

Original Research

Received 17 June 2026

Revised 23 July 2026

Accepted 06 Aug 2026

Natural Resources for Human Health 2026, Vol. 6 (16s): 1190–1201

KEYWORDS:

anxiety; nutritional intervention; dietary modification; nutritional supplementation; omega-3 fatty acids; probiotics; metabolic health; public health nutrition; gut-brain axis; anxiety management

The Significance of Nutritional Intervention in the Management of Anxiety

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ABSTRACT: Anxiety disorders are a worldwide mental-health problem, and must be treated in a manner that is more than symptom management based. The nutritional intervention has gained interest because of various biological connections between metabolic regulation and nutrient availability, dietary pattern, gut microbial activity, inflammatory signaling, and synthesis of neurochemicals and stress and anxiety pathways. In the present paper, we present and test an evidence-informed framework that includes four complementary pathways for anxiety management, namely the management of metabolic state, nutritional supplementation, dietary modification, and public-health supplementation. A structured evidence synthesis was conducted, which included the use of recent systematic reviews, meta-analyses and randomized controlled trials, as well as authoritative health guidance. Key sources used to obtain quantitative evidence included dietary quality; dietary interventions; omega-3 fatty acids; probiotics; prebiotics; symbiotic and multiple health-behavior interventions. The evidence shows that there is a significant amount of heterogeneity present. There was no overall significant pooled improvement in adults with metabolic conditions with dietary interventions (overall standardized mean difference -0.05 [95% CI: -0.20 to 0.10; $p=0.49$]). The effects of hypocaloric and isocaloric dietary interventions were non-significant. A dose response meta-analysis, however, found a moderate reduction in anxiety symptoms with omega-3s (SMD -0.70 per 1 g/day; low certainty) and the greatest estimated benefit at 2 g/day. According to a meta-analysis of probiotics, prebiotics and symbiotic conducted in 2025, a significant decrease in anxiety symptoms was found: SMD -0.44 (95% CI -0.59 to -0.28; $p<0.001$), with considerable heterogeneity. The pooled effect of multiple health-behavior interventions was small but statistically significant for all studies (SMD -0.183, 95% CI -0.276 to -0.091), but not for the low risk-of-bias studies. The synthesis lends support to a differentiated model whereby nutritional intervention is seen as a complementary treatment to existing psychological and pharmacological treatments and not a substitute. Dietary modification alone is not as well supported by evidence as selected supplementation and interventions to the gut micro-ecology in specific metabolic populations. To develop clinically relevant protocols, nutrient status testing (clinically indicated), culturally sensitive dietary planning, and monitoring of anxiety outcome measures as well as long-term randomized control trials are needed.

1. INTRODUCTION

Anxiety disorders are one of the most common mental illnesses in the world. According to the World Health Organization, an anxiety disorder is the most common type of mental disorder, with an estimated 359 million people suffering from an anxiety disorder in 2021. Anxiety disorders are a disorder of excessive fear or worry with cognitive, behavioral and physical

symptoms that interfere with social, educational and occupational functioning (Ruyi and Sisugoswami, 2026). There is still a lack of access to treatment based on evidence, with the WHO estimating that only around one quarter of people with anxiety disorders receive treatment. There is a strong argument for the use of adjunctive strategies which can be used alongside existing psychological and pharmacological treatments, due to the need for scalable programs to address the treatment gap.

The treatment of anxiety has been targeted at psychological (particularly cognitive behavioral) and chemical (antidepressant) treatments. These strategies continue to be important to clinical practice. According to the WHO, the following interventions are recommended: psychological for generalized anxiety disorder and panic disorder: cognitive behavioral therapy, and antidepressants: selective serotonin reuptake inhibitors (considered for adults with generalized anxiety disorder and panic disorder). There's another avenue for nutrition intervention. It addresses conditions which can be biologically and behaviorally modified that can impact vulnerability, symptom severity, therapeutic response, and health. This should not then be regarded as an alternative to psychiatric care which is backed by evidence. It is relevant to its role in supporting existing care practices through dietary quality, nutrient adequacy, metabolic regulation and modification of the processes that impact brain function.

There is a biological plausibility link between nutrition and anxiety, but an empirical complexity link. Unbalanced intake of amino acids, fatty acids, vitamins, minerals and energy substrates important for brain functioning. Nutrition status can affect neurotransmitter synthesis, membrane composition, mitochondrial activity, antioxidant defense, immune signaling and endocrine regulation (Merino del Portillo et al., 2024). In addition, dietary patterns can also influence the gut microbial communities and their metabolites, which helps to explain how food consumption can impact gut-brain axis. The mechanisms discussed are not a recommendation for any food or supplement as a treatment for an anxiety disorder. Baseline nutritional status, dietary pattern, duration of intervention, presence of comorbid diseases, drug consumption, adherence and type of anxiety outcome all influence the effects of the intervention on the clinical outcome.

In the increasingly rich literature, there are examples that emphasize the need for such differentiation. They identified strong, prospective evidence for links between the Mediterranean diet and depression incidence in clinical depression and anxiety groups, and less conclusive evidence for links with anxiety incidence. For adults with metabolic disorders, a 2024 systematic review and meta-analysis showed that there was no significant pooled effect on anxiety, but the effect on depression was significant (Zhang et al., 2023). The pooled SMDs across the seven studies with 1,730 participants were estimated as -0.05 (95% CI: -0.20 to 0.10). The findings suggest that the diet quality has a wide range of health implications and yet may not necessarily have a uniform anxiolytic effect.

There is less promising evidence for supplementations. A meta-analysis of 23 randomized trials with 2,189 participants in 2024 showed a moderate effect of 1 g/day of omega-3 fatty acids related to a decrease in anxiety symptoms, SMD -0.70 (95% CI -1.17 to -0.22), with the estimated maximum reduction occurring around 2 g/day. Evidence was weak (low or very low) and care needs to be taken in interpreting pooled estimates as general guidance for treatment. In a 2024 systematic review of magnesium supplementation, 5 of 7 studies with an anxiety outcome showed a positive effect, but different forms and dosages of magnesium and some inconsistencies between the studies prevented definitive conclusions.

There are several evidence-based studies on nutritional intervention for the microbiome that have also surfaced. There were 72 randomized controlled trials (RCTs) in a 2025 systematic review and meta-analysis of RCTs with 3,912 anxious children in the intervention group and 3,912 anxious children in the control group (Heinz et al., 2025). The pooled anxiety effect was SMD -0.44 (95% CI -0.59 to -0.28 ; $p < 0.001$), however, there was high heterogeneity ($I^2 = 81\%$) and only a minority of the included studies were rated as low risk of bias on all of the criteria. Evidence suggests there may be benefits as well as the need for consistent strains, doses, duration of interventions, and clinically relevant population.

Then there's a built-in system to the importance of nutritive intervention. Management of metabolic state can help with obesity, insulin resistance, glycemic instability and other metabolic issues that can occur in addition to anxiety. Nutritional supplementation may be used to correct deficient or to target specific nutrients with reasonable neurobiological implications. Dietary modification, such as increasing the nutrient density, fiber, unsaturated fats, fruits, vegetables, legumes and whole grains, while limiting consumption of highly processed foods, free sugars, unhealthy fats and sodium, can boost and improve foods and nutrients. Micronutrient deficiencies at population level can be targeted by public health supplementation, via fortification and targeted supplementation programmers. These four pathways are not mutually exclusive, but are interconnected.

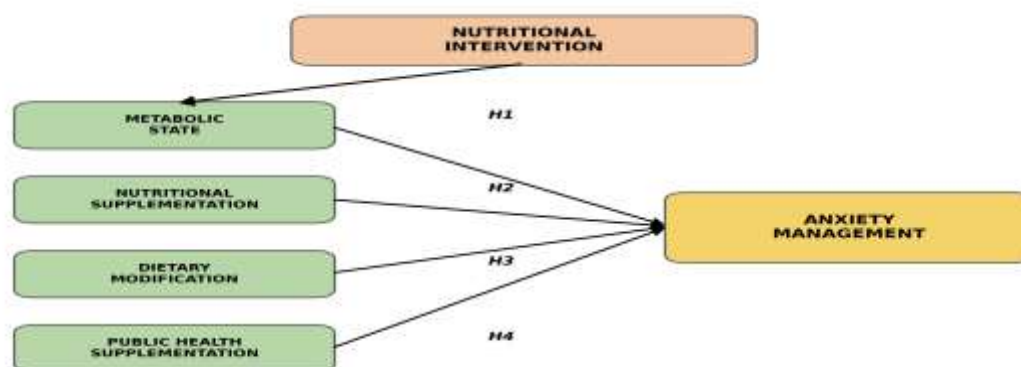
In the present paper, the conceptual framework provided for the study is developed to an evidence-based model. Nutritional intervention is the higher order construct, anxiety management is the outcome construct, metabolic state, nutritional supplementation, dietary modification and public-health supplementation are the pathways associated with anxiety management (Braverman et al., 2024). The aim is to: Summarize findings from previous evidence syntheses; numerically summarize key findings from recent evidence syntheses; describe the quality of evidence for each pathway; establish a research agenda for the clinical and public health relevance of nutritional approaches to anxiety.

2. CONCEPTUAL FOUNDATION

2.1 Nutritional intervention and anxiety management

Nutritional intervention refers to intentional changes in diet or exposure to nutrients, to nutrient supplements and to nutrient nutrition practices among populations to improve health outcomes. The construct has been used in the prescription of single nutrients in anxiety management but is more general (Philippe et al., 2022). This includes aspects of food quality and food pattern, addressing food inadequacy, managing metabolic risk and getting access to nutritious foods. This is a general definition as anxiety is a multifactorial disorder and is not a single nutrient deficiency disorder.

Furthermore, anxiety decrease differs from a decrease in a questionnaire score. The effectiveness of a clinically relevant nutritional intervention needs to be assessed using the following criteria: symptom level, functional impairments, sleep, adherence, quality of life, metabolic parameters and side effects. Higher comparability of scores is achieved when validated instruments are used like the Generalized Anxiety Disorder-7, Hamilton Anxiety Rating Scale, Hospital Anxiety and Depression Scale and State-Trait Anxiety Inventory, but there is considerable heterogeneity between instruments.



Four-pathway framework linking nutritional intervention with anxiety management

Redrawn from the supplied conceptual framework. H1–H4 denote the proposed pathways from metabolic state, nutritional supplementation, dietary modification and public-health supplementation to anxiety management.

Figure 1. Conceptual framework for nutritional intervention and anxiety management

2.2 Metabolic state as an intervention pathway

Nutritional intervention acts on metabolic state which is a physiology. Symptoms of anxiety can be related to obesity, type 2 diabetes, dyslipidemia, hypertension and metabolic syndrome. Dysfunction in metabolism can impact sleep, inflammation, energy regulation and autonomic function, and anxiety can impact eating habits, physical activity, and/or medication compliance (Mullins et al., 2023). Therefore, indirectly, the management of anxiety can benefit from nutrition for metabolic health.

It does not appear to be a rule that weight loss or a calorie reduction automatically reduces anxiety. The 2024 meta-analysis of the dietary interventions for adults with metabolic conditions failed to show a significant effect on anxiety. There was a pooled effect for all dietary interventions of -0.05 , and for hypocaloric and isocaloric interventions, -0.06 and -0.04 , respectively. Both of these effects were statistically insignificant and small. The findings indicate that there is a distinction

between the metabolic benefit and direct anxiolytic benefit. A diet might have an effect on blood pressure, body weight or glycemic control but not result in a noticeable difference in anxiety.

2.3 Nutritional supplementation

Nutritional supplementation is a specific use of nutrients and/or bioactive compounds when dietary intake is inadequate, when there is a scientific rationale to supplement the diet, or when there is clinical evidence of value. EPA and DHA are singled out because of their involvement in membrane structure of neurons and inflammatory signaling (Kumar et al., 2023). The 2024 dose-response meta-analysis found a consistent dose-response relationship of omega-3 supplementation on reducing anxiety symptoms, with the highest modeled dose around 2 g/day.

Relevance of Magnesium: its role in the neuromuscular function, energy metabolism and neuronal signaling. There were five out of seven studies reporting improved anxiety outcomes, and significant study heterogeneity and the small size of the studies prevented definitive conclusions in the 2024 systematic review. So supplementation needs to be decided clinically and not on an arbitrary self-treatment approach.

Circulating levels of certain micronutrients have been linked to neurobiological pathways, which could also be important for anxiety; however, there is no evidence that supplementing would have an effect on reducing anxiety symptoms. The clinical principle of deficiency correction is more defensible than the universal high dose supplementation. Safety, drug interactions, upper intake levels and underlying disease should be considered before supplementation.

2.4 Dietary modification

Dietary modification addresses the whole pattern of food, instead of specific nutrients. The Mediterranean diet consists of an adequate amount of vegetables, fruits, legumes, whole grains, nuts and olive oil, consumed in moderation with fish and dairy products, and with lower quantities of red and processed meat and highly processed foods (Magomedova and Fatima, 2025). Such dietary patterns are a source of fiber, polyphenols, unsaturated fatty acids, minerals and vitamins.

The signs of anxiety are not as consistent as the signs of depression. Systematic review of diet quality in clinical depression and anxiety cohort studies in 2023 showed limited and mixed evidence for diet in anxiety, and some methodological limitations in the diet interventions in depression. Although there are no standardized protocol for anxiety disorders in the general literature, a randomized clinical trial with 60 participants showed that teaching the MD resulted in improvements in mental-health-related parameters.

2.5 Public-health supplementation

Public-health supplementation is done at population level. If the population is at risk of a deficiency, fortification of the staple food can help reduce the risk of that deficiency. The four principles of healthy diets outlined by WHO focus on dietary adequacy, dietary balance, dietary moderation and dietary diversity and recognize the need for fortification options where micronutrient deficiencies are particularly common (Kurapov et al., 2023). Therefore, a foundation for mental-health promotion is possible within public-health nutrition interventions, particularly in the context of food insecurity and nutrient deficiencies.

Population level pathway is not “personalized” supplementation. Fortification programmers are not a therapeutic method for anxiety disorders but they are targeting the nutrient status of a whole population. Their relevance in the management of anxiety is understood more when considering the prevention of nutritional deficiencies, and not in terms of any direct treatment for anxiety.

3. LITERATURE REVIEW

3.1 Dietary quality and mental health

The dietary quality research paradigm has taken a new turn toward dietary patterns. In 2023, 44 studies, including observational studies and interventional studies, were identified from a systematic review on diet quality and anxiety/depressive disorders. Evidence on the Mediterranean dietary pattern was found to be favorable and in relation to depression the number of cases was lower, and evidence was limited in relation to anxiety (Shawon et al., 2024). It is important to note the difference because depressive and anxiety disorders have similar symptoms and risk factors and may not be equally sensitive to dietary interventions.

Quality of diet could have several possible impacts on mental health. The microbes fermented and the resultant production of the short chain fatty acids is affected by a fiber rich diet. Unsaturated fats have an impact on cell membranes and inflammatory signaling. These antioxidant and anti-inflammatory compounds are provided by polyphenol-rich foods. Normal feeding regimen may impact availability of energy and sleep related behaviors. Reducing the amount of highly processed food may lead to an overall higher nutrient density. All are individually insufficient to provide a clinically adequate treatment for anxiety.

3.2 Dietary interventions in metabolic populations

Paris et al. identified 13 randomized controlled trials in individuals aged 18 years or older who had metabolic conditions. There were seven studies reporting anxiety outcome results, consisting of 1730 participants (Gunasiri et al., 2022). The overall effect (pooled) was not significant. The overall SMD was -0.05 , with a 95% CI from -0.20 to 0.10 and $p=0.49$. I^2 was 50% indicating moderate heterogeneity. The 627 participants in hypocaloric interventions had an SMD of -0.06 (95% CI -0.27 to 0.15 ; $p=0.56$), whereas the 1,103 participants in the five studies that examined isocaloric interventions had an SMD of -0.04 (95% CI -0.25 to 0.17 ; $p=0.72$).

The findings highlight the need to take these factors into account as a counterweight to the powerful reports of diet directly affecting anxiety. Nutrition intervention has shown to be effective for improving cardiometabolic health and improving depression, with low immediate impact on anxiety. This finding may be attributable to the short intervention duration, diversity of diets, non-clinical anxiety samples, poor power and/or co-treatment and baseline differences in nutrition status.

3.3 Omega-3 fatty acids

There is relatively quantitative evidence for the benefits of omega-3. Bakar et al. analyzed 23 RCTs with a total of 2,189 participants, and performed a dose-response meta-analysis. For every 1 g/day dose of omega-3, there was a moderate decrease in anxiety symptoms (SMD -0.70 , 95% CI: -1.17 to -0.22). The largest estimated improvement, identified by the nonlinear analysis, was around 2 g/day (SMD -0.93 , 95% CI -1.85 to -0.01) (Rashid et al., 2023). The odds ratio for adverse events was 1.20 (95 % CI 0.89 to 1.61) for omega-3 use. There was no significant effect of omega-3 on adverse events (Odds ratio 1.20 (95 % CI 0.89 to 1.61)). The level of certainty of the GRADE was low or very low.

There have been less consistent studies in the past. Omega-3 interventions for prevention did not result in a reduced risk of anxiety in a large systematic review of omega-3 interventions for prevention, suggesting that dosage, formulation and population need to be considered, as do the distinction between prevention and treatment. The newer dose response analysis suggests possible benefits, but is not without potential uncertainties regarding clinical populations, optimal EPA: DHA ratio or long term benefit.

3.4 Probiotics, prebiotics and symbiotic

Another crucial nutrient pathway is the gut-Brain axis. Meta-analysis of BMC Psychiatry 2025 included 72 randomized controlled trials (49 anxiety trials). The pooled anxiety effect was -0.44 (95% CI -0.59 to -0.28 ; $p<0.001$), with $I^2=81\%$. There were 38 anxiety studies involving probiotics, 12 involving prebiotics and 5 involving symbiotic. Some variation in subgroup estimates by intervention type and strain were found (Abbas et al., 2023).

Lack of uniformity in diversity makes it hard to relate to a universal intervention. Probiotics effects were different for various populations, length of duration, and strains. In the synthesis 2025, Bifidobacterium, combined Lactobacillus-Bifidobacterium and mixed-strain interventions showed a significant pooled anxiety effect while the Lactobacillus-only interventions did not. These studies provide information for strain-specific studies, but are not for generalization to prescribe probiotics.

3.5 Multiple health-behavior interventions

Comparing combined lifestyle approach with diet alone, the lifestyle approach was more effective in reducing anxiety. In 2024, a systematic review and meta-analysis of randomized controlled trials (RCTs) was performed, which included 46 trials in qualitative analysis and 34 trials in quantitative analysis. Thirty studies were related to the promotion of healthy diet and active living and other studies included smoking cessation (Rahi et al., 2023). The pooled SMD for anxiety was -0.183 (95% CI -0.276 to -0.091 ; $p<0.001$). When only low risk of bias studies were considered, there was a high degree of heterogeneity and the effect was no longer significant.

This evidence is congruent with a multi-modal interpretation. When considered in conjunction with physical activity, sleep regularity, stress management and other behavioral interventions, nutritional intervention may have a greater relevance. This practice is also in line with the overall approach that there are biological, psychological and social factors that influence anxiety.

4. METHODOLOGY

4.1 Research design

Primary participant-level clinical trial was not used but a structured evidence-synthesis design was used. This approach was selected because there is no original set of participant data, and the goal of the study is to evaluate the significance of a nutritional intervention by various interventions pathways. Recent systematic reviews and meta-analyses were used to extract quantitative results which were then interpreted in terms of comparison (Zhong et al., 2024). This design does not show participants' created data and not empirical data.

The evidence base was grouped into four conceptual pathways: (1) management of metabolic state, (2) nutritional supplementation, (3) dietary modification and (4) public-health supplementation. Anxiety was selected as the primary outcome domain. Randomized controlled trials, systematic review, meta-analysis or authoritative health guidance were considered more evidence than any other type of study.

4.2 Search strategy

The following terms were used to search PubMed-indexed articles and articles from major publishers: anxiety, anxiety disorder, nutrition, diet, dietary intervention, Mediterranean diet, omega-3, magnesium, probiotics, prebiotics, symbiotic, metabolic health and mental health. The searches were conducted on systematic reviews and meta-analyses that appeared between 2023 and 2025, when appropriate for interpretation, landmark evidence was taken into account. The guidance of WHO was added for the population-level dietary and anxiety management context.

4.3 Inclusion and exclusion principles

Eligible evidence included adult anxiety symptoms or anxiety disorders; quantified or structured evidence on dietary patterns, dietary supplementation with nutrients or structured interventions; or metabolic dietary intervention, intervention of the gut microbiome or integrated health-behavior interventions (Linardon et al., 2024). All quantitative synthesis was conducted on evidence that focused solely on an animal outcome and did not focus on a human outcome. Studies of outcomes unrelated to anxiety were merely employed to give a more general explanation to other mental health or nutrition outcomes where needed.

4.4 Data extraction and analysis: Data are collected and analyzed in an appropriate manner.

The extracted variables consisted of the publication year, intervention category, study design, sample size, number of anxiety studies, standardized mean difference, confidence interval, p value, heterogeneity and main limitations. The thresholds of the standardized mean difference were used to determine the significance of the effect size and that the statistical size does not necessarily correspond to the clinical size.

It is, then, evidence-level comparison when the quantitative parts of the results are compared against each other (Aaron et al., 2025). There was no pooled effect calculated across incompatible meta-analyses due to the differences of interventions, populations, outcome instruments and eligibility criteria. The sum of these estimates would give a methodological error in an overall estimate. These were compared within the context of the original analyses, rather than by pooled estimates..

5. RESULTS AND ANALYSIS

5.1 Evidence profile

The data show 4 different patterns. There was no clear evidence of a direct anxiety effect for dietary intervention, for adults who had metabolic conditions. Moderate pooled effect, low certainty, with omega 3 supplementation (Xiang et al., 2024). The pooled effect of probiotics, prebiotics and symbiotic was moderate with large heterogeneity. The pooled effect of multiple health-behavior interventions was small, with the effect registering a reduction after restricting to lower risk of bias trials.

Table 1. Quantitative evidence on nutritional intervention and anxiety management

Intervention or evidence stream	Evidence base	Participants	Anxiety effect	95% CI	p value	Heterogeneity
Dietary interventions in metabolic conditions	7 studies	1,730	SMD −0.05	−0.20 to 0.10	0.49	$I^2=50\%$
Hypocaloric dietary interventions	2 studies	627	SMD −0.06	−0.27 to 0.15	0.56	$I^2=37\%$
Iso-caloric dietary interventions	5 studies	1,103	SMD −0.04	−0.25 to 0.17	0.72	$I^2=60\%$
Omega-3 fatty acids	23 RCTs	2,189	SMD −0.70 per 1 g/day	−1.17 to −0.22	Significant	Dose-response
Probiotics/prebiotics/symbiotic	49 RCTs	3,912	SMD −0.44	−0.59 to −0.28	<0.001	$I^2=81\%$
Multiple health-behavior interventions	34 RCTs	Pooled analysis	SMD −0.183	−0.276 to −0.091	<0.001	Substantial

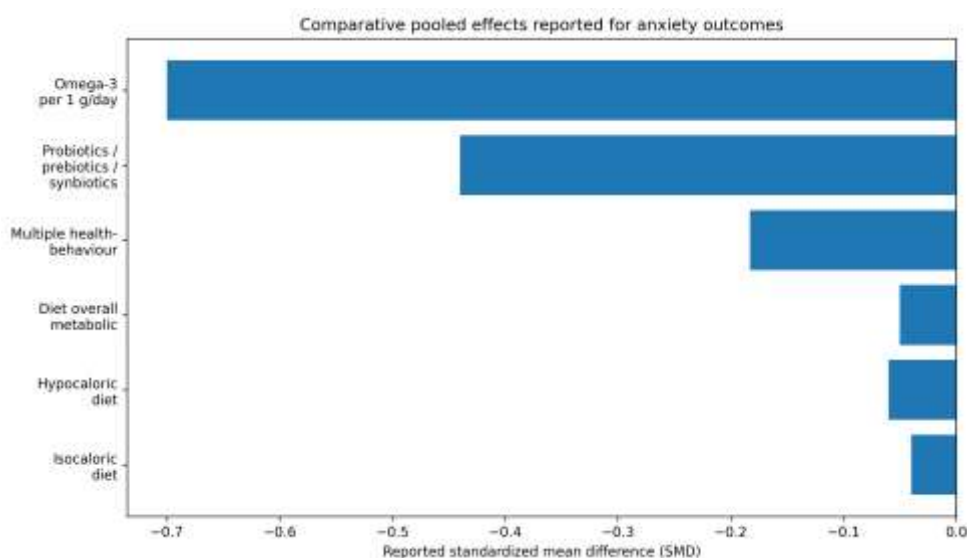
5.2 Comparative effect-size analysis

The comparative effect-size analysis is presented in Figure 2. Negative standardized mean differences indicate that the intervention group had lower anxiety scores than the comparison group. It should be noted that the estimates are not directly interchangeable due to the different intervention(s) and study population(s).

The probiotic/prebiotic/symbiotic estimate is larger in magnitude than the omega-3 estimate, which is -0.70 . The multiple health-behavior estimate of -0.183 is smaller, although significant. For the metabolic population, estimates near zero and CIs crossing the null value are observed for dietary interventions (Andersen et al., 2023). These differences suggest a pathway-specific model instead of a broad statement about the effectiveness of all types of nutrition intervention.

RESULTS VISUALIZATIONS

Lower SMD scores in the intervention group suggest lower levels of anxiety compared to the comparison group. Estimates are not directly pooled across studies, but come from separate evidence syntheses.



Negative SMD values indicate lower anxiety scores in the intervention group relative to the comparison group. Estimates originate from separate evidence syntheses and are not directly pooled across studies.

Figure 2. Comparative pooled effects reported for anxiety outcomes

5.3 Composition of microbiome intervention evidence

A total of 38 probiotic, 12 prebiotic and five symbiotic studies reporting anxiety outcomes were included in the 2025 meta-analysis. The probiotic studies accounted for about 69.1% of the anxiety evidence, prebiotic studies accounted for 21.8% and symbiotic studies accounted for 9.1% of the evidence (Verhoeven et al., 2023). This distribution is shown in figure 3.

As seen in the distribution, probiotics are the most common evidence base. There are fewer symbiotic and prebiotic studies and this makes it more uncertain about comparative effectiveness. Higher numbers of trials do not necessarily mean greater certainty; there is still a possibility of heterogeneity and risk of bias.

Composition of anxiety-outcome evidence in the 2025 microbiome meta-analysis

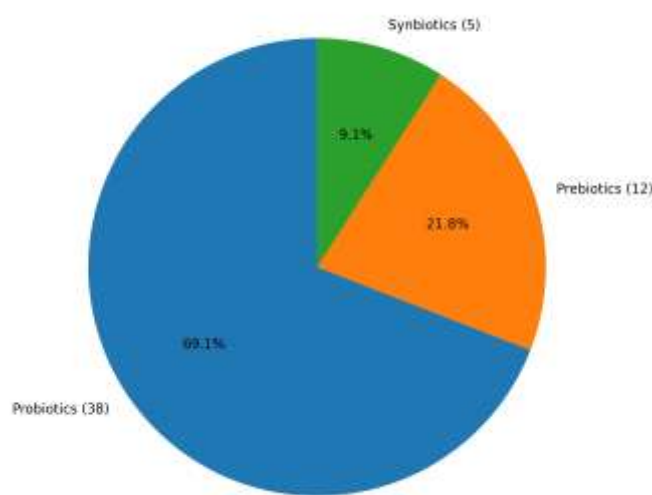


Figure 3. Composition of anxiety-outcome evidence in the 2025 microbiome meta-analysis

Study counts represent the intervention categories contributing anxiety outcomes in Zhang et al. (2025): 38 probiotic, 12 prebiotic and 5 symbiotic studies.

5.4 Interpretation of the four pathways

Metabolic-state management provides an enabling pathway. It is its role to optimize physiological conditions, not with the aim of treating anxiety directly. The strongest quantitative indication is provided by nutritional supplementation, particularly for omega-3 fatty acids, although formulation details, doses, and patient characteristics are still unknown for these compounds. Although dietary changes offer wide-ranging nutritive and cardiometabolic health benefits, there is no direct and consistent anxiety effect found in adults with metabolic disorders (Selta et al., 2026). Public health supplementation has the ability to help prevent population-level deficiency and promote nutritional status; it should not be confused with treatment for individual anxiety.

6. DISCUSSION

6.1 Nutritional intervention as an adjunctive strategy

There is evidence that nutrition intervention may have a role in anxiety management with some degree of caution, but with clinical relevance. Treatment of an anxiety disorder should be based on evidence-based psychological and (as necessary) pharmacological interventions. Nutritional interventions can be used in conjunction with these interventions and work by enhancing the quality of food eaten, correcting nutritional deficiencies, increasing metabolic functioning and potentially modifying inflammatory and gut-brain pathways.

An important distinction is that between adjunctive and replacement treatment. Psychological interventions are recommended as well as pharmacologic interventions when clinically appropriate, as are recommended by WHO for anxiety

(Werntz et al., 2023). Currently, nutritional intervention is not at the same evidence-level as primary treatment of diagnosed anxiety disorders. A diet plan should thus be part of overall treatment, not a substitute for treatment started when it is needed.

6.2 Why dietary modification alone produces inconsistent anxiety effects

There are a number of explanations for the weak pooled effect of the dietary interventions in the metabolic populations. Dietary interventions can be very different in their composition, energy restriction and length of time and adherence levels required. There are also differences among instruments for measuring anxiety (Cheng et al., 2022). Participants might not have anxiety disorders, but rather subclinical anxiety which may limit their improvement in symptoms. Other medications, exercise, and psychological care may further impact outcomes.

Diet quality could also be a mediator along longer term metabolic and inflammatory pathways. If the mechanism of action for anxiety requires a long-term change of body composition, metabolic function or microbial ecology, a 3 or 6 month dietary intervention might not be enough to capture the changes of anxiety. On the other hand, a brief period of eating less highly processed food can lead to greater energy stability and better sleep, without causing significant shifts in anxiety measures.

6.3 Significance of omega-3 evidence

One of the more straightforward quantitative signals in the present body of evidence is omega-3 supplementation (Gentili et al., 2022). The 2024 dose-response meta-analysis suggests that increased consumption, especially within the modeled range of approximately 2 g/day, could be linked to greater reductions in anxiety. However, when information is of low certainty, this does not mean that this estimate can be interpreted as the universal clinical dose. Variance in EPA:DHA ratio, dietary intake prior to treatment, clinical diagnosis and placebo formulation may affect results.

Assessment of dietary intake, comorbidities, medication use, medication safety is therefore a first priority for clinical application. Supplementation should be used in a targeted fashion as an adjunct and not as a blanket treatment for anxiety.

6.4 Significance of the gut-brain axis

Evidence for probiotics, prebiotics and symbiotic along with their role in gut-brain nutrition is supported in 2025. The pooled anxiety effect is of clinical interest (-0.44), and $I^2=81\%$ suggests that there is considerable heterogeneity. Such heterogeneity indicates that the intervention category includes several different therapies (biologically speaking) and not one single therapy.

The results, strain-specific, reinforce evidence for precision nutrition. There was no significant pooled anxiety effect for Lactobacillus-only interventions in the 2025 subgroup analysis, but significant effects were observed for the Bifidobacterium and the combined strains and the mixed multi-strain interventions (Rashid et al., 2023). Thus, no general recommendation can be made for a probiotic product to treat anxiety. Future trials should identify strain, dose, viability, formulation, duration and characteristics of baseline microbiome.

6.5 Role of metabolic health

Anxiety-related nutrition programs should incorporate metabolic health as a factor, as obesity, diabetes, dyslipidemia, and hypertension can have an impact on the complexity of treatment and health-related stress. However, the lack of an anxiety effect in dietary trials for metabolic conditions shows that the improved effects of diet on metabolism and on anxiety are separable.

Thus a clinically useful programmed should include the monitoring of both domains. Validated anxiety scales can be used in conjunction with measures of weight, waist circumference, blood pressure, glycemic measures and lipid profiles (Abbas et al., 2023). This is a two-pronged evaluation to avoid the impression of evaluating only psychological outcomes when assessing nutritional programmers, and to avoid the inference of psychological outcomes from metabolic outcomes.

6.6 Public-health implications

Food Security, micronutrient adequacy, access to healthy diets are among the mental-health promotion areas in which public-health nutrition can make a contribution. WHO advises the diets to be diverse, adequate, balanced and moderate and emphasizes fortification as a measure in high prevalence areas of micronutrient deficiency. The measures are of general relevance to the population's health.

Its public health importance is particularly relevant when there is a gap in mental health care and inadequate nutritional intake (Rahi et al., 2023). Enabling access to healthy, nutritious foods could lower a structural impediment to healthy dietary behavior. It is important to note, however, that public-health supplementation should not be the sole treatment for anxiety disorders that have been diagnosed by a health professional.

6.7 Implications for clinical practice.

Nutritional risk assessment and clinical screening for nutritional risk can be the initial step in a nutrition-informed pathway for managing anxiety (Zhong et al., 2024). Assessment may include meal regularity, fruit and vegetable consumption, whole-grain and legume consumption, fish and omega-3 consumption, ultra processed food consumption, caffeine and alcohol consumption, food insecurity, dietary restrictions. Testing should be targeted to a specific diagnosis or clinical indication and not performed as a general screening test.

Individualization of intervention can then be achieved. A whole food diet approach can serve as a base, and addressing specific deficiencies can help correct specific nutritional risks. If evidence and patient characteristics support supplementation, then this should be considered. Anxiety symptoms as well as nutritional and metabolic outcomes should be monitored.

6.8 Research implications

Randomized controlled trials with large sample size, uniform diagnostic criteria, well-validated anxiety assessment instruments, and clear food instructions should be considered as main focus in future studies. Adherence, baseline diet, nutrient status, medication and physical activity and sleep should be reported in trials. Nutritional interventions should be sufficiently detailed so they can be replicated.

Incorporating biomarkers can help in mechanistic interpretation (Linardon et al., 2024). Responder identification may be possible based on omega-3 index, vitamin D, ferritin, vitamin B12, folate, glycemic markers, inflammatory biomarkers and microbiome profiles. Symptoms can improve either through a metabolic or inflammatory pathway, or a gut-brain pathway, which can be determined through mediation analysis.

Longitudinal trials are necessary as nutritional effects may develop slowly. Beyond the time of the intervention, follow-up is also needed to see if benefits continue post-intervention. Comparative effectiveness research can be comparing dietary modification against supplementation and integrated nutrition-behavior programmers.

7. HYPOTHESIS DEVELOPMENT

H1 suggests that there is a positive relationship between improved management of the metabolic state and anxiety management. Current evidence is consistent with biological plausibility, but evidence of direct effects of anxiety is inconsistent. The hypothesis is thus suitable to be tested empirically in the future with simultaneous metabolic and psychological outcomes.

H2 suggests that nutritional supplementation has a positive correlation with anxiety management. There is more recent quantitative evidence to support specific supplements, notably omega-3 fatty acids, than for a supplementation category (Aaron et al., 2025). Therefore the hypothesis needs to be operationalized by specific nutrient, dose, baseline status and clinical population.

H3 suggests that diet positively correlates to anxiety management. No direct evidence is found for current supplements. Energy restricted diets should be differentiated from overall diet quality in future testing, and validated dietary indices should be used in conjunction with anxiety measures.

H4 suggests that there is a positive link between public-health supplementation and the management of anxiety. This hypothesis is most suitable at population level and should be tested by measuring changes in nutrient status, mental-health markers and availability of nutritious food, instead of individual exposure to supplements.

8. CONCLUSION

In addition to the main treatments outlined above, nutritional intervention is a major and important complementary area of the anxiety management field. The research is inconclusive regarding the effectiveness of dietary changes for reducing anxiety symptoms in every population, thus highlighting the need for further research. The evidence is not consistent across all

populations and dietary change is not consistently an effective treatment for anxiety symptoms, which means that further research is warranted. Pooled anxiety effect for adults with metabolic conditions showed no significant effect with SMD of -0.05 . The discovery sets an interesting precedent for interpretation and helps to avoid generalizing dietary-health information to make broad therapeutic claims.

Some nutritional supplements demonstrate more distinct quantitative indicators. A large 2025 meta-analysis of probiotics, prebiotics and symbiotic revealed a significant pooled reduction in anxiety symptoms, and a dose-response meta-analysis on omega-3 revealed a moderate reduction in anxiety symptoms. The microbiome evidence is still diverse and the omega-3 evidence is limited by low certainty. Multiple health-behavior interventions also generated a small pooled benefit, suggesting that nutrition might be more meaningful when combined with physical activity and other health behavior interventions.

A four-pathway model is suggested to guide future research. There are four types of intervention: metabolic-state management, targeted nutrient exposure, dietary modification, and public-health supplementation. These should be seen as an alternative and not an alternative.

A clinically plausible nutrition strategy for anxiety should focus on the following: Dietary adequacy, personal nutrition assessment, correction of known deficiencies, and supplementation based on scientific evidence and integration with established mental-health treatments. The research should be directed towards precision nutrition, standardized protocol intervention, biomarker stratification and long-term randomized studies. It can determine the clinical significance and consistency of using nutrition to treat anxiety, in addition to the well-established effect of nutrition on overall health.

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