression

| Studies                 | Country | Research design | Intervention/exposure/n                                                              | Population                                       | Key findings                                                                                                                                                                  |
|-------------------------|---------|-----------------|--------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Adjibade et al, 2018    | France  | Cohort          | Adherence to the MD was estimated using the relative Mediterranean diet score (rMED) | 3523                                             | Supplémentation en Vitamines et Minéraux Antioxydants (SU.VI.MAX) cohort who had at least three dietary records at baseline, free of depression at the beginning of the study |
| Bakirhan et al, 2022    | Turkey  | Cross sectional | Mediterranean diet adherence score                                                   | 250                                              | Online questionnaire was used on peoples between the ages of 19-64                                                                                                            |
| Bardinet, 2022          | France  | Cohort          | Adherence to the med diet was assessed using MeDi-Lite score                         | 1018 participants, aged 75.6 years ( $\pm 4.8$ ) | The Center for Epidemiologic Studies Depression (CES-D) scale score of 16 or greater and/or use of antidepressant treatment                                                   |
| Barkhordari et al, 2022 | Iran    | Cross sectional | <b>MIND</b> (Mediterranean-DASH Intervention for Neurodegenerative Delay)            | 7165                                             | Valid Iranian version of the Depression, Anxiety, and Stress Scale (DASS 21)                                                                                                  |

- Adherence to the rMED score (continuous variable) was significantly associated with incident depressive symptoms in men, but not in women.

- Following the Mediterranean diet pattern at a high level were found to have significantly less depression symptoms than those following this diet pattern at poor and moderate level ( $p < 0.001$ )

- Only when restricting the definition of DS to a CES-D score  $\geq 16$  was a borderline-significant trend towards a benefit of greater adherence to the MeDi with reduced odds of DS found ( $p$ -value = 0.053).

- Highest compared to the lowest quartile of MIND diet score had significantly lower odds of depression

|                      |           |                 |                                                                         |                      |                                                                                                                       |                                                                                                                                                                                                                       |
|----------------------|-----------|-----------------|-------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bayes et al, 2022    | Australia | Open label RCT  | Mediterranean Diet Adherence Score (MEDAS).                             | 72 males 18–25 years | Adherence to the MD or Befriending therapy for the control group. Beck Depression Inventory Scale—version II (BDI-II) | <ul style="list-style-type: none"> <li>The mean change in BDI-II score was significantly higher in the MD group compared with the befriending group at week 12</li> </ul>                                             |
| Bonaccio et al, 2022 | Italy     | Cross-sectional | MedDiet score                                                           | 2060                 | PHQ-9 and depressive items from the Screening Questionnaire for Disaster Mental Health- SQD-D)                        | <ul style="list-style-type: none"> <li>Psychological distress poorly influenced changes toward an MD, except for depression (SQD-D) that resulted inversely associated in the ALT RISCOVID-19 participants</li> </ul> |
| Cherian et al, 2021  | USA       | Cohort          | Mediterranean DASH Intervention for Neurodegenerative Delay (MIND) diet | 709                  | Center for Epidemiologic Studies Depression scale.                                                                    | <ul style="list-style-type: none"> <li>Participants in the highest tertile of the MIND had lower rates of depressive symptoms compared to those in the lowest tertiles</li> </ul>                                     |
| Corezzi et al, 2020  | Italy     | Cross-sectional | Mediterranean Diet Adherence Screener (MEDAS) was used                  | 502                  | Warwick-Edinburgh Mental Wellbeing Scale (WEMBS), was used                                                            | <ul style="list-style-type: none"> <li>MEDAS score <math>\geq 6</math> was associated to a lower risk of depression</li> </ul>                                                                                        |
| Crichton et al, 2013 | Australia | Cross-sectional | Adherence to the MedDiet                                                | 1183 aged 40–65      | Self-reported cognitive failures, memory, anxiety, stress, self-esteem                                                | <ul style="list-style-type: none"> <li>The majority of Australians (71.7%) had a medium adherence to a MedDiet pattern. Overall MedDiet adherence was not related to cognitive function</li> </ul>                    |
| Dinu et al, 2023     | Italy     | Cross-sectional | MD adherence through the Medi-Lite score                                | 344                  | Depression Anxiety Stress Scale (DASS-21)                                                                             | <ul style="list-style-type: none"> <li>Low MD adherence were associated with a significantly higher risk of depression</li> </ul>                                                                                     |

|                         |            |                 |                                                                     |                               |                                                                                                                |                                                                                                                                                                                                                                                                                                    |
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| Elmaliklis et al, 2020  | Greek      | Cross-sectional | Mediterranean diet adherence was evaluated using the Med Diet Score | 120                           | Beck Depression Inventory (BDI)                                                                                | <ul style="list-style-type: none"> <li>No significant association between Mediterranean diet adherence and depression levels (<math>p &gt; 0.05</math>)</li> </ul>                                                                                                                                 |
| Elstgeest et al, 2019   | Netherland | Cross-sectional | Mediterranean Diet Score (MDS)                                      | 1312 ( $\geq 55$ years)       | Centre for Epidemiologic Studies Depression scale (CES-D) was used to assess depression                        | <ul style="list-style-type: none"> <li>Chronic/recurrent depressive symptoms (<math>CES-D \geq 16</math>) were associated with lower MDS scores</li> <li>History of depressive symptoms (ever <math>CES-D \geq 16</math>) was associated with lower MDS in men only</li> </ul>                     |
| Fresan et al, 2019      | Spain      | Cohort          | Mediterranean Diet Adherence Screener & MIND adherence scores       | 15,980                        | Prevalent or lifetime depression was assessed as self-reported depression and/or antidepressant medication use | <ul style="list-style-type: none"> <li>Comparing the highest versus the lowest quartiles of adherence, we found no association of the MIND diet and incident depression.</li> <li>This relation was statistically significant for the Mediterranean diet (HR: 0.75, 95% CI: 0.61, 0.94)</li> </ul> |
| Garcia-Toro et al, 2016 | Spain      | Cohort          | 14-item Mediterranean diet adherence score                          | 273 Major depressive patients | Beck Depression Inventory                                                                                      | <ul style="list-style-type: none"> <li>At the baseline Mediterranean diet adherence was inversely associated with depressive symptoms (<math>p=0.007</math>)</li> <li>Depression response was not associated with Mediterranean diet adherence (<math>p=0.625</math>) in follow up</li> </ul>      |

|                          |             |                 |                                                                                                                                                 |                                   |                                                                                                                                     |                                                                                                                                                                                                                                      |
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| Gianfredi et al, 2021    | Netherlands | Cohort          | Mediterranean diet score (9 item)                                                                                                               | 2646 aged 40–75 yr.               | 9-item Patient Health Questionnaire (PHQ-9)                                                                                         | <ul style="list-style-type: none"> <li>Adherence to Mediterranean diets was not associated with incident depressive symptoms.</li> </ul>                                                                                             |
| Gibson-Smith et al, 2020 | Netherlands | Cohort          | Mediterranean diet score (11 item)                                                                                                              | 2069                              | Composite International Diagnostic Interview (CIDI) 30-item Inventory of Depressive Symptomatology—Self Report (IDS-SR, range 0–84) | <ul style="list-style-type: none"> <li>MDS score shows the strongest relationships with depression</li> </ul>                                                                                                                        |
| Godos et al, 2023        | Italy       | Cross sectional | Mediterranean diet adherence score                                                                                                              | 883                               | Center for the Epidemiological Studies of Depression Short Form                                                                     | <ul style="list-style-type: none"> <li>Highest quartile of adherence to the Mediterranean diet were less likely to have depressive symptoms (OR = 0.19, 95 % CI: 0.08, 0.46)</li> </ul>                                              |
| Gomez-Gomez et al, 2023  | Spain       | Cluster RCT     | MHBC intervention to promote adherence to the Mediterranean diet, physical activity, and/or <u>smoking cessation</u> OR usual care for 12 month | 22 PHC (public health care)       | Patient Health Questionnaire-9 (PHQ-9)                                                                                              | <ul style="list-style-type: none"> <li>The intervention was not effective in preventing major depression (OR 1.17; [95% CI 0.53 to 2.59]) or reducing depressive symptoms (Mean difference: 0.30; [95% CI -0.77 to 1.36])</li> </ul> |
| Hardman et al, 2020      | Australia   | RCT             | MedDiet (MedDiet score (MedDietS)), exercise, and a combination of both                                                                         | 102 participants, aged 60–90 year | Depression Anxiety Stress Scale (DASS)                                                                                              | <ul style="list-style-type: none"> <li>Exercise group and the exercise and diet group demonstrated a significantly lower total DASS score than the control group</li> </ul>                                                          |
| Hershey et al, 2022      | Spain       | Cohort          | The MEDLIFE index (on food consumption, dietary                                                                                                 | 15,279                            | Self-reported new cases of depression                                                                                               | <ul style="list-style-type: none"> <li>The second and third quartiles of MEDLIFE adherence were</li> </ul>                                                                                                                           |

|                            |             |                  |                                                                         |                                          |                                                                  |                                                                                                                                                                                                                                                                                                |
|----------------------------|-------------|------------------|-------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |             |                  | habits, physical activity, rest, social habits, and conviviality)       |                                          |                                                                  | significantly associated with a decreased relative risk for incident depression                                                                                                                                                                                                                |
| Jasmin et al, 2023         | USA         | Cross- sectional | 14-item Questionnaire of Mediterranean diet Adherence                   | 100                                      | Beck's Depression Inventory (BDI)                                | <ul style="list-style-type: none"> <li>There was a significant negative correlation, indicating that MD adherence is associated with reduced depression</li> </ul>                                                                                                                             |
| Lahouti et al, 2021        | Iran        | Cross sectional  | Semi-Mediterranean dietary pattern using PCA                            | 217 aged 20–45 yr                        | Beck Depression Inventory                                        | <ul style="list-style-type: none"> <li>“Semi-Mediterranean” dietary pattern had no significant association with the depressive symptoms</li> </ul>                                                                                                                                             |
| Lai et al, 2016            | Australia   | Cohort           | Mediterranean Diet pattern (MDP)                                        | 11 046 women                             | Centre for Epidemiologic Depression Scale (CESD)                 | <ul style="list-style-type: none"> <li>There was a significant association between baseline diet quality and depression (<math>\beta=-0.24</math>, <math>P=0.001</math>), but this was lost when time-varying covariates were added (<math>\beta=-0.04</math>, <math>P=0.10</math>)</li> </ul> |
| Lasserre et al, 2021       | Switzerland | Cross sectional  | Mediterranean Diet pattern (MDP)                                        | 3554 participants                        | Diagnostic Interview for Genetic Studies (DIGS)                  | <ul style="list-style-type: none"> <li>No association was found between Mediterranean dietary score patterns and depression status</li> </ul>                                                                                                                                                  |
| Lawrie et al, 2023         | UK          | Cross-sectional  | Mediterranean-DASH Diet Intervention for Neurodegenerative Delay (MIND) | 162 individuals with Parkinson's Disease | Beck Depression Inventory, Hospital Anxiety and Depression Scale | <ul style="list-style-type: none"> <li>No significant association of MIND with depression</li> </ul>                                                                                                                                                                                           |
| Mahdavi-Roshan et al, 2019 | Iran        | Cross-sectional  | Mediterranean Diet Adherence Screener (MEDAS)                           | 344                                      | Beck Depression Inventory (BDI)                                  | <ul style="list-style-type: none"> <li>No relationship was discovered between depression and dietary adherence (<math>P = 0.249</math>)</li> </ul>                                                                                                                                             |
| Mamalaki et                | Greece      | Cohort           | MedDiet Score (11                                                       | 879 aged $\geq 65$                       | Geriatric                                                        | <ul style="list-style-type: none"> <li>MeDi was associated</li> </ul>                                                                                                                                                                                                                          |

|                             |                       |                 |                                               |                                 |                                                                                       |                                                                                                                                                                                                                                        |
|-----------------------------|-----------------------|-----------------|-----------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| al, 2023                    |                       |                 | item)                                         | years old                       | Depression Scale or antidepressant medication and/or clinical diagnosis of depression | <p>with a 6.2% decrease in the risk for depression (<math>p &lt; 0.001</math>).</p> <ul style="list-style-type: none"> <li>MeDi is negatively associated with depression longitudinally, above and beyond cognitive status.</li> </ul> |
| Mantzorou et al, 2021       | Greece                | Cross-sectional | MedDiet Score                                 | 2092 over 65 years              | Geriatric Depression Scale (GDS)                                                      | <ul style="list-style-type: none"> <li>Higher MD adherence was significantly associated with GDS scores</li> </ul>                                                                                                                     |
| Marcos-Pardo et al, 2022    | Spain                 | Cohort          | Adherence Mediterranean diet                  | 40 adults during COVID lockdown | Centre for Epidemiologic Studies Depression (CESD)                                    | <ul style="list-style-type: none"> <li>Adherence to the Mediterranean diet was shown to be a protective factor against increased depression (<math>p=0.03</math>)</li> </ul>                                                           |
| Masana et al, 2018          | Mediterranean islands | Cross sectional | Adherence to the Mediterranean diet (MedDiet) | 2718 older people               | Geriatric Depression Scale (GDS)                                                      | <ul style="list-style-type: none"> <li>Adherence to the MedDiet was associated with the absence of depression [(OR, 95% CI): 0.65, 0.50–0.85]</li> </ul>                                                                               |
| NatalieParletta et al, 2019 | Australia             | RCT             | MedDiet score                                 | 152 adults aged 18–65           | Depression Anxiety Stress Scale (DASS-21)                                             | <ul style="list-style-type: none"> <li>The MedDiet group had greater reduction in depression (<math>P = 0.03</math>) at 3 months</li> </ul>                                                                                            |
| Oddo et al, 2022            | USA                   | Cross sectional | Alternate Med Diet score (aMED)               | 11,769 adults                   | Patient Health Questionnaire-9 (PHQ-9)                                                | <ul style="list-style-type: none"> <li>Compared to individuals with the lowest aMED (Q1), individuals in Q3 and Q4 had 40% and 45% lower odds of depressive symptoms</li> </ul>                                                        |
| Olivan-Blazquez et al, 2021 | Spain                 | Cross sectional | MEDAS (Med diet adherence screener)           | 3062                            | Patient Health Questionnaire-9 (PHQ-9)                                                | <ul style="list-style-type: none"> <li>A higher score obtained in the MEDAS has been significantly related to a lower depressive symptomatology</li> </ul>                                                                             |

|                        |             |                            |                                                          |                         |                                                                            |                                                                                                                                                                                                                                                                                                                                                                                               |
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| ÖZCAN et al, 2021      | Turkey      | Cross sectional            | Mediterranean Diet Adherence Screener (MEDAS)            | 1053 individuals        | Beck Depression Inventory,                                                 | <ul style="list-style-type: none"> <li>Negative significant correlations were found between the MEDAS scores and depression scores (<math>p &lt; 0.001</math>)</li> </ul>                                                                                                                                                                                                                     |
| Paans et al, 2019      | Netherlands | Cross sectional            | Mediterranean diet score (MDS)                           | 1442 participants       | Self-reported depressive symptoms (Inventory of Depressive Symptomatology) | <ul style="list-style-type: none"> <li>Current depression diagnosis and severity were associated with lower MDS</li> </ul>                                                                                                                                                                                                                                                                    |
| Pagliai et al, 2018    | Italy       | Cross sectional            | Mediterranean Diet Score (8 item)                        | 388 nonagenarians       | Geriatric Depression Scale (GDS)                                           | <ul style="list-style-type: none"> <li>Slightly lower MD score in depressed than non-depressed, but not significant (<math>33.9 \pm 3.9</math> vs. <math>34.6 \pm 3.3</math>, <math>p=0.149</math>).</li> <li>Depressed women reported a significantly lower score than non-depressed (<math>33.6 \pm 4</math> vs. <math>34.7 \pm 3.4</math>, <math>p=0.036</math>) but not in men</li> </ul> |
| Parastouei et al, 2023 | Iran        | Cross sectional            | Mediterranean Diet Score (8 item)                        | 400 male military       | Depression, Anxiety, and Stress Scale-21 (DASS-21)                         | <ul style="list-style-type: none"> <li>MD has no association with depression</li> </ul>                                                                                                                                                                                                                                                                                                       |
| Recchia et al, 2020    | UK          | Cohort                     | Transformed-Mediterranean Diet Score (tMDS)              | 4949 Whitehall II Study | Center for Epidemiologic Studies Depression Scale (CESD)                   | <ul style="list-style-type: none"> <li>Baseline tMDS associated with lower risk of recurrent depressive symptoms over the 13-year follow-up. However No robust associations were observed for long-term tMDS</li> </ul>                                                                                                                                                                       |
| Rienks et al, 2013     | Australia   | Cohort and Cross-sectional | Mediterranean style diet pattern (using factor analysis) | Cross-sectional (8369)  | Centre for Epidemiologic Studies Depression                                | <ul style="list-style-type: none"> <li>Mediterranean-style diet had a cross-sectional association with lower</li> </ul>                                                                                                                                                                                                                                                                       |

|                              |       |                                 |                                                  |                                |                                                           |                                                                                                                                                                                               |
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|                              |       |                                 |                                                  | women) and longitudinal (7588) | scale (CESD)                                              | prevalence of depressive symptoms <ul style="list-style-type: none"> <li>Longitudinally with lower incidence of depressive symptoms</li> </ul>                                                |
| Riera-Sampol et al, 2021     | Spain | Cross-sectional                 | Adherence to the Mediterranean diet (14-item)    | 310 (aged 35-75 years)         | Patient Health Questionnaire (PHQ-9)                      | <ul style="list-style-type: none"> <li>Significant associations between depression levels and adherence to the Mediterranean diet (OR: 0.85; 95% CI: 0.73, 0.99)</li> </ul>                   |
| Rostami et al, 2022          | Iran  | Cross-sectional                 | MIND diet                                        | 400 male health professionals  | Depression, anxiety, and stress scale (DASS-21),          | <ul style="list-style-type: none"> <li>No association of MIND with depression and anxiety</li> </ul>                                                                                          |
| Sadeghi et al, 2021          | Iran  | Cross-sectional                 | Mediterranean dietary scores (9 item)            | 3172 aged 18–55 yr.            | Hospital Anxiety and Depression Scale (HADS)              | <ul style="list-style-type: none"> <li>Greatest adherence to the Mediterranean diet had lower odds for depression</li> </ul>                                                                  |
| Sahasrabudhe et al, 2023     | USA   | Cohort                          | Mediterranean diet adherence (9-item)            | 1404                           | Center for Epidemiologic Studies Depression Scale (CES-D) | <ul style="list-style-type: none"> <li>MD adherence was significantly associated with CES-D score at baseline cross sectional and also longitudinally across 3 waves of follow ups</li> </ul> |
| Salari-Moghaddam et al, 2019 | Iran  | Cross-sectional                 | MIND diet                                        | 3176 adults                    | Hospital Anxiety and Depression Scale (HADS)              | <ul style="list-style-type: none"> <li>Highest quartile of the MIND diet score had a lower odds of depression</li> </ul>                                                                      |
| Sánchez-Villegas et al, 2009 | Spain | Cohort                          | Mediterranean diet adherence score (9-item)      | 10094                          | Self-reported diagnosis of depression                     | <ul style="list-style-type: none"> <li>Significant inverse association of depression with higher adherence of the MDP</li> </ul>                                                              |
| Sanchez-Villegas et al. 2013 | Spain | Multicentre RCT(PREDIMED trial) | MD-+EVOO, and the MD-+nuts (intervention groups) | 3,923 participants             | Clinical or Self-reported diagnosis of depression         | <ul style="list-style-type: none"> <li>Inverse association with depression in Mediterranean diet supplemented with nuts</li> </ul>                                                            |

|                       |           |                 |                                                                   |                                  |                                                                    |                                                                                                                                                                                                                  |
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|                       |           |                 |                                                                   |                                  |                                                                    | for type 2 DM participants but not the whole group                                                                                                                                                               |
| Skarupski et al, 2013 | USA       | Cohort          | MedDiet Score                                                     | 3502 aged 65+ years              | Center for Epidemiologic Studies Depression scale                  | <ul style="list-style-type: none"> <li>Greater adherence to a Mediterranean-based diet was associated with a reduced number of newly occurring depressive symptoms</li> </ul>                                    |
| Veronese et al, 2016  | USA       | Cohort          | aMED (modified Mediterranean diet score)                          | 4470 participants                | CES-D (Depression)                                                 | <ul style="list-style-type: none"> <li>Higher aMED was significantly associated with lower CES-D scores</li> </ul>                                                                                               |
| Vicinanza et al, 2020 | Italy     | Cross sectional | Adherence to the Med-Diet (14 item)                               | 143 geriatric patients           | Geriatric Depression Scale (GDS)                                   | <ul style="list-style-type: none"> <li>Associations were found between MDQ score and GDS</li> </ul>                                                                                                              |
| Vuckovic et al, 2021  | Croatia   | Cross sectional | Mediterranean Diet Serving Score (14 item)                        | 115 kidney transplant recipients | Beck Depression Inventory-II (BDI-II)                              | <ul style="list-style-type: none"> <li>Inverse associations were found between BDI-II score and consumption of fish and white meat, as suggested by the MeDi</li> </ul>                                          |
| Wade et al, 2020      | Australia | Cross-over RCT  | Mediterranean diet with 3-4 daily serves of dairy food (MedDairy) | 41 aged $\geq 45$ yrs            | Profile of Mood States (POMS) and Short-Form Health Survey (SF-36) | <ul style="list-style-type: none"> <li>Significant improvements were observed for Total Mood Disturbance (<math>P = .01</math>), Depression (<math>P = .03</math>)</li> </ul>                                    |
| Wardle et al, 2000    | England   | RCT             | Mediterranean diet or low fat diet or control                     | 176 adults                       | Beck Depression Inventory                                          | <ul style="list-style-type: none"> <li>Significant improved depression from baseline but no change between groups</li> </ul>                                                                                     |
| Xu et al, 2022        | USA       | Cross sectional | Mediterranean diet score (NHANES)                                 | 3,190 adults                     | Patient Health Questionnaire-9 (PHQ-9)                             | <ul style="list-style-type: none"> <li>MEDS score was correlated with a reduced risk of depression in patients with cancer</li> <li>MEDS score also showed a decreased risk of depression in patients</li> </ul> |

|                             |              |                 |                                               |                                 |                                                                                                  | with 1 cancer                                                                                                                                                                                                                                                                                                                             |
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| Yin et al, 2021             | Sweden       | Cohort          | MDP score (9 item)                            | 49,261 Swedish women aged 29-49 | Clinical diagnosis of depression from registry                                                   | <ul style="list-style-type: none"> <li>• Lower risk of depression for medium (score 4-5) and high (6-9) adherence to MDP, compared with low (0-3)</li> <li>• Per unit increase of adherence, the risk of depression was reduced by 5%</li> <li>• The association became stronger when restricting to severe form of depression</li> </ul> |
| Zamani et al, 2023          | Iran         | Cross sectional | Mediterranean diet score (11 item)            | 435 women (20- 50 yrs)          | Depression, Anxiety, and Stress Scale (DASS-21)                                                  | <ul style="list-style-type: none"> <li>• Those in the third tertile of the Mediterranean diet score were at lower risk of depression compared with those in the first tertile</li> </ul>                                                                                                                                                  |
| Jacka et al, 2017           | Australia    | RCT             | Modified Med diet                             | 67 (33 vs 34)                   | Montgomery-Åsberg Depression Rating Scale (MADRS) & HADS (Hospital Anxiety and Depression Scale) | <ul style="list-style-type: none"> <li>• Remission of depression was observed in 32.3% in the intervention group</li> </ul>                                                                                                                                                                                                               |
| Alfaro-Gonzalez et al, 2025 | Spain        | Cross sectional | Mediterranean diet adherence screener (MEDAS) | 428                             | University students, aged 18-30 years Beck Depression Inventory (BDI-II)                         | <ul style="list-style-type: none"> <li>• High adherence to the MedDiet exhibited lower scores for depression symptoms (<math>p &lt; 0.05</math>) than did students with low adherence to the MedDiet.</li> </ul>                                                                                                                          |
| Alnabulsi et al, 2024       | Saudi Arabia | Cross sectional | Mediterranean diet adherence screener (MEDAS) | 467                             | Online questionnaire was used on peoples                                                         | <ul style="list-style-type: none"> <li>• MedDiet-adherent group had a significantly lower PHQ-9 score than the</li> </ul>                                                                                                                                                                                                                 |

|                          |                      |                 |                                                                         |                                          |                                                                                         |                                                                                                                                                                                             |
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|                          |                      |                 |                                                                         |                                          | aged 19-64 years                                                                        | non-adherent group                                                                                                                                                                          |
| Amiri S et al, 2025      | United Arab Emirates | Cross sectional | Mediterranean diet adherence screener (MEDAS)                           | 567                                      | World Health Organization – five well-being index (WHO-5) was used to assess depression | <ul style="list-style-type: none"> <li>Adherence to the Mediterranean diet was linked to a reduced risk of depression</li> </ul>                                                            |
| Ardekani M et al, 2023   | Iran                 | Cross sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 339 aged 20-50 years                     | Adults with obesity & Depression, Anxiety, and Stress Scale (DASS-21) was used          | <ul style="list-style-type: none"> <li>No association for depression in highest versus lowest MIND diet tertiles (<math>P &gt; 0.05</math>)</li> </ul>                                      |
| Arshad H et al, 2024     | UK                   | Cohort          | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 4824 Adults with mean age = 61 $\pm$ 5.9 | Center for Epidemiologic Studies Depression Scale                                       | <ul style="list-style-type: none"> <li>Participants in the highest tertile of the MIND diet score had 26% lower odds of recurrent DepSs compared to those in the lowest tertile.</li> </ul> |
| Conti S et al, 2024      | Italy                | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                     | 798 Elders aged 65-97 years              | Center for Epidemiologic Studies Depression Scale                                       | <ul style="list-style-type: none"> <li>High adherence to MDS significantly reduced the odds of depressive symptoms</li> </ul>                                                               |
| Dakanalis A et al, 2024  | Greece               | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                     | 558 Adults with MS aged 18-64 yrs.       | MS Quality of Life-54 (MSQOL-54), Beck Depression Inventory II, BDI-II                  | <ul style="list-style-type: none"> <li>Elevated MD compliance was independently associated with lower depressive symptoms</li> </ul>                                                        |
| Kabiri S et al, 2024     | Iran                 | RCT             | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 52 Women with PCOS, aged 18 to 45 years  | Depression Anxiety Stress Scales 21 (DASS-21)                                           | <ul style="list-style-type: none"> <li>MIND diet significantly reduced depression compared to control</li> </ul>                                                                            |
| Kamrani F et al, 2024    | Iran                 | Cross sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 4579 Adults aged 30–70 years             | Adults aged 30–70 Depression Anxiety Stress Scales 21 (DASS-21)                         | <ul style="list-style-type: none"> <li>Participants in the highest quartile of MIND diet exhibited significantly lower risks of depression</li> </ul>                                       |
| Menichetti F et al, 2025 | Italy                | Cross sectional | adherence to the Mediterranean diet                                     | 4957 Adults with obesity.                | State-Trait Anxiety Inventory (STAI2)                                                   | <ul style="list-style-type: none"> <li>A 7% reduction in the odds of depression for</li> </ul>                                                                                              |

|                            |        |                 |                                                                             |                                       |                                                                                                         |                                                                                                                                                                   |
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|                            |        |                 | (MEDAS)                                                                     |                                       | and The Depression Questionnaire (QD)                                                                   | each 1-point MEDAS increase                                                                                                                                       |
| Morales G et al, 2023      | Chile  | Cross sectional | Chilean Mediterranean diet Index (MDI)                                      | 934 University students.              | Depression Anxiety and Stress Scale (DASS-21)                                                           | <ul style="list-style-type: none"> <li>Moderate and high adherence to Mediterranean diet showed lower odds of depression than those with low adherence</li> </ul> |
| Natalello G et al, 2024    | Italy  | Cross sectional | Mediterranean Diet Adherence Screener (14-MEDAS)                            | 387 Patients with Systemic Sclerosis. | Hospital Anxiety and Depression Scale (HADS)                                                            | <ul style="list-style-type: none"> <li>Poor adherence to the MD was associated with a more prominent depressive mood</li> </ul>                                   |
| Niu T et al, 2025          | China  | Cross sectional | Chinese Mediterranean-DASH Intervention for Neurodegenerative Delay (cMIND) | 6945 Seniors >= 65 years              | Center for Epidemiology Studies Depression Scale (CES-D-10), Generalized Anxiety Disorder Scale (GAD-7) | <ul style="list-style-type: none"> <li>The cMIND diet score had a significant protective effect on both depressive and anxiety symptoms</li> </ul>                |
| Papadopoulou K et al, 2023 | Greece | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                         | 3941 Postpartum women.                | Edinburgh Postnatal Depression Scale (EPDS)                                                             | <ul style="list-style-type: none"> <li>Postpartum depression was independently associated lower levels of MD adherence</li> </ul>                                 |
| Radkhah N et al, 2023      | Iran   | RCT             | MedDiet intervention or control (standard care)                             | 60                                    | Depression Anxiety and Stress Scale (DASS-21)                                                           | <ul style="list-style-type: none"> <li>Depression scores decreased significantly in the Med diet as compared to control</li> </ul>                                |
| Sharifi M et al, 2025      | Iran   | RCT             | Modified MedDiet intervention or traditional Persian diet                   | 90 People with multiple sclerosis     | Beck depression Inventory                                                                               | <ul style="list-style-type: none"> <li>There was no association between depression scores and MED diet intervention</li> </ul>                                    |
| Shiraseb F et al, 2023     | Iran   | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                         | 266 Females aged 18-48 yrs.           | Depression Anxiety and Stress Scale (DASS-21)                                                           | <ul style="list-style-type: none"> <li>Significant inverse association between adherence to the Mediterranean diet and severe depression scores</li> </ul>        |
| Sorli V et al,             | Spain  | Cross sectional | Adherence to the                                                            | 465 Elders                            | Beck Depression                                                                                         | <ul style="list-style-type: none"> <li>MedDiet adherence was</li> </ul>                                                                                           |

|                                |           |                 |                                                                        |                                                |                                                  |                                                                                                                                                                                        |
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| 2024                           |           |                 | Mediterranean diet (MedDiet score)                                     | aged 55-75 yrs.                                | Inventory (BDI-II)                               | strongly and inversely associated with depressive symptoms                                                                                                                             |
| Staudacher M et al, 2023       | Australia | RCT             | MedDiet intervention or habitual diet                                  | 48 Adults with irritable bowel syndrome (IBS). | Hospital anxiety and depression scale (HADS)     | <ul style="list-style-type: none"> <li>MedDiet intervention improves anxiety and depressive symptoms</li> </ul>                                                                        |
| Tryfonos C et al, 2024         | Greece    | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                    | 279 adults over 65 yr with multiple sclerosis. | Geriatric Depression Scale (GDS),                | <ul style="list-style-type: none"> <li>Higher MD compliance was independently associated with reduced depressive symptoms</li> </ul>                                                   |
| Unal & Ozenoglu, 2024          | Turkey    | Cross sectional | Mediterranean diet quality index for children and adolescents (KIDMED) | 750 University students age 19 to 24 yrs.      | Depression anxiety stress scale-42 (DASS-42)     | <ul style="list-style-type: none"> <li>Higher adherence to the KIDMED was correlated with lower depression</li> </ul>                                                                  |
| Vaghef-Mehrabani E et al, 2024 | Canada    | Cohort          | Adherence to the Mediterranean diet (MedDiet score)                    | 1141 Pregnant womens at baseline.              | Edinburgh Postpartum Depression Scale (EPDS)     | <ul style="list-style-type: none"> <li>White participants in the MED tertile-3 had lower risk of depression (EPDS &lt; 10) compared with tertile-1 but not people of colour</li> </ul> |
| Zhang K et al, 2025            | China     | Cohort          | Alternate Mediterranean diet score (aMED)                              | 52, 232 Adults mean age of 58 yrs.             | Depression cases were defined using ICD-10 codes | <ul style="list-style-type: none"> <li>A higher level of adherence to the aMED was notably linked to a decreased risk of incident depression</li> </ul>                                |

**Table 2: Anxiety, Stress, psychological well-being and quality of life**

| Studies                 | Country   | Research design | Intervention/exposure/                                                                                                              | N                | Population & scale                                                                                  | Key findings                                                                                                                                                                                                                                   |
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| Barkhordari et al, 2022 | Iran      | Cross sectional | <i>MIND</i> (Mediterranean-DASH Intervention for Neurodegenerative Delay) diet score                                                | 7165             | Iranian version of the Depression, Anxiety, and Stress Scale (DASS 21)                              | <ul style="list-style-type: none"> <li>Highest compared to the lowest quartile of MIND diet score had significantly lower odds of anxiety. No significant association for psychological stress</li> </ul>                                      |
| Bastos et al, 2020      | Brazil    | Cross sectional | Traditional MDP (included only foods with characteristics of the original MDP) and Brazilian-MDP (includes non-Mediterranean foods) | 545 elders       | Common mental disorders (CMD) were identified through the Self Reporting Questionnaire-20 (SRQ-20). | <ul style="list-style-type: none"> <li>Moderate and high adherence to Traditional MDP were associated with a lower prevalence of CMD</li> <li>CMD was not significantly associated with any level of adherence to the Brazilian-MDP</li> </ul> |
| Bayes et al, 2022       | Australia | Open label RCT  | MD adherence was measured with the Mediterranean Diet Adherence Score (MEDAS).                                                      | 72 males 18–25 y | Secondary outcome was quality of life (QoL).                                                        | <ul style="list-style-type: none"> <li>The mean change in QoL score was significantly higher in the MD group compared with the befriending group at week 12</li> </ul>                                                                         |
| Boaz et al, 2021        | Israel    | Cross-sectional | Israeli Mediterranean diet screener (I-MEDAS) was used to measure MedDiet                                                           | 3271             | General Anxiety Disorder 7-point scale (GAD-7) was used to measure anxiety                          | <ul style="list-style-type: none"> <li>An inverse association was detected between the Mediterranean diet score and the GAD-7 score in both women and men, and the correlation</li> </ul>                                                      |

|                      |           |                 |                                                                                                                                                                      |                         |                                                                              |                                                                                                                                                                                                                                                                                                                  |
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|                      |           |                 |                                                                                                                                                                      |                         |                                                                              | <p>coefficients did not differ by sex</p> <ul style="list-style-type: none"> <li>• Mediterranean diet score and age both reduced the odds of elevated anxiety (GAD-7 <math>\geq 10</math>)</li> </ul>                                                                                                            |
| Bonaccio et al, 2022 | Italy     | Cross-sectional | Modifications in adherence to the MD were evaluated by computing a score (MD score) which scored foods according to their position in the Mediterranean diet pyramid | 2060                    | Anxiety (GAD-7), stress (PSS-4), and post-traumatic stress disorder (SQD-P). | <ul style="list-style-type: none"> <li>• In both cohorts, psychological distress poorly influenced changes toward an MD</li> </ul>                                                                                                                                                                               |
| Carlos et al, 2020   | Spain     | Cross-sectional | Adherence to the Mediterranean diet (AMD) was measured using (KIDMED) questionnaire                                                                                  | 252 university students | State-Trait Anxiety Inventory and the Emotional Eater Questionnaire          | <ul style="list-style-type: none"> <li>• AMD was predicted only by trait-anxiety (MD significant positive correlation with trait anxiety)</li> </ul>                                                                                                                                                             |
| Corezzi et al, 2020  | Italy     | Cross-sectional | Mediterranean Diet Adherence Screener (MEDAS) was used                                                                                                               | 502                     | Warwick-Edinburgh Mental Wellbeing Scale (WEMBS), was used                   | <ul style="list-style-type: none"> <li>• The 24% of the sample resulted at high risk of depression (WEMWBS score &lt;40) and the 22.7% at high risk of psychological distress (WEMWBS score 41-45)</li> <li>• The main variables that had a negative association with MD adherence were WEMWBS &lt;40</li> </ul> |
| Crichton et al, 2013 | Australia | Cross-sectional | Adherence to the MedDiet                                                                                                                                             | 1183 aged 40–65         | Outcome measures included                                                    | <ul style="list-style-type: none"> <li>• The majority of Australians (71.7%)</li> </ul>                                                                                                                                                                                                                          |

|                        |       |                      |                                                                     |                    |                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                        |
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|                        |       |                      |                                                                     |                    | self-reported cognitive failures, memory, anxiety, stress, self-esteem                                                                                                  | had a medium adherence to a MedDiet pattern. Overall MedDiet adherence was not related to cognitive function                                                                                                                                                                                           |
| Dinu et al, 2023       | Italy | Cross-sectional      | MD adherence through the Medi-Lite score                            | 344                | Depression Anxiety Stress Scale (DASS-21)                                                                                                                               | <ul style="list-style-type: none"> <li>• Participants with psychological disorders had significantly (<math>p &lt; 0.05</math>) lower MD adherence</li> <li>• Low MD adherence were associated with a significantly higher risk of anxiety and stress</li> </ul>                                       |
| Elmaliklis et al, 2020 | Greek | Cross-sectional      | Mediterranean diet adherence was evaluated using the Med Diet Score | 120                | State-Trait Anxiety Inventory (STAI-X-1,2)                                                                                                                              | <ul style="list-style-type: none"> <li>• The study did not show a statistically significant association between Mediterranean diet adherence and anxiety (<math>p &gt; 0.05</math>).</li> </ul>                                                                                                        |
| Aleman et al, 2022     | Spain | Longitudinal /cohort | The Mediterranean Food Pattern                                      | 152 pregnant women | Positive affect (the extent to which a person feels enthusiastic, active, and alert) and negative affect was assessed with the State Positive Affect Schedule (PANAS-S) | <ul style="list-style-type: none"> <li>• A greater MD adherence was inversely associated with negative affect and anxiety; and positively associated with emotional regulation, resilience and positive affect at the 16th and 34th g.w. (<math> \beta </math> ranging from 0.179 to 0.325)</li> </ul> |

|                             |       |                 |                                                               |                                      |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                            |
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|                             |       |                 |                                                               |                                      | <p>The Trait Meta-Mood Scale (TMMS) were employed to assess emotional attention, emotional clarity and emotional clarity</p> <p>The Connor-Davidson Resilience Scale (CD-RISC) was employed to assess resilience to stress</p> <p>The State Trait Anxiety Index (STAI-S) and Center for were also used</p> |                                                                                                                                                                                                                                                                                                                                                            |
| Galilea-Zabalza et al, 2018 | Spain | Cross sectional | A 17-item questionnaire that assessed adherence to an MedDiet | 6430 men and women (age 55–70 years) | 36-item questionnaire about health-related quality of life (HRQoL)                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Higher adherence to the MedDiet was independently associated with significantly better scores in the eight dimensions of HRQoL.</li> <li>• Adjusted differences of <math>&gt; = 3</math> points between the highest and the lowest dietary adherence groups to the MedDiet were observed for vitality,</li> </ul> |

|                             |             |                 |                                                                         |                                 |                                                                                                                        |                                                                                                                                                                                                      |
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|                             |             |                 |                                                                         |                                 |                                                                                                                        | emotional role, and mental health and of $\geq 2$ points for the other dimensions                                                                                                                    |
| Gibson-Smith et al, 2020    | Netherlands | Cohort          | Mediterranean diet score (11 item)                                      | 2069                            | Beck Anxiety Inventory (BAI, range 0–63)                                                                               | <ul style="list-style-type: none"> <li>MDS score shows the strongest relationships with anxiety</li> </ul>                                                                                           |
| Godos et al, 2023           | Italy       | Cross sectional | Mediterranean diet adherence score                                      | 883                             | Manchester Short Assessment of Quality of Life, Short Portable Mental Status Questionnaire, and Successful Aging Index | <ul style="list-style-type: none"> <li>Highest quartile of adherence to the Mediterranean diet were less likely to have cognitive impairment and more likely to have good quality of life</li> </ul> |
| Hardman et al, 2020         | Australia   | RCT             | MedDiet (MedDiet score (MedDietS)), exercise, and a combination of both | 102 participants, aged 60–90 yr | Depression Anxiety Stress Scale (DASS) Profile of Mood States (POMS)                                                   | <ul style="list-style-type: none"> <li>Exercise group and the exercise and diet group demonstrated a significantly lower total DASS score than the control group</li> </ul>                          |
| Hodge et al, 2013           | Australia   | Cohort          | Mediterranean Diet Score (MDS)                                          | 8,660                           | Kessler Psychological Distress Scale (K10)                                                                             | <ul style="list-style-type: none"> <li>MDS was inversely associated with psychological distress, top-scoring to the lowest scoring group being</li> </ul>                                            |
| Jasmin et al, 2023          | USA         | Cross-sectional | 14-item Questionnaire of Mediterranean diet Adherence                   | 100                             | Generalized Anxiety Disorder-7 (GAD-7)                                                                                 | <ul style="list-style-type: none"> <li>There was a significant negative correlation, indicating that MD adherence is associated with reduced anxiety</li> </ul>                                      |
| Kaufman-Shriqui et al, 2022 | Global      | Cross-sectional | Mediterranean Diet Score (possible range: 0–                            | 3797                            | General Anxiety Disorder 7-point                                                                                       | <ul style="list-style-type: none"> <li>High Mediterranean diet score is</li> </ul>                                                                                                                   |

|                             |           |                 |                                                                         |                                          |                                                                 |                                                                                                                                                              |
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|                             |           |                 | 17 points)                                                              |                                          | scale (GAD-7)                                                   | associated with reduced odds of elevated anxiety, even after controlling for age, sex and other variables.                                                   |
| Lawrie et al, 2023          | UK        | Cross-sectional | Mediterranean-DASH Diet Intervention for Neurodegenerative Delay (MIND) | 162 individuals with Parkinson's Disease | Hospital Anxiety and Depression Scale                           | <ul style="list-style-type: none"> <li>No significant association of MIND with anxiety</li> </ul>                                                            |
| LoMoro et al, 2021          | Italy     | Cross-sectional | Mediterranean Diet adherence (MedDiet)                                  | 502 Uni students                         | Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)              | <ul style="list-style-type: none"> <li>MWB and MedDiet were positively associated</li> </ul>                                                                 |
| Munoz et al, 2009           | Spain     | Cross sectional | Mediterranean diet score (MDS)                                          | 8195 (35-74 yrs)                         | Quality of life using short form (SF-12) questionnaire          | <ul style="list-style-type: none"> <li>An increase in the MDS was directly associated with changes in men and women in the mental component score</li> </ul> |
| NatalieParletta et al, 2019 | Australia | RCT             | MedDiet score                                                           | 152 adults aged 18–65                    | Assessment of Quality of Life (AQoL)-8D                         | <ul style="list-style-type: none"> <li>The MedDiet group had improved mental health QoL scores (at 3 months)</li> </ul>                                      |
| Olveira et al, 2014         | Spain     | Cross sectional | Mediterranean diet questionnaire (PREDIMED)                             | 205 participants                         | Hospital anxiety and depression scale (HADS)                    | <ul style="list-style-type: none"> <li>Increased symptoms of anxiety were significantly associated with worse QOL and a lower PREDIMED score</li> </ul>      |
| ÖZCAN et al, 2021           | Turkey    | Cross sectional | Mediterranean Diet Adherence Screener (MEDAS)                           | 1053 individuals                         | Beck Anxiety Scale, Beck Depression Inventory, Pittsburgh Sleep | <ul style="list-style-type: none"> <li>Negative significant correlations were found between the MEDAS scores and PSQI, Anxiety</li> </ul>                    |

|                              |         |                 |                                                                         |                               |                                                                                                             |                                                                                                                                                                      |
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|                              |         |                 |                                                                         |                               | Quality Scale (PSQI)                                                                                        | <ul style="list-style-type: none"> <li>Increasing adherence to Mediterranean-diet has been found to reduce anxiety during the COVID-19 pandemic</li> </ul>           |
| Parastouei et al, 2023       | Iran    | Cross sectional | Mediterranean Diet Score (8 item)                                       | 400 male military             | Depression, Anxiety, and Stress Scale-21 (DASS-21)                                                          | <ul style="list-style-type: none"> <li>MD has no association with stress and anxiety</li> </ul>                                                                      |
| Rostami et al, 2022          | Iran    | Cross-sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 400 male health professionals | Depression, anxiety, and stress scale (DASS-21),                                                            | <ul style="list-style-type: none"> <li>No association of MIND with anxiety</li> </ul>                                                                                |
| Sadeghi et al, 2021          | Iran    | Cross-sectional | Mediterranean dietary scores (9 item)                                   | 3172 aged 18–55 yr.           | Hospital Anxiety and Depression Scale (HADS), General Health Questionnaire (GHQ) for Psychological distress | <ul style="list-style-type: none"> <li>Greatest adherence to the Mediterranean diet had lower odds for anxiety and psychological distress</li> </ul>                 |
| Salari-Moghaddam et al, 2019 | Iran    | Cross-sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 3176 adults                   | Hospital Anxiety and Depression Scale (HADS) General Health Questionnaire (GHQ)                             | <ul style="list-style-type: none"> <li>Highest quartile of the MIND diet score had a lower odds of psychological distress but no association with anxiety</li> </ul> |
| Salvatore et al, 2019        | Croatia | Cross-sectional | Mediterranean Diet Serving Score (MDSS)                                 | 3,392                         | General Health Questionnaire (GHQ) for mental distress                                                      | <ul style="list-style-type: none"> <li>MD compliance was associated with lesser mental distress</li> </ul>                                                           |
| Torabynasab et al, 2023      | Iran    | Case-control    | Mediterranean-DASH Intervention for Neurodegenerative Delay             | 170 healthy subjects          | Generalized Anxiety Disorder-7 (GAD-7)                                                                      | <ul style="list-style-type: none"> <li>Higher adherence to MIND diet was associated with the</li> </ul>                                                              |

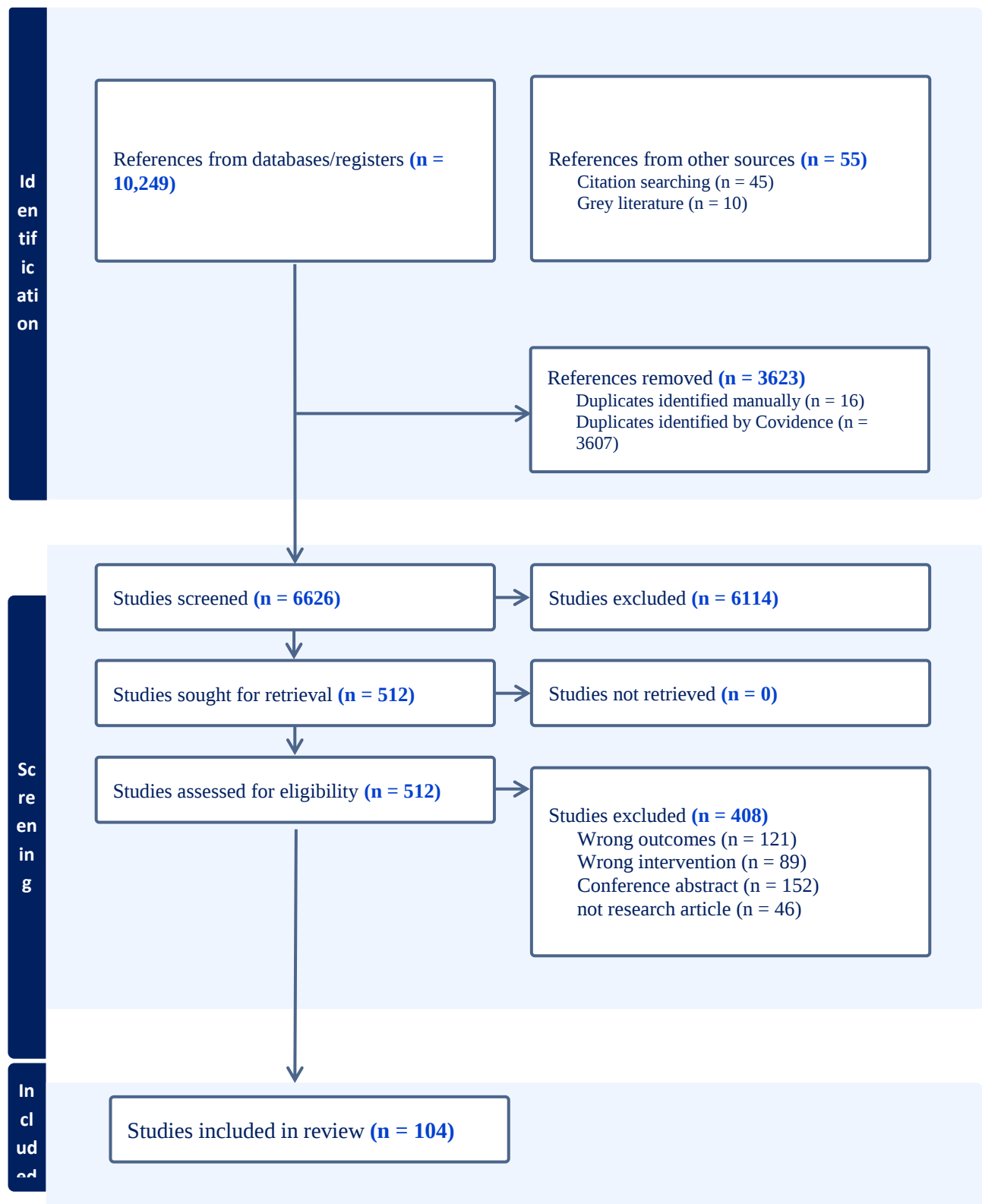
|                             |           |                 |                                                                                                                   |                                   |                                                                                       |                                                                                                                                                                                                                  |
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|                             |           |                 | (MIND) diet                                                                                                       |                                   |                                                                                       | lower GAD-7 score                                                                                                                                                                                                |
| Trovato et al, 2012         | Italy     | Cross sectional | Adherence to Mediterranean Diet profile                                                                           | 88 Stable Atrial Fibrillation pxs | Psychological Stress Measure (PSM)                                                    | <ul style="list-style-type: none"> <li>Greater Adherence to Mediterranean Diet profile associated with a reduced hazard of perceived stress</li> </ul>                                                           |
| Veronese et al, 2016        | USA       | RCT             | aMED (modified Mediterranean diet score)                                                                          | 4470 participants                 | Short-Form Health Outcome Survey (SF-12),                                             | <ul style="list-style-type: none"> <li>Higher aMED was significantly associated with a higher SF-12 physical composite and lower CES-D scores</li> </ul>                                                         |
| Wade et al, 2020            | Australia | Cross-over RCT  | Mediterranean diet with 3-4 daily serves of dairy food (MedDairy)                                                 | 41 aged $\geq 45$ yrs             | Profile of Mood States (POMS) and Short-Form Health Survey (SF-36)                    | <ul style="list-style-type: none"> <li>Significant improvements were observed for Total Mood Disturbance, Depression</li> </ul>                                                                                  |
| Yau et al, 2022             | China     | RCT             | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) Diet plus Forest Bathing (FB) versus MIND Diet | 72 hypertensive patients          | State and Trait Anxiety Inventory (STAI), Profile of Mood States Short Form (POMS-SF) | <ul style="list-style-type: none"> <li>Mean difference for state and trait anxiety level, total mood states, tension-anxiety, fatigue, anger, and confusion were significantly lower in MIND-FB group</li> </ul> |
| Zamani et al, 2023          | Iran      | Cross sectional | Mediterranean diet score (11 item)                                                                                | 435 women (20- 50 yrs)            | Depression, Anxiety, and Stress Scale (DASS-21)                                       | <ul style="list-style-type: none"> <li>Those in the third tertile of the Mediterranean diet score were at lower risk of anxiety, and stress compared with those in the first tertile</li> </ul>                  |
| Alfaro-Gonzalez et al, 2025 | Spain     | Cross sectional | Adherence to the MedDiet was assessed                                                                             | 428 University students, aged     | General Anxiety Disorder-7 (GAD-                                                      | <ul style="list-style-type: none"> <li>High adherence to the MedDiet</li> </ul>                                                                                                                                  |

|                              |        |                 |                                                                                                 |                                          |                                                                                                                     |                                                                                                                                                                                                             |
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|                              |        |                 | using the MEDAS questionnaire.                                                                  | 18-30 years                              | 7) was used                                                                                                         | exhibited lower scores for anxiety symptoms ( $p < 0.05$ ) than did students with low adherence to the MedDiet.                                                                                             |
| Ardekani M et al,2023        | Iran   | Cross sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet                         | 339 Adults with obesity aged 20-50 years | Depression, Anxiety, and Stress Scale (DASS-21) was used                                                            | <ul style="list-style-type: none"> <li>Lower odds of stress (<math>P &lt; 0.05</math>) in the highest versus lowest MIND diet tertiles but no association for anxiety (<math>P &gt; 0.05</math>)</li> </ul> |
| Cabrera-Suarez M et al, 2023 | Spain  | RCT             | Mediterranean Diet intervention compared to control (only usual clinical care)                  | 196 Adults with history of depression    | SF-36 health survey questionnaire was used                                                                          | <ul style="list-style-type: none"> <li>Intervention showed an improvement in some dimensions of HRQoL such as vitality, mental health component and general health</li> </ul>                               |
| Casas I et al,2023           | Spain  | RCT             | A Mediterranean diet intervention or a Mindfulness-Based Stress Reduction program or usual care | 680 Pregnant women                       | State Trait Anxiety Inventory (STAI), Perceived Stress Scale (PSS)), well-being (WHO Five Well Being Index (WHO-5)) | Participants in the Mediterranean diet group had significantly lower perceived stress and anxiety scores.                                                                                                   |
| Chowdhury U et al, 2024      | USA    | Cross sectional | Mediterranean diet pattern                                                                      | 1591 Adults 18 yrs and older             | Perceived Stress Scale and the Kessler Psychological Distress scale (K-6)                                           | <ul style="list-style-type: none"> <li>Significant negative correlations between perceived stress and mental distress with several components of the Mediterranean diet</li> </ul>                          |
| Dakanalis A et al, 2024      | Greece | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                                             | 558 Adults with MS aged 18-64 yrs.       | MS Quality of Life-54 (MSQOL-54)                                                                                    | <ul style="list-style-type: none"> <li>Elevated MD compliance was also independently</li> </ul>                                                                                                             |

|                            |          |                 |                                                                         |                                          |                                                                                       |                                                                                                                                                                                                   |
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|                            |          |                 |                                                                         |                                          |                                                                                       | associated with an improved quality of life                                                                                                                                                       |
| Duarte C et al, 2025       | Portugal | Cross sectional | Adherence to the Mediterranean diet (MEDAS)                             | 102 Adults with low socioeconomic status | HRQoL (SF-36)                                                                         | <ul style="list-style-type: none"> <li>No statistically significant correlation was found between MedDiet adherence and total HRQoL scores across the eight health concepts</li> </ul>            |
| Kabiri S et al, 2024       | Iran     | RCT             | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 52 Women with PCOS, aged 18 - 45 years   | Depression Anxiety Stress Scales 21 (DASS-21)                                         | <ul style="list-style-type: none"> <li>MIND diet significantly reduced anxiety compared to control</li> </ul>                                                                                     |
| Kamrani F et al, 2024      | Iran     | Cross sectional | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet | 4579                                     | Adults aged 30–70<br>Depression Anxiety Stress Scales 21 (DASS-21)                    | <ul style="list-style-type: none"> <li>Participants in the highest quartile of MIND diet exhibited significantly lower risks of anxiety and stress</li> </ul>                                     |
| Mahmoudzadeh S et al, 2023 | Iran     | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                     | 181 Volunteer women                      | Quality of Life Questionnaire (QLQ),<br>Depression Anxiety Stress Scales 21 (DASS-21) | <ul style="list-style-type: none"> <li>The individuals in the lowest quartile for the MD pattern had a significantly higher prevalence of a high stress score, poorer quality of life,</li> </ul> |
| Menichetti F et al, 2025   | Italy    | Cross sectional | Adherence to the Mediterranean diet (MEDAS)                             | 4957 Adults with obesity.                | State-Trait Anxiety Inventory (STAI2)                                                 | <ul style="list-style-type: none"> <li>A 7% reduction in the odds of anxiety for each 1-point MEDAS increase</li> </ul>                                                                           |
| Migdanis A et al, 2024     | Greece   | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                     | 60 Patients with crohn's disease.        | Quality of life (QoL) using the Crohn's and                                           | <ul style="list-style-type: none"> <li>Adherence to the MD was positively correlated with</li> </ul>                                                                                              |

|                          |           |                 |                                                                                        |                                                |                                                               |                                                                                                                                                                    |
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|                          |           |                 |                                                                                        |                                                | ulcerative colitis questionnaire CUCQ-8                       | quality of life (QoL)                                                                                                                                              |
| Ng L et al, 2023         | Australia | Cohort          | Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet                | 2844 Adults with mean age $47.3 \pm 9.7$       | Short-Form Health Survey-36 for HR-QoL                        | <ul style="list-style-type: none"> <li>An improvement in MIND was associated with an improvement in global QoL</li> </ul>                                          |
| Niu T et al, 2025        | China     | Cross sectional | Chinese version of Mediterranean-DASH Intervention for Neurodegenerative Delay (cMIND) | 6945 Seniors aged 65 and above.                | Generalized Anxiety Disorder Scale (GAD-7)                    | <ul style="list-style-type: none"> <li>The cMIND diet score had a significant protective effect on anxiety symptoms</li> </ul>                                     |
| Raad T et al, 2024       | Ireland   | RCT             | MedDiet intervention or Irish Healthy Eating Guidelines                                | 40 adults with rheumatoid arthritis (RA).      | Rheumatoid Arthritis Quality of Life Questionnaire (RAQoL)    | <ul style="list-style-type: none"> <li>Participants in the MedDiet group reported significantly better quality of life compared to HEG group</li> </ul>            |
| Radkhah N et al, 2023    | Iran      | RCT             | MedDiet intervention or control (standard care)                                        | 60                                             | Depression Anxiety and Stress Scale (DASS-21)                 | <ul style="list-style-type: none"> <li>Anxiety and stress scores decreased significantly in the Med diet as compared to control</li> </ul>                         |
| Shiraseb F et al, 2023   | Iran      | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                                    | 266 Females aged 18–48 yrs.                    | Depression Anxiety and Stress Scale (DASS-21)                 | <ul style="list-style-type: none"> <li>Significant inverse association between adherence to the Mediterranean diet and mild and moderate anxiety scores</li> </ul> |
| Staudacher M et al, 2023 | Australia | RCT             | MedDiet intervention or habitual diet                                                  | 48 Adults with irritable bowel syndrome (IBS). | Hospital anxiety and depression scale (HADS), quality of life | <ul style="list-style-type: none"> <li>MedDiet intervention improves anxiety symptoms and QoL</li> </ul>                                                           |

|                         |        |                 |                                                                        |                                           |                                                              |                                                                                                                                                          |
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|                         |        |                 |                                                                        |                                           | (IBS-QOL)                                                    |                                                                                                                                                          |
| Taherpour A et al, 2025 | Iran   | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                    | 350 Breastfeeding mothers.                | Quality-of-Life Questionnaire (QLQ)                          | <ul style="list-style-type: none"> <li>Adherence to the MD style was associated with high mother's Quality-of-Life (QoL)</li> </ul>                      |
| Tryfonos C et al, 2024  | Greece | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                    | 279 $\geq 65$ yr with multiple sclerosis. | State form of the anxiety inventory (STAI-6)                 | <ul style="list-style-type: none"> <li>Higher MD compliance was independently associated anxiety and perceived stress</li> </ul>                         |
| Tryfonos C et al, 2024  | Greece | Cross sectional | Adherence to the Mediterranean diet (MedDiet score)                    | 227 $\geq 65$ yr with multiple sclerosis. | MS Quality of Life-54 (MSQOL-54)                             | <ul style="list-style-type: none"> <li>Higher MD compliance was independently associated better quality of life</li> </ul>                               |
| Unal & Ozenoglu, 2024   | Turkey | Cross sectional | Mediterranean diet quality index for children and adolescents (KIDMED) | 750 University students age 19 to 24 yrs. | Depression anxiety stress scale-42 (DASS-42)                 | <ul style="list-style-type: none"> <li>Higher adherence to the KIDMED was correlated with lower stress levels</li> </ul>                                 |
| UygunOzel S et al, 2024 | Turkey | Cross sectional | Mediterranean Diet Adherence Screener (MEDAS)                          | 95 Adults with MS (18-65 yrs).            | Multiple Sclerosis Quality of Life-54 Instrument (MS-QoL-54) | <ul style="list-style-type: none"> <li>Adherence to the Mediterranean diet was associated with physical and mental quality of life parameters</li> </ul> |



**Figure 1:** PRISMA flow diagram of the screening and selection process for narrative review on the effect of Mediterranean diet on mental health