

Exploring the Role of The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) Diet on Psychological Disorders in Adults: A Scoping Review

M Zapawi MM^a, You YX^a, Mazri FH^a, Subramaniam P^c, Shahril MR^b, Ismail M^a, Wei Yap AXW^a, Kannan D^a, Shahar S^a

^aDietetic Programme, Centre for Healthy Ageing and Wellness (HCARE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia.

^bNutrition Programme, Centre for Healthy Ageing and Wellness (HCARE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia.

^cClinical Psychology and Behavioral Health Programme, Centre for Healthy Ageing and Wellness (HCARE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia.

ABSTRACT

Psychological disorders are a major global health concern, affecting millions of adults worldwide. The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet has emerged as a potential dietary approach for reducing the risk of psychological disorders. This scoping review aimed to map and synthesize the existing evidence on the association between MIND diet adherence and psychological disorders among adults. This review followed the Arksey and O'Malley (2005)'s framework and the PRISMA-ScR 2020 guidelines. Four databases (Scopus, Web of Science, PubMed, and the Cochrane Library) were searched. Of 236 records identified, 17 studies met the inclusion criteria (eight cross-sectional, five cohort, one case-control, and three randomized controlled trials (RCTs)). Most studies were conducted in Asia, particularly Iran, China and Pakistan. Three cross-sectional studies reported higher MIND diet adherence was associated with lower depression and anxiety, while one study demonstrated significant reductions in depression, anxiety and stress. However, other studies found no significant association with stress. Cohort study findings were inconsistent, with most reporting weak or non-significant associations, although two studies observed reduced depressive symptoms with higher MIND diet adherence. Two RCTs found no significant effects on psychological outcomes, whereas one reported significant improvements in depression and anxiety. The case-control study demonstrated an inverse association between MIND diet adherence and anxiety disorders. Although current evidence suggests that MIND diet adherence may improve psychological health, findings remain inconsistent across study designs. Further high-quality longitudinal studies and well-designed RCTs are needed to establish its effectiveness in preventing and managing psychological disorders in adults.

Keywords

MIND diet, psychological disorder, mental health, depression, anxiety

Corresponding Author

Dr. Yee Xing You
Dietetic Programme, Centre for
Healthy Ageing and Wellness (HCARE),
Faculty of Health Sciences,
Universiti Kebangsaan Malaysia,
Kuala Lumpur, Malaysia.
E-mail: youyeexing@ukm.edu.my

Received: 24th December 2025; Accepted:
7th August 2026

Doi:
<https://doi.org/10.31436/10.31436/imjm.v25i04/2959>

INTRODUCTION

Psychological disorders are mental conditions that affect cognition, emotion, behaviour, and brain function, leading impairing daily functioning.¹ Common psychological disorders include depression, anxiety

disorders, and attention-deficit/hyperactivity disorder (ADHD). Although neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease may co-exist or influence psychological symptoms, they are distinct

disorders with different underlying pathologies.² It is estimated that more than 300 million people worldwide, representing approximately 4.4% of the global population, experience major depressive disorders, while a similar number are affected by anxiety disorders, which frequently co-occur with depression.³ Furthermore, the Global Burden of Disease (GBD) Study found that approximately 970 million people, or one in eight individuals worldwide, were living with a psychological disorder in 2019.⁴ In Malaysia, the National Health and Morbidity Survey (NHMS) 2023 reported that the prevalence of depression has doubled since 2019, affecting approximately one million people (4.6% of individuals aged 15 and above). Alarming, nearly half of those affected reported experiencing thoughts of self-harm or suicide, particularly among individuals aged 16-29 years.⁵

Dietary habits and healthy lifestyle practices play important roles in promoting overall health and preventing psychological disorders.⁶ However, identifying the most effective dietary pattern for maintaining brain health remains an active area of research. Evidence suggests that dietary components such as nuts, berries, fish, and the Mediterranean dietary pattern possess neuroprotective properties compared with the Western dietary pattern.⁷ The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet combines key components of the Mediterranean diet and the Dietary Approaches to Stop Hypertension (DASH) diet.⁸ The MIND has been proposed as a modifiable lifestyle strategy to promote brain health and cognitive function. The MIND diet is rich in nutrients with anti-inflammatory and antioxidant properties, including lutein, zeaxanthin, vitamin E, and folate, which are believed to contribute to neuroprotection and cognitive health.⁹

In recent years, growing evidence has demonstrated that both the Mediterranean and DASH dietary patterns are associated with improved psychological well-being. The MIND diet emphasizes a high consumption of leafy greens, berries, olive oil, nuts, whole grains, legumes, and

other plant-based foods.¹⁰ Conversely, it limits the consumption of foods derived from animals and foods high in saturated fat, such as red meat, and its byproducts, butter, cakes, including pastries.¹¹ Although previous studies have highlighted the beneficial effects of the MIND diet on cognitive health,^{8,12,13} its potential role in preventing or managing psychological disorders, including depression and anxiety, remains less well established, particularly across diverse populations. Therefore, this scoping review aims to synthesize existing evidence on the association between adherence to the MIND diet and psychological disorders among adults and to evaluate its potential as a dietary strategy for promoting mental health.

METHODOLOGY

This scoping review has been performed relying on the framework outlined by Arksey and O'Malley (2005) and in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement.^{14,15} A PRISMA diagram detailing the review process is included. The review process followed five stages, as described below. The review protocol was submitted for registration on the Open Science Framework on 16 July 2024 (Registration number: osf.io/zp3da).

Identifying Research Questions

This review aims to map the existing literature on the MIND diet's association with psychological outcomes in adults, using a scoping review framework to identify knowledge gaps and guide future research. The research question was formulated to guide the review and identify relevant research. As a result, the main question of the review is – what is the association between adherence to the MIND diet and psychological disorders among adults? was the basis for this scoping review.

Identifying Relevant Studies

Search Strategy

This scoping review queried four databases: Scopus, Web of Science (WoS), PubMed, and Cochrane Library

for studies published between 2015 and 2025 to systematically identify relevant publications. The PICO (Population, Intervention, Comparator, and Outcome) guided the selection criteria, focusing on adults with psychological disorders as the target population, MIND diet as the intervention, and psychological disorders as the outcome which are detailed in Appendix 1. Reviewers meticulously analysed Medical Subject Headings (MeSH) for important terms associated with the MIND diet, psychological disorders, and adults. Truncation and wildcard parameters, including Boolean connectors “AND/OR” techniques, were applied to ensure that the search focused on the specific key terms. The search string employed in this review is detailed in Appendix 2.

Study Selection

Inclusion Criteria:

- Studies reporting on the MIND diet and psychological disorders
- Peer-reviewed full-text articles published in English between 2015 - 2025
- Studies with adult participants (≥18 years)

Exclusion Criteria:

- Editorials, reviews, abstracts only publications
- Non-human studies
- Non-English publications

Two reviewers independently screened titles and abstracts, followed by full-text assessment. Discrepancies were resolved through discussion or consultation with a third reviewer.

Charting the Data

All the selected data gathered from the journal databases were categorized utilizing EndNote software. A standardized data extraction form was developed and pilot-tested by the review team to ensure consistency and accuracy, and this form was subsequently used to extract all relevant variables from the included studies. The extracted information includes the author(s), publication year, study objectives and purposes, and

participants' characteristics - age, study design, settings, duration of study, study populations, features, outcomes, and findings.

Collating, Summarizing and Reporting Results

Following the Arksey and O'Malley (2005) guideline, the final step involved organizing the relevant findings according to the review questions, with a focus on the relationship that exists between the MIND diet and psychological disorders in adults. Figure 1 presents the flow diagram for this scoping review, which outlines the studies considered for this work.

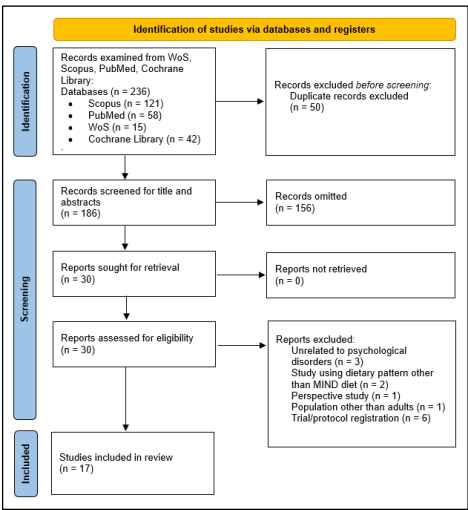


Figure 1: The PRISMA 2020 for association between MIND diet with psychological disorders among adults.

RESULTS

Characteristics of the Selected Studies

Table I displays the characteristics of the selected studies, which were published between 2019 and 2024. Note that the research designs include eight (47.1%) cross-sectional studies, five (29.4%) cohort studies, three (17.6%) randomized clinical trials, and one (5.9%) case-control study. While most studies included both men and women, encompassing adults and older adults, only two studies focused exclusively on women. Besides, most studies were also conducted in Iran and were primarily cross-sectional (8 of 17). The sample sizes varied from 52 to 15,980 participants, with age spanning from 18 to 79 years old.

Author(s) (Year)	Country	Study Design	N	Participants	Age Range (Mean Age)
Ardekani <i>et al.</i> (2023)	Iran	Cross-sectional study	339	Obese adults	20 to 50 years (40.6 years)
Barkhordari <i>et al.</i> (2022)	Iran	Cross-sectional study	7165	Adults	20 to 70 years
Seifollahi <i>et al.</i> (2022)	Iran	Cross-sectional study	282	Obese and overweight women	18 to 56 years (36.5 years)
Rostami <i>et al.</i> (2022)	Iran	Cross-sectional study	400	Health professional males	- (38.7 years)
Haghighatdoost <i>et al.</i> (2020)	Iran	Cross-sectional study	2818	Adults	-
Salari-Moghaddam <i>et al.</i> (2019)	Iran	Cross-sectional study	3176	Adults	18 to 55 years
Kamrani <i>et al.</i> (2024)	Iran	Cross-sectional study	4579	Healthy government employees	30 to 70 years
Kabiri <i>et al.</i> (2024)	Iran	Randomized clinical trial	52	Women with PCOS	18 to 45 years
Lawrie <i>et al.</i> (2023)	United Kingdom	Cross-sectional study	162	Adults diagnosed with Parkinson's Disease	- (62.0 years)
Ma <i>et al.</i> (2023)	United Kingdom	Randomized controlled trial	314	Healthy individuals	18 to 79 years (40.6 years)
Arshad <i>et al.</i> (2024)	United Kingdom	Cohort study	4824	Civil servants	35 to 55 years
Wang <i>et al.</i> (2023)	China	Cohort study	2724	Older adults	>65 years
Yau <i>et al.</i> (2022)	China	Randomized controlled pilot study	72	Older adults with hypertension	> 50 years (66.9 years)
Cherian <i>et al.</i> (2021)	United States	Cohort study	709	Older adults	- (80.4 years)
Cherian <i>et al.</i> (2022)	United States	Cohort study	86	Older adults with history of stroke	- (82.0 years)
Torabynasab <i>et al.</i> (2023)	Pakistan	Case-control study	255	85 patients with anxiety disorders 170 healthy adults	18 to 60 years
Fresan <i>et al.</i> (2019)	Spain	Cohort study	15,980	University graduates	-

Table I: General characteristics for the selected studies ($n=17$)

Construction of the MIND Diet Scores in the Selected Studies

Table II summarize the comparison of food components between the primary version of the MIND diet and those used in the selected studies. Originally, the primary MIND diet consisted of 15 components, having 10 brain-healthy and 5 brain-unhealthy food groups being studied.⁸ In the chosen studies, the primary MIND diet was also utilized with elimination of certain food groups. Wine is eliminated in most of the selected studies, due to insufficient data on wine consumption; and the prohibition of consuming wine in the study population.¹⁶⁻²⁴ Besides, four studies eliminated the component of olive oil consumption due to limited information as well.^{18,20,22,25} The rest of selected studies considered all components in the primary MIND diet.

Table III presents the tools in which the MIND diet scores are estimated in the selected studies. Eight cross-sectional studies (47.1%) used a validated semi-quantitative food frequency questionnaire to estimate the participants' dietary intake, which the authors have indicated that the food frequency questionnaires are reliable and validated to be applied in the study populations.^{16-20,23,26,27}

Type and Its Assessment of Psychological Disorders

This review identified several psychological disorders that were examined in association with the MIND diet, as demonstrated in Table 3. The most commonly studied disorders were depression and anxiety, which were assessed in multiple studies.^{16,17,19-31} Additionally, stress was also evaluated in several studies.^{16,17,19,23,24,26} Other psychological outcomes investigated included sleep disorders, mood disorders, day-time sleepiness, insomnia, psychosomatic complaints, and psychological distress. A variety of validated assessment tools were employed to measure psychological disorders across the studies. The Depression Anxiety Stress Scales (DASS-21) is commonly utilized to evaluate anxiety, depression, and stress.^{16,17,19,23,24,26}

The Association between MIND Diet and Psychological Disorders

Table III provides a summary regarding the results of the selected research. Of the 17 studies incorporated in this review, 15 explored the connection between the MIND diet and psychological outcomes, for example, anxiety, depression, or stress. Notably, among the eight cross-sectional studies, three studies found substantial associations between the MIND diet and depression, two studies reported significant associations with anxiety, and one study found a significant association with stress.^{16-20,23,26,27} In addition, five cohort studies also explored these psychological outcomes.^{22,25,28,29} Among them, only two found a relevant association between the MIND diet and depression. Three RCTs were included however only one recorded a substantial association between the MIND diet with depression

Table II: Comparison of food components in primary MIND diet and selected studies

Selected studies	MIND diet Food Components														
	Whole grains	Green leafy vegetables	Other vegetables	Berries	Olive oil	Fish (not fried)	Beans	Nuts	Poultry (not fried)	Wine	Pastries and sweets	Butter, margarine	Cheese	Red meat and products	Fried/fast foods
Morris <i>et al.</i> (2015)*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Barkhordari <i>et al.</i> (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Torabynasab <i>et al.</i> (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Seifollahi <i>et al.</i> (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fresan <i>et al.</i> (2019)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ardekani <i>et al.</i> (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Rostami <i>et al.</i> (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Haghighatdoost <i>et al.</i> (2020)	✓	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Salari-Moghaddam <i>et al.</i> (2019)	✓	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Yau <i>et al.</i> (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cherian <i>et al.</i> (2022)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cherian <i>et al.</i> (2021)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wang <i>et al.</i> (2023)	✓	✓	✓	✓	X	✓	✓	✓	X	X	✓	X	X	X	X
Lawrie <i>et al.</i> (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ma <i>et al.</i> (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kabiri <i>et al.</i> (2024)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓
Arshad <i>et al.</i> (2024)	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kamrani <i>et al.</i> (2024)	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓

*Primary version of the MIND diet; MIND, Mediterranean-DASH Intervention for Neurodegenerative Delay

and anxiety.²⁴ Meanwhile, one case-control study found a significant association between higher MIND diet adherence and lower anxiety.²¹

Regarding dietary intake, four cross-sectional studies, two cohort studies, and one case-control study reported higher fruit and vegetable intake among participants with the highest MIND diet scores. However, significant associations with psychological outcomes (depression, anxiety, or stress) were only found in four studies.^{16,17,21,25} Among the 17 studies, 13 studies incorporated olive oil in their assessment of the MIND diet score. However, only five studies reported significant associations with psychological outcomes, for instance, anxiety, depression, or stress.^{16,17,21,23,24} Apart from that, four studies reported relatively high intake of legumes such as nuts and beans among participants regarding the top quartiles of MIND diet score and found significant associations with depression, anxiety, or stress.^{16,17,21,25} Regarding the intake of unhealthy foods, seven studies reported lower consumption among participants with higher MIND diet scores.^{16-19,21,25,28} However, only four of

these studies found significant associations with depression, anxiety, or stress.^{16,17,21,25}

DISCUSSION

Key Findings

This scoping review examined how adherence to the MIND diet is associated with psychological disorders in adults. Our comprehensive analysis of the literature revealed mixed findings regarding the association between the MIND diet and psychological disorders. While some studies suggest a positive association, the overall findings indicate variability in results. Notably, observational studies tended to show stronger associations than RCTs, possibly reflecting differences in follow-up duration or confounding factors. The review encompassed a range of psychological disorders including stress, sleep disorders, mood disorders, psychosomatic complaints and psychological distress, with depression and anxiety being the most frequently studied.

Table III: Estimation of the MIND diet scores, type of assessment tools, psychological disorders measures and outcomes of the selected research.

Author/ Year/ Country	Estimation of MIND Diet Score	Psychological Disorders Assessment	Psychological Disorders Measured	Outcome
Barkhordari et al. (2022) Iran	178-item Semi- quantitative FFQ	DASS-21 questionnaire	Depression Anxiety Stress	High MIND diet adherence was linked to lower odds concerning depression (OR=0.62, 95% CI 0.40 – 0.96; P=0.02) and anxiety (OR=0.61, 95% CI 0.41-0.91; P=0.01) but indicated no association with stress (OR=0.57, 95% CI 0.28 – 1.14; P=0.83).
Torabynasab et al. (2023) Pakistan	147-item validated FFQ	Generalized Anxiety Disorder-7 (GAD-7) questionnaire	Anxiety	Higher MIND diet adherence significantly reduced the risk concerning anxiety disorders (OR: 0.03, 95% CI: 0.01, 0.09) (p<0.001). Insignificant associations were found between MIND diet adherence and severity regarding depression (OR = 0.87 95%, CI: 0.7–1.09, P = 0.23), anxiety (OR = 1.02, 95% CI: 0.81–1.27, P = 0.86), stress (OR = 0.99 95%, CI: 0.79–1.23, P = 0.92) or sleep quality (OR = 0.99 95%, CI: 0.77–1.27, P = 0.96).
Seifollahi et al. (2022) Iran	Semi- quantitative FFQ	Pittsburgh Sleep Quality Index (PSQI) DASS	Sleep disorders Depression Anxiety Stress	No association was assessed between MIND diet adherence and depression [HR 0.96 (95% CI 0.89, 1.04)].
Fresan et al. (2019) Spain	136-item validated FFQ	Self-reported depression or/and antidepressant medication use at baseline or within the first 2 years upon entry to the cohort.	Depression	Higher MIND diet adherence was correlated to lower stress in fully adjusted model (OR: 0.913; 95% CI: 0.842-0.990). However, no significant correlations were found for depression and anxiety.
Ardekani et al. (2023) Iran	168-item semi- quantitative FFQ	Self-administered DASS-21 questionnaire	Depression Anxiety Stress	MIND diet adherence was associated with better sleep quality (OR for T3 vs. T1: 0.56 (95% CI: 0.34, 0.92), P- trend =0.023) and reduced daytime sleepiness (P- trend<0.05) and insomnia (OR for T3 vs. T1: 0.54 (95% CI: 0.31, 0.93), P trend =0.031), though insignificant correlations were determined for stress, anxiety, or depression (P>0.05).
Rostami et al. (2022) Iran	168-item semi- quantitative FFQ	PSQI DASS Standard questionnaire	Sleep quality Depression Anxiety Stress Day-time sleepiness and insomnia	A non-significant trend towards fewer depressive symptoms was found with higher MIND diet adherence (T3 vs. T1: β = -0.1559 (SE=0.0840, p=0.06); p trend=0.08).
Cherian et al. (2021) United States	144-item semi- quantitative FFQ	10-item version concerning the Center for Epidemiologic Studies Depression (CESD) scale	Depression	No significant difference was found for anxiety or mood disorders after MIND diet intervention.
Yau et al. (2022) Hong Kong	163-item semi- quantitative Harvard FFQ	Self-reported Chinese questionnaires regarding State and Trait Anxiety Inventory (STAI) The Profile of Mood States Short Form (POMS-SF)	Anxiety Mood disorders	

Cont.

Wang et al. (2023) China	100-item non- quantitative FFQ	100-item non- quantitative FFQ	Depression	Higher MIND diet adherence minimized the risk of depression, especially in older adults exposed to indoor pollution (HR: 1.72, 95% CI: 1.24,2.38).
Haghighatdoost et al. (2020) Iran	106-item self- completed dish-based FFQ	Self- administered Persian validated questionnaire	Psychosomatic complaints	Highest adherence to the MIND diet possessed lower risk of psychological complaints (OR = 0.60, 95% confidence interval (CI): 0.42, 0.86; P trend < 0.0001), and pharyngeal-respiratory (OR = 0.57, 95% CI: 0.41, 0.79; P = 0.002).
Salari- Moghaddam et al. (2019) Iran	106-item semi- quantitative dish-based FFQ	Iranian validated version of Hospital Anxiety and Depression Scale (HADS) General Health Questionnaire (GHQ)	Depression anxiety Psychological distress	Highest adherence to the MIND diet possessed lower odds of depression (OR = 0.68, 95% CI: 0.53-0.89) and psychological distress (OR = 0.68, 95% CI: 0.52–0.89). However, there was no significant correlation with anxiety.
Ma et al. (2023) United Kingdom	Positive and Negative Affect Schedule (PANAS) questionnaire	Positive and Negative Affect Schedule (PANAS) questionnaire	Mood	Highest adherence to the MIND diet possessed lower odds of depression (OR = 0.68, 95% CI: 0.53–0.89) and psychological distress (OR = 0.68, 95% CI: 0.52–0.89). However, there was no significant correlation with anxiety.
Cherian et al. (2022) United States	144-item semi quantitative FFQ	10-item version of the CESD scale	Depression	Insignificant differences were found between tertiles of MIND diet adherence and depressive symptoms in stroke survivors (P = 0.34), even after adjusting for confounding variables.
Lawrie et al. (2023) United Kingdom	130-item semi- quantitative European Prospective Investigation into Cancer FFQ (EPIC FFQ)	Beck Depression Inventory HADS Epworth Sleepiness Scale Unified Parkinson's Disease Rating Scale (UPDRS)	Depression Anxiety Daytime sleepiness Sleep problems	Insignificant correlations were found between the MIND diet and depression, anxiety, sleep problems, or daytime sleepiness.
Kabiri et al. (2024) Iran	3-day food record	Iranian- validated DASS-21 questionnaire	Depression Anxiety Stress	MIND diet resulted in substantial decreases in depression and anxiety scores (P = 0.011 and P = 0.024, respectively), having no substantial changes regarding stress score (P = 0.689) in comparison to the control group.
Arshad et al. (2024) United Kingdom	127-item food frequency questionnaire	CESD scale	Recurrent depressive symptoms	Highest adherence to the MIND diet possessed lower odds of recurrent depressive symptoms (OR = 0.74, 95% CI: 0.58 to 0.93) after adjusting for potential confounders.
Kamrani et al. (2024) Iran	118-item semi- quantitative food frequency questionnaire (FFQ)	DASS-21 questionnaire	Depression Anxiety Stress	Depression, Anxiety Stress, Highest adherence to the MIND diet had substantially lower risks concerning depression (OR: 0.611, 95% CI: 0.447–0.836; P=0.005), anxiety (OR: 0.559, 95% CI: 0.418-0.746; P<0.001), and stress (OR: 0.629, 95% CI: 0.419–0.944; P=0.008).

FFQ, Food Frequency Questionnaire; MIND, Mediterranean-DASH Intervention for Neurodegenerative Delay; OR, Odd Ratio; CI, Confidence Interval; HR, Hazard Ratio.

Associations of MIND diet and Psychological Disorders

This review found both positive and inconclusive associations, varying by study design and psychological outcome. While some studies demonstrate promising connections between higher MIND diet scores and a lower risk or severity of certain psychological disorders, others show mixed or inconclusive results. Table IV summarises the findings on the MIND diet and psychological disorders based on the research's outcomes included.

This review illuminated that the MIND diet may offer unique advantages over other dietary patterns due to its emphasis on neuroprotective components such as berries and green leafy vegetables. The MIND diet distinguishes itself from other dietary patterns through its recommendation for consumption of berries, which have lots of antioxidants, instead of other fruits (suggested in the Mediterranean and DASH diets) and emphasizes the importance of consuming green leafy vegetables, which are packed with vital nutrients. Saghafian et al. (2018) found that vegetable and fruit intake was positively linked to a lower risk concerning depression.³² The high levels of minerals, vitamins, and polyphenols in berries and green leafy vegetables help protect against free radicals.³³ These foods, key components with regard to the MIND diet, are abundant in antioxidants as well as possess anti-inflammatory properties (such as Vitamin E). They also contribute to the inhibition of β -amyloid deposition (via folate, Vitamin E, carotenoids, and flavonoids) and prevent neurotoxic cell death (through flavonoids, Vitamin E), demonstrating their beneficial and direct connection to mental health.³⁴ These effects may be mediated by antioxidant and anti-inflammatory pathways, though causal mechanisms remain speculative and require further investigation.

However, given the high cost and limited availability of berries in Asia markets, the direct adoption of the original MIND diet may not be fully appropriate for Southeast Asian populations. Previous work adapting

the MIND diet for Malaysia (MY-MINDD©) has already addressed this issue by replacing the berries group with locally available, flavonoid-rich fruits such as dried prunes, roselle, raisins, pomegranate, red dragon fruit, and pink guavas.¹⁰ These fruits contain substantial amounts of anthocyanins, flavonoids, and other neuroprotective bioactive compounds comparable to those found in berries.

The findings of this review demonstrate that the MIND diet consistently emphasizes fish consumption, with all included studies incorporating fish as a key component. Reduced fish consumption appears to be linked to an increased incidence of depression.³⁵ Fish is a primary dietary source of omega-3 polyunsaturated fatty acids (PUFAs), which have been discovered to influence inflammatory pathways and neurotransmitter function, which are critical in managing depressive symptoms.^{36,37} Besides, whole grains are an essential element of the MIND diet, consistently included in all selected studies. Whole grains are high in bioactive compounds, comprising fiber, vitamins B and E, antioxidants, magnesium, and phytoestrogens, which have been proven to lower the risk concerning psychological disorders.³⁸ El Mikkawi et al. (2024) revealed that a strong adherence to the Mediterranean diet, which is marked by a high intake of whole grains, was linked to lower anxiety and stress level.³⁹ Whole grain consumption may reduce insulin resistance, which is linked to improved mood and reduced anxiety.⁴⁰

Majority of the selected studies considered olive oil in the MIND diet. According to RCT, numerous observational studies have found a negative relationship between olive oil consumption and the risk of depression.⁴¹ Moreover, olive oil, an essential part of the Mediterranean diet, has been associated with a reduced risk of depression according to a longitudinal analysis and randomized trial.⁴² The monounsaturated fatty acids and bioactive phenolic compounds found in olive oil are probably responsible for its biological effects in combating depression and mood disorders.⁴¹ Legumes are abundant in bioactive compounds having anti-

Table IV: Summary of findings

Selected studies	Study design	Associations of MIND diet and Psychological Disorders								
		Depression	Anxiety	Stress	Sleep disorders	Day-time sleepiness	Insomnia	Mood disorders	Psychosomatic complaints	Psychological distress
Salari-Moghaddam <i>et al.</i> (2019)	Cross-sectional	– ^a	=	NA	NA	NA	NA	NA	NA	– ^a
Haghighatdoost <i>et al.</i> (2020)	Cross-sectional	NA	NA	NA	NA	NA	NA	NA	– ^a	NA
Barkhordari <i>et al.</i> (2022)	Cross-sectional	– ^a	– ^a	=	NA	NA	NA	NA	NA	NA
Scifollahi <i>et al.</i> (2022)	Cross-sectional	=	=	=	=	NA	NA	NA	NA	NA
Rostami <i>et al.</i> (2022)	Cross-sectional	=	=	=	– ^a	– ^a	– ^a	NA	NA	NA
Ardekani <i>et al.</i> (2023)	Cross-sectional	=	=	– ^a	NA	NA	NA	NA	NA	NA
Lawrie <i>et al.</i> (2023)	Cross-sectional	=	=	NA	=	=	NA	NA	NA	NA
Kamrani <i>et al.</i> (2024)	Cross-sectional	– ^a	– ^a	– ^a	NA	NA	NA	NA	NA	NA
Fresan <i>et al.</i> (2019)	Cohort	=	NA	NA	NA	NA	NA	NA	NA	NA
Cherian <i>et al.</i> (2021)	Cohort	=	NA	NA	NA	NA	NA	NA	NA	NA
Cherian <i>et al.</i> (2022)	Cohort	=	NA	NA	NA	NA	NA	NA	NA	NA
Wang <i>et al.</i> (2023)	Cohort	– ^a	NA	NA	NA	NA	NA	NA	NA	NA
Arshad <i>et al.</i> (2024)	Cohort	– ^a	NA	NA	NA	NA	NA	NA	NA	NA
Yau <i>et al.</i> (2022)	RCTs	NA	=	NA	NA	NA	NA	=	NA	NA
Ma <i>et al.</i> (2023)	RCTs	NA	NA	NA	NA	NA	NA	=	NA	NA
Kabiri <i>et al.</i> (2024)	RCTs	– ^a	– ^a	=	NA	NA	NA	NA	NA	NA
Torabynasab <i>et al.</i> (2023)	Case-control	NA	– ^a	NA	NA	NA	NA	NA	NA	NA

^asignificant association with MIND diet; – negative/inverse association with MIND diet; = no difference/association

inflammatory properties, essential for reducing inflammation and oxidative stress. Other than that, they provide valuable protein, minerals, vitamin B, as well as beneficial phytochemicals with biological effects.¹⁰ A study examining the link between the Dietary Phytochemical Index (DPI) and psychological disorders found that a higher intake of phytochemical-rich foods was inversely related to the likelihood of experiencing depression and anxiety symptoms.⁴³

Moreover, the MIND diet comprises limited amounts of unhealthy foods. It includes butter, red meat, fried/fast foods, pastries, and sweets which promote inflammation and oxidative stress, that may be damaging to brain health.⁸ The intake of butter, red meat, and margarine has been discouraged in MIND diet. Many prospective research works have examined a correlation between a diet low in saturated and trans-unsaturated (hydrogenated) fats, which slows the rates of psychological disorders.^{44–46} Frying, as a cooking method, greatly reduces the levels of n-3 and n-6 fatty acids.⁴⁷ Long-term exposure to acrylamide, a common contaminant in fried foods, encourages lipid peroxidation as well as oxidative stress, which

contributes to neuroinflammation in the brain that may lead to psychological disorders.⁴⁸ Excessive consumption of sweets/sugar can also disrupt insulin and glucose metabolism. It increases neuroinflammation and oxidative stress, leading to structural changes in the brain which would impact mental health.¹²

The Potential Role of MIND diet in Sleep Disorders

Among the studies reviewed, only one explored the correlation that exists between the MIND diet and sleep disorders, discovering a significant association. Sleep is a critical component of overall well-being and disruptions in sleep have been linked to a variety of psychological disorders.^{49,50} High intake of MIND diet food components, vegetables, beans, berries and whole grains, was linked to improved sleep quality, with reduced insomnia and daytime sleepiness.¹⁹ The MIND diet, rich in anti-inflammatory components like omega-3 fatty acids found in walnuts and fish, folate in green leafy vegetables, vitamin E in olive oil and nuts, and flavonoids in berries, may provide stronger anti-inflammatory effects than Mediterranean or DASH diets alone.⁵¹ Therefore, the MIND diet could serve a practical function in enhancing sleep quality and possibly

reducing the risk of sleep disorders. This underscores the necessity for further research exploring the correlation that exists between the MIND diet and sleep disorders.

STRENGTHS

This review possesses several notable strengths. First and foremost, this review lies in its comprehensive coverage of research conducted since the MIND diet's establishment in 2015. By focusing on studies from this period, it provides a timely and relevant snapshot of the emerging evidence linking the MIND diet to psychological disorders, ensuring that the analysis reflects the most current insights in this evolving field. Besides, the inclusion of studies that span various psychological disorders like depression, anxiety, stress, and sleep disturbances, offering a comprehensive understanding with regard to the possible impacts concerning the MIND diet. Additionally, the variety of study designs (e.g., cross-sectional studies, RCTs, and cohort studies) enhances the analysis by integrating diverse methodological perspectives and results. While the benefits of the MIND diet for cognitive health were extensively studied, this is among the first reviews that specifically focus on its link to psychological disorders like depression, anxiety, and stress.

LIMITATIONS

Upon reviewing the current literature on the MIND diet and psychological disorders, several studies reported no significant associations. This heterogeneity among the included studies could be due to variations in sample size, participant characteristics, and health status, differences in the FFQ employed to examine food intake and the psychological health assessment questionnaires, and the methods for calculating MIND diet scores. Besides, most studies focus on depression and anxiety, leaving other psychological disorders comparatively understudied. For instance, there is limited research on the MIND diet's effects on bipolar disorder, schizophrenia, or eating disorders.

Furthermore, most studies use cross-sectional designs, which are unable to determine causality or investigate the long-term effects concerning the MIND diet with regard to mental health. Longitudinal studies are scarce, with only a few examining outcomes over time.^{28,29} Apart from that, there is a shortage of RCTs that could provide stronger evidence for the diet's efficacy. There is also limited exploration concerning the potential mechanisms through which the MIND diet could impact mental health, including its effects on inflammation, oxidative stress, or gut microbiota. Therefore, addressing these gaps in future research would significantly enhance our comprehension regarding the MIND diet's role in psychological health.

CONCLUSIONS

This scoping review highlights the potential roles of the MIND diet in reducing the risk of psychological disorders, particularly depression, anxiety, and stress. Although the available evidence suggests promising associations, the underlying mechanisms through which the MIND diet influences psychological health remain unclear. Future research should focus on elucidating these biological and behavioural mechanisms, particularly across diverse populations and cultural. In addition, investigating the role of gut microbiota modulation and the gut–brain axis may provide valuable insights into the relationship between the MIND diet and psychological health. Further, integrating the MIND diet into dietary guidelines could serve as a preventive strategy for mental health, particularly in populations at higher risk for psychological disorders.

FUNDING

This study is funded by Universiti Kebangsaan Malaysia under the Research University Grant (GUP-2024-019).

CONFLICT OF INTEREST

The authors acknowledge no conflict of interest.

ACKNOWLEDGEMENTS

I sincerely thank all the co-authors for their contributions to this review and the research team for their unwavering dedication and support.

REFERENCES

1. Tay KW, Subramaniam P, Oei TP. Cognitive behavioural therapy can be effective in treating anxiety and depression in persons with dementia: a systematic review. *Psychogeriatrics*. 2019;19(3):264-275. Doi: 10.1111/psyg.12391
2. Kaur P, Sharma M. Diagnosis of Human Psychological Disorders using Supervised Learning and Nature-Inspired Computing Techniques: A Meta-Analysis. *J Med Syst*. 2019;43(7):204. Doi: 10.1007/s10916-019-1341-2
3. Chodavadia P, Teo I, Poremski D, et al. Prevalence and economic burden of depression and anxiety symptoms among Singaporean adults: results from a 2022 web panel. *BMC Psychiatry*. 2023;23(1):104. Doi: 10.1186/s12888-023-04581-7
4. Chan JKN, Correll CU, Wong CSM, et al. Life expectancy and years of potential life lost in people with mental disorders: a systematic review and meta-analysis. *EClinicalMedicine*. 2023;65:102294. Doi: 10.1016/j.eclinm.2023.102294
5. IPH. National Health & Morbidity Survey 2023 [Internet]. 2023; Accessed September 7, 2024. Available from: <https://iku.nih.gov.my/images/nhms2023/key-findings-nhms-2023.pdf>
6. Malek Rivan NF, Yahya HM, Shahar S, et al. The Impact of Poor Nutrient Intakes and Food Insecurity on the Psychological Distress among Community-Dwelling Middle-Aged and Older Adults during the COVID-19 Pandemic. *Nutrients*. 2021;13(2). Doi: 10.3390/nu13020353
7. Shahar S, Omar A, Vanoh D, et al. Approaches in methodology for population-based longitudinal study on neuroprotective model for healthy longevity (TUA) among Malaysian Older Adults. *Aging Clin Exp Res*. 2016;28(6):1089-1104. Doi: 10.1007/s40520-015-0511-4
8. Morris MC, Tangney CC, Wang Y, et al. MIND diet slows cognitive decline with aging. *Alzheimers Dement*. 2015;11(9):1015-1022. Doi: 10.1016/j.jalz.2015.04.011
9. La Fata G, Weber P, Mohajeri MH. Effects of vitamin E on cognitive performance during ageing and in Alzheimer's disease. *Nutrients*. 2014;6(12):5453-5472. Doi: 10.3390/nu6125453
10. Zapawi MMM, You YX, Shahar S, et al. Development of Malaysian-MIND diet scores for prediction of mild cognitive impairment among older adults in Malaysia. *BMC Geriatr*. 2024;24(1):387. Doi: 10.1186/s12877-024-04966-7
11. Arjmand G, Abbas-Zadeh M, Eftekhari MH. Effect of MIND diet intervention on cognitive performance and brain structure in healthy obese women: a randomized controlled trial. *Sci Rep*. 2022;12(1):2871. Doi: 10.1038/s41598-021-04258-9
12. Huang X, Aihemaitijiang S, Ye C, et al. Development of the cMIND Diet and Its Association with Cognitive Impairment in Older Chinese People. *J Nutr Health Aging*. 2022;26(8):760-770. Doi: 10.1007/s12603-022-1829-1
13. Saito S, Yamamoto Y, Ihara M. Development of a Multicomponent Intervention to Prevent Alzheimer's Disease. *Front Neurol*. 2019;10:490. Doi: 10.3389/fneur.2019.00490
14. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. Doi: 10.1136/bmj.n71
15. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*. 2005;8(1):19-32. Doi: 10.1080/1364557032000119616
16. Ardekani AM, Vahdat S, Hojati A, et al. Evaluating the association between the Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet, mental health, and cardio-metabolic risk factors among

- individuals with obesity. *BMC Endocr Disord.* 2023;23(1):29. Doi: 10.1186/s12902-023-01284-8
17. Barkhordari R, Namayandeh M, Mirzaei M, et al. The relation between MIND diet with psychological disorders and psychological stress among Iranian adults. *BMC Psychiatry.* 2022;22(1):496. Doi: 10.1186/s12888-022-04128-2
 18. Haghghatdoost F, Feizi A, Esmailzadeh A, et al. The MIND (Mediterranean-DASH Diet Intervention for Neurodegenerative Delay) and Mediterranean Diets are differently associated with psychosomatic complaints profile in adults: Results from SEPAHAN Cross-sectional study. *Mediterranean Journal of Nutrition and Metabolism.* 2020;13(4):341-359. Doi: 10.3233/mnm-200426
 19. Rostami H, Parastouei K, Samadi M, et al. Adherence to the MIND dietary pattern and sleep quality, sleep related outcomes and mental health in male adults: a cross-sectional study. *BMC Psychiatry.* 2022;22(1):167. Doi: 10.1186/s12888-022-03816-3
 20. Salari-Moghaddam A, Keshteli AH, Mousavi SM, et al. Adherence to the MIND diet and prevalence of psychological disorders in adults. *J Affect Disord.* 2019;256:96-102. Doi: 10.1016/j.jad.2019.05.056
 21. Torabynasab K, Shahinfar H, Jazayeri S, et al. Adherence to the MIND diet is inversely associated with odds and severity of anxiety disorders: a case-control study. *BMC Psychiatry.* 2023;23(1):330. Doi: 10.1186/s12888-023-04776-y
 22. Wang, Ye C, Huang X, et al. cMIND Diet, Indoor Air Pollution, and Depression: A Cohort Study Based on the CLHLS from 2011 to 2018. *Nutrients.* 2023;15(5). Doi: 10.3390/nu15051203
 23. Kamrani F, Kachouei AA, Sobhani SR, et al. Nourishing the mind: how the EAT-Lancet reference diet (ELD) and MIND diet impact stress, anxiety, and depression. *BMC Psychiatry.* 2024;24(1):709. Doi: 10.1186/s12888-024-06165-5
 24. Kabiri SS, Javanbakht Z, Zangeneh M, et al. The effects of MIND diet on depression, anxiety, quality of life and metabolic and hormonal status in obese or overweight women with polycystic ovary syndrome: a randomised clinical trial. *Br J Nutr.* 2024;1-14. Doi: 10.1017/S0007114524001168
 25. Arshad H, Recchia D, Head J, et al. Adherence to MIND Diet and Risk of Recurrent Depressive Symptoms: Prospective Whitehall II Cohort Study. *Nutrients.* 2024;16(23). Doi: 10.3390/nu16234062
 26. Seifollahi A, Sardari L, Yarizadeh H, et al. Associations between adherence to the MIND diet and prevalence of psychological disorders, and sleep disorders severity among obese and overweight women: A cross-sectional study. *Nutr Health.* 2022;2601060221127461. Doi: 10.1177/02601060221127461
 27. Lawrie S, Coe S, Mansoubi M, et al. Dietary Patterns and Nonmotor Symptoms in Parkinson's Disease: A Cross-Sectional Analysis. *J Am Nutr Assoc.* 2023;42(4):393-402. Doi: 10.1080/07315724.2022.2056544
 28. Fresan U, Bes-Rastrollo M, Segovia-Siapco G, et al. Does the MIND diet decrease depression risk? A comparison with Mediterranean diet in the SUN cohort. *Eur J Nutr.* 2019;58(3):1271-1282. Doi: 10.1007/s00394-018-1653-x
 29. Cherian L, Wang Y, Holland T, et al. DASH and Mediterranean-Dash Intervention for Neurodegenerative Delay (MIND) Diets Are Associated With Fewer Depressive Symptoms Over Time. *J Gerontol A Biol Sci Med Sci.* 2021;76(1):151-156. Doi: 10.1093/gerona/glaa044
 30. Yau KY, Law PS, Wong CN. Cardiac and Mental Benefits of Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) Diet plus Forest Bathing (FB) versus MIND Diet among Older Chinese Adults: A Randomized Controlled Pilot Study. *Int J Environ Res Public Health.* 2022;19(22). Doi: 10.3390/ijerph192214665
 31. Cherian L, Agarwal P, Holland T, et al. Western diet associated with increased post-stroke depressive symptoms. *J Nutr Sci.* 2022;11:e44. Doi: 10.1017/jns.2022.38

32. Saghafian F, Malmir H, Saneei P, et al. Consumption of fruit and vegetables in relation with psychological disorders in Iranian adults. *Eur J Nutr*. 2018;57(6):2295-2306. Doi: 10.1007/s00394-018-1652-y
33. You Y, Shahar S, Haron H, et al. More Ulam for Your Brain: A Review on the Potential Role of Ulam in Protecting Against Cognitive Decline. *Sains Malaysiana*. 2018;47(11):2713-2729. Doi: 10.17576/jsm-2018-4711-15
34. Ebrahimpour-Koujan S, Keshteli AH, Afshar H, et al. Adherence to low carbohydrate diet and prevalence of psychological disorders in adults. *Nutr J*. 2019;18(1):87. Doi: 10.1186/s12937-019-0513-8
35. Morales-Suarez-Varela M, Amezcua-Prieto C, Llopis-Gonzalez A, et al. Prevalence of Depression and Fish Consumption among First Year Spanish University Students: UniHcos Project. *Nutrients*. 2023;15(12). Doi: 10.3390/nu15122757
36. Serefko A, Jach ME, Pietraszuk M, et al. Omega-3 Polyunsaturated Fatty Acids in Depression. *Int J Mol Sci*. 2024;25(16). Doi: 10.3390/ijms25168675
37. Mazri FH, Manaf ZA, Shahar S, et al. The Association between Chronotype and Dietary Pattern among Adults: A Scoping Review. *Int J Environ Res Public Health*. 2019;17(1). Doi: 10.3390/ijerph17010068
38. Rawat M, Varshney A, Rai M, et al. A comprehensive review on nutraceutical potential of underutilized cereals and cereal-based products. *Journal of Agriculture and Food Research*. 2023;12. Doi:10.1016/j.jafr.2023.100619
39. El Mikkawi H, El Khoury C, Rizk R. Adherence to the Mediterranean diet and mental health among university students in Lebanon. *Applied Food Research*. 2024;4(1). Doi: 10.1016/j.afres.2024.100435
40. Ross AB, Shertukde SP, Livingston Staffier K, et al. The Relationship between Whole-Grain Intake and Measures of Cognitive Decline, Mood, and Anxiety-A Systematic Review. *Adv Nutr*. 2023;14(4):652-670. Doi: 10.1016/j.advnut.2023.04.003
41. Foshati S, Ghanizadeh A, Akhlaghi M. Extra-Virgin Olive Oil Improves Depression Symptoms Without Affecting Salivary Cortisol and Brain-Derived Neurotrophic Factor in Patients With Major Depression: A Double-Blind Randomized Controlled Trial. *J Acad Nutr Diet*. 2022;122(2):284-297. Doi: 10.1016/j.jand.2021.07.016
42. Oddo VM, Welke L, McLeod A, et al. Adherence to a Mediterranean Diet Is Associated with Lower Depressive Symptoms among U.S. Adults. *Nutrients*. 2022;14(2). Doi: 10.3390/nu14020278
43. Darabi Z, Vasmehjani AA, Salehi-Abargouei A, et al. Dietary phytochemical index and psychological disorders in a large sample of Iranian adults: a population-based study. *J Health Popul Nutr*. 2023;42(1):126. Doi: 10.1186/s41043-023-00456-5
44. Morris MC. Nutritional determinants of cognitive aging and dementia. *Proc Nutr Soc*. 2012;71(1):1-13. Doi: 10.1017/S0029665111003296
45. Morris MC, Tangney CC. Dietary fat composition and dementia risk. *Neurobiol Aging*. 2014;35 Suppl 2:S59-64. Doi: 10.1016/j.neurobiolaging.2014.03.038
46. Cherian L, Wang Y, Fakuda K, et al. Mediterranean-Dash Intervention for Neurodegenerative Delay (MIND) Diet Slows Cognitive Decline After Stroke. *J Prev Alzheimers Dis*. 2019;6(4):267-273. Doi: 10.14283/jpad.2019.28
47. Pasarin B, Hoha GV, Simeanu C, et al. The Influence of Thermal Frying Treatments on The Nutritional and Health Properties of Fish Meat. *Animal & Food Sciences Journal*. 2023.
48. Wang A, Wan X, Zhuang P, et al. High fried food consumption impacts anxiety and depression due to lipid metabolism disturbance and neuroinflammation. *Proc Natl Acad Sci U S A*. 2023;120(18):e2221097120. Doi: 10.1073/pnas.2221097120

-
49. Su P, He M. Relationship between sleep quality and subjective well-being: resilience as a mediator and belief in a just world as a moderator. *Front Psychiatry*. 2023;14:1297256. Doi: 10.3389/fpsy.2023.1297256
 50. Pratiwi TR, Larasatie Nur Fibri D, et al. The Correlation between Probiotic Consumption and Sleep Quality among Adults : A Systematic Review and Meta-Analysis. *Jurnal Gizi dan Pangan*. 2024;19(3):147-156. Doi: 10.25182/jgp.2024.19.3.147-156
 51. Stefaniak O, Dobrzynska M, Drzymala-Czyz S, et al. Diet in the Prevention of Alzheimer's Disease: Current Knowledge and Future Research Requirements. *Nutrients*. 2022;14(21). Doi: 10.3390/nu14214564