MLS – HEALTH & NUTRITION RESEARCH (MLSHNR)
http://mlsjournals.com/Health&nutritionrsearch-Journal
ISSN: 2603-5820
(2025) MLS-Health & Nutrition Research, 4l(2), 93-112. doi.org/10.60134/mlshn.v4n2.4193

The impact of the Vegetarian Diet, the Low-Carbohydrate Diet, and the Mediterranean Diet on the management of Generalized Anxiety Disorder

El impacto de la dieta vegetariana, la dieta baja en carbohidratos y la dieta mediterránea en el manejo del trastorno de ansiedad generalizada

Miriam Aja Peramo
European University of the Atlantic, Spain (https://orcid.org/0009-0005-1405-8267) (apermiriam@gmail.com)

Manuscript information:
Recibido/Received:20/05/25
Revisado/Reviewed: 18/06/25
Aceptado/Accepted: 06/10/25

Keywords:
Vegetarian Diet. Low-Carbohydrate Diet. Mediterranean Diet. Generalized Anxiety Disorder (GAD). Dietary Intervention.

ABSTRACT

The Vegetarian Diet (VD), as a dietary intervention for Generalized Anxiety Disorder (GAD), is supported by studies of low methodological quality and presents a similar number of publications both in favor of and against its potential beneficial effect on the disorder. In contrast, the Low-Carbohydrate Diet (LCD) is supported by studies of higher quality; however, many of them involve small, homogeneous samples. Additionally, the LCD tends to show poor long-term adherence, potential adverse effects over time, and deficiencies in key nutrients such as fiber and magnesium, which are relevant to the gut–brain axis. Finally, there are high-quality studies that position the Mediterranean Diet (MD) as a promising dietary pattern for reducing GAD symptoms. These studies are well-designed in terms of sample size and follow-up; however, they often include homogeneous populations, limiting the generalizability of the findings to the broader population affected by this mental health condition. The MD emerges as a suitable nutritional approach for managing GAD alongside pharmacological treatment, supported by solid evidence of its positive effects on the disorder, high adherence in the general population, its content of fiber, omega-3 fatty acids, and magnesium, and the absence of known health risks.

Palabras clave:
Dieta Vegetariana. Dieta Baja en Carbohidratos. Dieta Mediterránea. Trastorno de Ansiedad Generalizada (TAG). Intervención dietética.

RESUMEN

La DV como intervención dietética en el TAG cuenta con una baja calidad de los estudios existentes y un similar número de estudios a favor de su efecto beneficioso en la enfermedad y en contra del mismo. Por otro lado, la DBC plantea estudios de mayor calidad, pese a ello, gran parte de ellos son con una muestra baja y homogénea. Asimismo, una DBC presenta efectos adversos a largo plazo, una baja adherencia a la dieta y déficits de nutrientes clave como la fibra o el magnesio en el eje microbiota-intestino-cerebro. Por último, existen estudios de alta calidad que posicionan a la DM como patrón dietético a seguir para la reducción de síntomas del TAG, estos estudios están correctamente planteados a nivel de número de muestra y seguimiento, sin embargo, la población resulta ser homogénea y no representa a la población general que padece esta afección mental. La DM se presenta como abordaje nutricional para el

TAG combinado con el tratamiento farmacológico debido a la existencia de estudios de calidad que verifican su efecto positivo en la enfermedad, su alta adherencia poblacional, el contenido de fibra, omega 3 y magnesio y, por último, la ausencia de riesgos conocidos.

Introduction

Today, there are numerous diets capable of reversing or minimizing symptoms of cardiovascular, endocrine, digestive, etc. diseases. More recently, scientific interest has grown exponentially in the impact of diet on mental health, suggesting that certain dietary patterns may modulate neurobiological processes related to disorders such as anxiety (1).

Generalized Anxiety Disorder (GAD) is a mental condition consisting of excessive worry about future events, which involves neurotransmitters and hormones capable of deregulating mood, sleep, concentration, etc. (2). This disorder, including signs/symptoms, has a prevalence of 10.4% in the world population, a figure that is increasing, as is the excessive consumption of drugs that treat it (3,4).

While it is true that many patients consider pharmacology as a beneficial therapy, a significant number of people establish this option as not accessible, tolerable and/or effective, so a practical therapeutic approach such as nutritional intervention is necessary (3).

The bidirectional communication between the gut and the brain through the Autonomic Nervous System (ANS) and Enteric Nervous System (ENS), which includes neurotransmitters such as GABA or serotonin, and the hypothalamic-pituitary-adrenal (HPA) axis, which regulates the adaptive response to stress by means of hormones such as cortisol, demonstrates the ability of the microbiota and thus the diet to influence the neurological communications involved in mental illnesses such as GAD (5).

It is known that a healthy diet and lifestyle pattern, including a varied and balanced diet and physical exercise, can have positive effects on mental health, reducing the risk of mental disorders such as GAD (6). This is because healthy habits directly influence the cognitive and emotional functions of those who practice them. Despite the obvious benefits of eating a varied and balanced diet, there is no specific approach to diet as an adjuvant in the treatment of GAD, i.e., one that helps to reduce the severity of its symptoms or even to completely remission (7).

In addition to the relationship between diet and mental health conditions, there is a bidirectional association between GAD and obesity and overweight. On the one hand, people who are overweight or obese are at increased risk of anxiety due to factors such as social stigmatization, body dissatisfaction and metabolic dysregulation such as chronic inflammation. On the other hand, anxiety may contribute to the development and maintenance of obesity, since it is associated with emotional eating. Likewise, in individuals with obesity there is also an imbalance in the neurotransmitters cortisol and serotonin (8).

Regarding the effects of diet on GAD, the microbiota-gut-brain axis plays a key role in emotional regulation and in the production of neurotransmitters related to this mental condition (7). Because of these connections between diet and mental health, it has been proposed that a dietary intervention, such as the Vegetarian Diet (VD), the Low Carbohydrate Diet (LCD) and the Mediterranean Diet (MD), could be an effective strategy that treats or decreases GAD symptomatology. These three diets are characterized by promoting the consumption of foods that promote brain health, in addition to decreasing inflammation and regulating the metabolic response, which could have a positive effect on the patient with GAD (9).

In addition to diet, it is important to consider certain nutrients that have a positive effect on mental health and to take them into account when choosing the most

appropriate option for the treatment of anxiety. Nutrients such as omega-3, fiber and magnesium have some evidence for their positive impact on GAD (10).

The omega-3 (PUFA) is a polyunsaturated fat obtained from foods such as oily fish, nuts, seeds, vegetable oils, etc.. Omega-3 is essential, that is, it cannot be synthesized by the body and must be acquired through the diet. At the brain level, this essential fatty acid promotes cognition, neuronal preservation and protects against neurodegeneration. In addition, several clinical trials relate low levels of omega-3 with the suffering of anxiety and, on the other hand, the use of these fatty acids as a treatment in the reduction of the symptoms of GAD (11-15).

Following the bidirectional communication between the gut and the brain, one nutrient capable of improving the composition of the microbiota is fiber. This nutrient is found in fruits, vegetables, whole grains, seeds, etc., so an adequate intake of these foods would meet the recommendations. However, the fiber intake of the population is far below the recommended intake of 25-35 g per day. Fiber has been studied through clinical trials as a possible improvement of the clinical picture of anxiety, stating that its integration in the diet exerts beneficial effects on mental health (16-18).

Magnesium (Mg) is the fourth most abundant cation in the human body. The recommended daily intake of this mineral is 375 mg per day from fruits, vegetables, legumes, nuts and whole grains. Its possible positive effects on GAD are due to the fact that Mg acts as a modulator of the central nervous system, being an agonist of the GABAA receptor and inhibitor of the NMDA receptor (N-methyl-D-aspartate), in addition, hypomagnesemia in adults has been related to the suffering of anxiety (19). Different clinical trials have related sufficient Mg intake to lower scores in GAD symptomatology (19-21).

Beyond the physiological effects of the diets, it is important to evaluate the level of adherence of each of the dietary interventions proposed in order to verify that it is a useful and effective strategy for people suffering from GAD (22).

In this context, it is essential to analyze in depth the role of different dietary interventions in the symptomatology of GAD. Among the most studied diets are the Vegetarian Diet (VD), the Low Carbohydrate Diet (LCD) and the Mediterranean Diet (MD), each with specific nutritional profiles that may differentially influence anxiety (1).

Method

This literature review consists of an analysis of several documents with the aim of comparing and evaluating the Vegetarian Diet, the Low Carbohydrate Diet and the Mediterranean Diet as a dietary intervention in Generalized Anxiety Disorder.

For the literature review, we included cross-sectional, observational studies and clinical trials examining the relationship of different diets to the treatment of GAD.

The search for articles and other publications began on February 5, 2025 and ended on April 18, 2025. In addition, a systematic search of two pages was carried out; PubMed and ScienceDirect, in which the following filters and key words in English were applied:

- Maximum 5 years old.
- Research articles.
- Sample size: no minimum due to the low proportion of studies related to the subject.
- Type of sample: in humans.
- Key words for the search of studies: (“anxiety”) AND ((“mediterranean diet”) OR

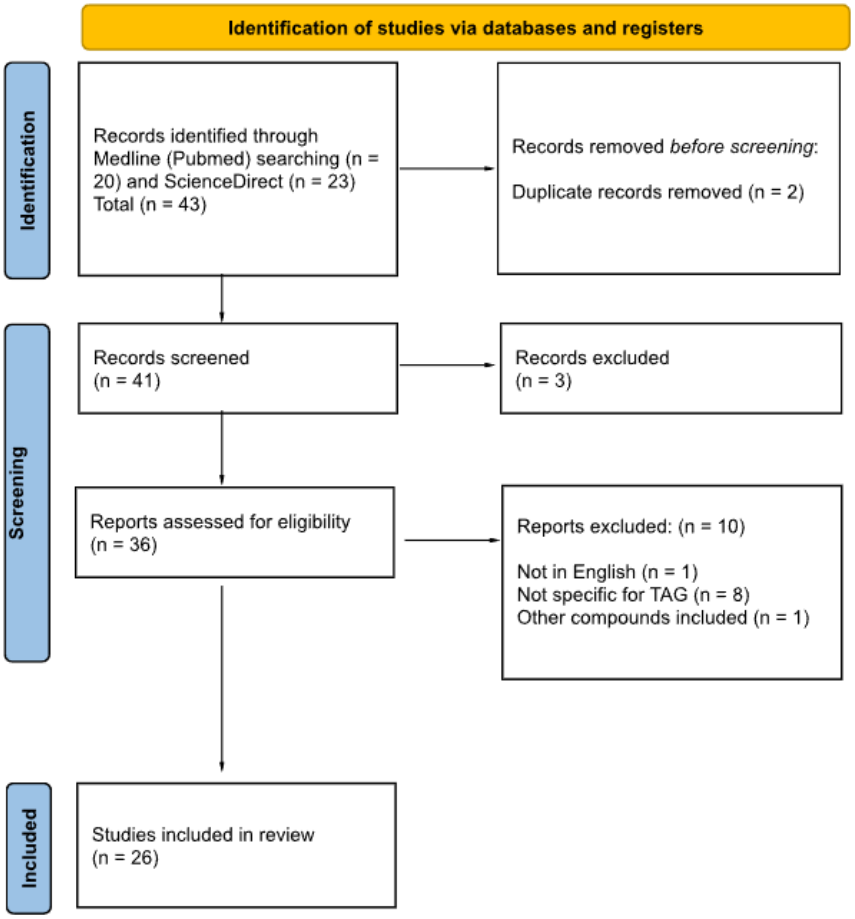
("low-carb diet") OR ("vegetarian diet") OR ("plant-based diet") OR ("omega 3") OR ("fiber") OR ("magnesium"))

- Keywords for general search terms:
  - ("Anxiety") AND (("prevalence") OR ("mechanism") OR ("treatment"))
  - ("gut-microbiota-brain axis")
  - ("gut-microbiota-brain axis") AND ("anxiety")
  - ("diet") AND ("anxiety")

In the end, 53 articles were found for the realization of the present Final Degree Project. Of these, 26 studies were selected and analyzed in depth to draw conclusions about the efficacy of different diets as possible nutritional interventions in the treatment of GAD.

Results

Figure 1. Outline of the bibliographic search. Selected and analyzed studies on different diets and their efficacy as a nutritional approach in GAD.



Discussion and Conclusions

A dietary intervention in GAD is presented as a practical and effective approach when it comes to reducing symptomatology, improving quality of life or even remission of GAD. Three diets have been compared, the Vegetarian Diet, the Low Carbohydrate Diet and, finally, the Mediterranean Diet.

If we begin by analyzing the plant-based dietary pattern, there are 8 studies that investigate this type of nutritional approach as a treatment for GAD as well as the possible improvement of the symptomatology of the mental condition presented in Table 1. (23-30).

Likewise, the three authors Zamani et al (23)wang et al (24) and Senturk et al (25) which establish DV as having a possible beneficial effect on GAD symptomatology. These studies are cross-sectional, so that the follow-up of the diet is not precise and, therefore, an adequate vegetarian dietary pattern cannot be assured. All three authors agree on the importance of the quality of the diet in terms of nutritional treatment as a treatment for GAD.

Two other studies by Conner et al (26) and Haghighatdoost et al (27) relate diet quality to lower scores on anxiety questionnaires and, conversely, also relate poorer quality of DV to higher prevalence of anxiety. So, like the above, the impact of DV depends more on the quality than on the diet itself.

On the other hand, three observational studies by Kohl et al (28), Saintila et al (29) and Bègue and Shankland (30) found worse results in GAD symptomatology, in addition to a higher prevalence of the disease, in individuals who followed a VD with respect to those who consumed an omnivorous diet. Research established a possible negative effect of VD on the incidence of anxiety in the populations studied. Although all three studies found a higher percentage of people with the disease in those individuals who had a plant-based dietary pattern, causal relationships cannot be established because they are observational studies with low follow-up of diet. It should be noted that the research by Saintila et al (29) despite finding an association of VD with greater episodes of anxiety and depression, found a lower BMI and emotional eating in people who follow a plant-based eating pattern. If we add the samples of the three studies that negatively relate VD to GAD, we obtain a representation of 21,562 people.

Despite the differences between the studies mentioned above, the planning of the VD carried out in each study must be taken into account, since a poorly designed VD may imply nutritional deficiencies such as deficiency of vitamin B12, iron or essential fatty acids (omega 3 and omega 6). Lack of these nutrients can negatively affect mood and, thereby, worsen GAD symptomatology (31). A properly structured VD also provides the ideal amount of omega-3 fatty acids, magnesium and, above all, fiber.

The beneficial effect of VD in the management of GAD cannot be proven due to the methodological limitations of the available studies. Most of the investigations analyzed present observational designs, cross-sectional or with unrepresentative samples, which makes it difficult to establish solid causal relationships between the follow-up of a VD and the improvement of anxiety symptoms. In addition, many of the investigations do not compare with an omnivorous diet, do not specify the degree of adherence to the diet, and do not specify the follow-up of the diet.

Therefore, it is not possible to affirm the use of a vegetarian dietary pattern for the improvement of GAD symptomatology. Thus, the impact of VD on GAD seems to depend more on the quality and planning of the diet than on the type of pattern itself.

Author	Reference	Year	Population	Sample	Duration of follow-up	Results
Zamani et al.	(23)	2020	Adult women	435	-	A healthy vegetarian diet was inversely associated with psychological disorders.
Wang et al.	(24)	2024	Older adults (>70)	11.971	20 years	A healthy vegetarian diet was positively associated with the prevention and management of anxiety in this population.
Senturk et al.	(25)	2023	Adults	1355	-	The meat-free diet group had lower anxiety scores, less emotional eating and less uncontrolled eating than the omnivorous diet group.
Conner et al.	(26)	2025	Young adults	78	10 weeks	They found no differences between individuals who consumed red meat and those who consumed meat of vegetable origin. Improved diet quality improves mental health.
Haghighatdoost et al.	(27)	2023	Adults	2033	1 year and 4 months	An unhealthy dietary index of a vegetarian diet resulted in higher levels of anxiety.
Kohl et al.	(28)	2023	Adults (35-70 years old)	14216	2 years	Vegetarian diet was associated with more depressive episodes and worse mental health.
Saintila et al.	(29)	2024	Adults	768	2 months	Vegetarian and vegan diets were associated with higher levels of anxiety and depression.
Bègue and Shankland	(30)	2022	Adolescents 18 and 19 years of age (mostly females)	6578	11 months	Individuals who performed a VD had higher anxiety scores than non-vegetarians.

Table 1. Studies on the use of a VD in GAD (from 23 to 30).

Secondly, there are 8 studies analyzing a CBD as a possible dietary intervention in GAD included in Table 2. (32-39)of which a greater proportion show a positive influence of CBD on the remission of GAD symptomatology.

There are 6 research studies that establish CBD as a possible treatment for GAD (32-37). The clinical trials of Danan et al. (32) Tidman (33), Calabrese et al. (34) and Bernia P. (35) have a very small, unrepresentative sample and, moreover, without a control group. The study by Danan et al. (32) is presented as a correctly planned research since it focuses on people with mental disorders such as anxiety and depression, it proposes the maximum daily dose of CH and the established period, however, there is no control group, the patients knew what they were undergoing, adherence to the diet was achieved after 4 weeks and, in addition, the state of ketosis was not monitored. Similarly, Tidman (33) carried out his study in a person with Parkinson's disease, so his results cannot be extrapolated. Like Danan et al. (32)calabrese et al. (34) conducted their research in patients with mental disorders; however, only 3 participants were included, so there was no room for a control group. Along the same lines, Bernia P. (35) finds positive results regarding CBD as a nutritional intervention for anxiety, in spite of this, the diet proposed contains more than the 40 g HC daily since it is an isocaloric DM to which he adds coconut oil and, in addition, they are patients with multiple sclerosis without a control group.

Likewise, the other 2 studies that find beneficial effects of CBD on anxiety are observational, so the causes of the results obtained are not established, in addition to not having a sample of people with GAD or symptomatology of the disease to recognize the positive effects of CBD on it. Daneshzad et al. (36) found this relationship in his research on 265 women with type II diabetes mellitus, stating that clinical trials are needed to confirm his findings due to the non-heterogeneity of the sample and the type of study. Similarly, Daneshzad et al. (36)garner et al. (37) in their cohort study shows a positive association of CBD on mental health in healthy adults, so CBD is not analyzed as a treatment or adjuvant, but as a prevention of mental illness.

On the other hand, two other observational studies by Sangsefidi et al (38) and Tabesh et al (39) do not establish a correlation between CBD and GAD. It should not be overlooked that the sample size of both is very large (>10,000 in total), however, the way the results are collected through a semi-quantitative online Consumption Frequency Questionnaire does not support high dietary follow-up. In turn, the study by Sangsefidi et al (38) study does not establish its duration and that of Tabesh et al (39) lasts 2 years, a rather long period to maintain this dietary pattern that has shown quite a few adverse effects in the long term. As they are observational studies, they do not establish the causal relationships of their results.

In order to prove that a CBD is an effective strategy, it is essential to know the negative effects it has on health if implemented over the long term. A CBD maintained over time increases LDL and total cholesterol, which increases the risk of cardiovascular disease, and also increases the risk of metabolic acidosis, which decreases bone density, increases tiredness and fatigue, and worsens mood. In addition to that, CBD is a dietary intervention low in fiber and vitamins due to the low consumption of fruit and, in many cases, vegetables, which would eliminate all the benefits at intestinal, cerebral, renal, cardiovascular, etc. levels. (16,18,40).

Despite the fact that CBD studies are better designed than the previous ones, its use as a treatment for GAD cannot be confirmed due to the fact that most of these studies present small samples, non-randomized designs without a control group, and with a non-representative sample. In addition to all this, there are the possible adverse effects of long-

term CBD (40) such as lipid alterations, fiber and micronutrient deficiency, or adherence problems.

Author	Reference	Year	Population	Sample	Duration of follow-up	Results
Danan et al.	(32)	2022	Hospitalized adults with severe and persistent mental illnesses	31	6-248 days	A ketogenic diet is associated with considerable improvements in mental health symptoms.
Tidman	(33)	2022	Woman with Parkinson's disease	1	24 weeks	A ketogenic diet decreases anxiety symptoms in Parkinson's disease.
Calabrese et al.	(34)	2024	Adults aged 32 to 36 years with depression and/or anxiety	3	12-16 weeks	Complete remission of the disease was obtained 7-12 weeks after starting ketosis.
P. Bernia	(35)	2019	Patients with multiple sclerosis	27	4 months	A CBD in these patients improves anxiety levels.
Daneshzad et al.	(36)	2020	Women with type II diabetes mellitus	265	-	Patients who consume fewer carbohydrates have better sleep quality and lower incidence of mental disorders.
Garner et al.	(37)	2024	Healthy adults	260	7-8 months	A ketogenic diet was positively associated for mental health.
Sangsefidi et al.	(38)	2021	Healthy adults	7165	-	A CBD was not associated with mental disorders such as anxiety and depression. It was associated with a lower probability of depression in women.
Tabesh et al.	(39)	2023	Adults	5405	2 years	The insulinemic potential of the diet was not associated with anxiety.

Table 2. Studies on the use of a CBD in GAD (from 41 to 50).

Third and finally, there are 10 studies investigating DM as a possible treatment or adjuvant for GAD represented in Table 3.3. (41-50). DM is presented with greater scientific support in general terms, despite this, the evidence on its use as a nutritional intervention in GAD is not clear.

According to 8 studies, MD could be an effective strategy as a treatment or adjuvant for GAD (41-45). The research of Flor-Alemany et al (41), Alshahwan et al (42), Mikkawi et al (43), Godos et al (44) and Jasmin et al (45) are cross-sectional studies that do not establish the specific causes of the results. Likewise, the publications of Flor-Alemany et al (41), Alshahwan et al (42) and Mikkawi et al (43) are to a specific population such as pregnant women in the former and students in the latter two. Still, they establish DM as a dietary intervention that reduces anxiety symptoms in pregnant women and college students. Research such as that of Godos et al (44) and Jasmin et al (45) in addition to relating DM with an improvement in GAD, relate people who follow a Mediterranean dietary pattern with a better lifestyle.

On the other hand, the studies of Casas et al (46) martínez-Rodríguez et al (47) and Foscolou et al (48) are clinical trials that establish DM as a nutritional intervention for GAD. The study by Casas et al (46) is limited to pregnant women and therefore cannot be extrapolated to a larger population. It should be noted that this is a study with a large sample and, in addition, it has a control group with which to compare the results. The other trial by Martínez-Rodríguez et al (47) uses a rather low and, like the previous one, non-representative sample, since it is carried out on women with fibromyalgia. Likewise, this study includes 60 mg of tryptophan and magnesium derived from the consumption of nuts at breakfast and dinner in addition to following the Mediterranean dietary pattern, so the beneficial effect of nuts on GAD is contemplated. Despite the number and type of sample, the study has a correct follow-up of the diet and control group. Similar to the previous ones, the research of Foscolou et al (48) was conducted in adolescent women with PCOS, so it does not represent the general population with GAD. However, anxiety is a common symptom in PCOS and, moreover, establishes the importance of a correct support system to increase adherence to DM.

In contrast, two clinical trials do not recognize the relationship between DM and improvement of GAD. Esgunoglu et al (49) states in their clinical trial that their research conducted established a short period of time (5 days) that does not reflect the possible benefits of DM on anxiety. In turn, Radkhah et al (50) does analyze this dietary pattern for a longer period of time (12 weeks) but he himself states that they did not have sufficient follow-up of the diet and establishes MD as a possible dietary intervention to achieve mental well-being, since after adjusting for factors that could have influenced the outcome, the group that followed the Mediterranean dietary pattern obtained better results. It is worth noting that in the study by Radkhah et al (50) there was a control group that had a normal healthy diet, so the possible beneficial results in DM anxiety that the author found after the changes are favorable toward this intervention since the study itself was correctly approached.

A well-planned MD provides omega-3 fatty acids, fiber, magnesium, antioxidants and polyphenols, compounds that are essential for the correct functioning of the nervous system and, likewise, beneficial when considering a dietary intervention as a treatment and/or adjuvant for GAD (16,18,21,51). In addition to all this, there are no adverse effects in people who follow the diet, both in GAD and in general, and well-designed clinical trials that support its use, so that MD could be a nutritional intervention to follow in people suffering from GAD.

Table 3. Studies on the use of a DM in GAD (from 41 to 50).

Author	Reference	Year	Population	Sample	Duration of follow-up	Results
Flor-Alemany et al.	(41)	2022	Pregnant women	152	23 weeks	They associated greater adherence to MD with less anxiety during pregnancy.
Alshahwan et al.	(42)	2023	University students	1.134	-	Adherence to MD was associated with lower severity of anxiety/depression.
EI Mikkawi et al.	(43)	2024	University students	200	-	Greater adherence to MD was associated with lower levels of anxiety and/or depression.
Godos et al.	(44)	2023	Healthy adults	2044	-	Better mental and cognitive health in adults with greater adherence to MD.
Jasmin et al.	(45)	2023	Adults	100	-	Greater adherence to DM was associated with lower anxiety scores.
Casas et al.	(46)	2023	Pregnant women at high risk of suffering from anxiety and stress	1221	17-20 weeks	Identifies MD as an effective strategy to decrease anxiety and stress during pregnancy.
Martínez-Rodríguez et al.	(47)	2020	Women with fibromyalgia	22	16 weeks	A MD enriched with tryptophan and magnesium improves anxiety symptoms in women with fibromyalgia.
Fosculou et al	(48)	2024	Adolescent women with PCOS	40	3 months	A clinical decision support system improves adherence to MD. This increased adherence improves disease and anxiety levels.
Esgunoglu et al.	(49)	2024	Adults diagnosed with anxiety and/or mild depression	25	5 days	No association was found between MD and improvement of anxiety and/or depression symptomatology.
Radkh	(50)	2023	Adults with	60	12 weeks	No association was found

ah et al.			stress, anxiety and/or depression			between MD and improvement of anxiety and/or depression symptomatology. After some readjustments, he did identify the positive effects of MD.

In line with the above and considering the nutritional interventions that could contribute to the improvement of GAD, three micronutrients have been studied as possible components to take into account in the management of anxiety: omega-3, fiber and magnesium.

According to Al Sinani et al (12)the suffering of mental illnesses such as depression and/or anxiety is related to low omega-3 intake in pregnant women, so they recommend foods rich in this healthy fat such as oily fish or seafood or its supplementation to reduce the suffering of anxiety during pregnancy. Others, such as Wang et al (15) relate the optimal intake of omega-3 fatty acids with a decrease in GAD symptomatology. This essential fatty acid, in addition to its anti-inflammatory power, its protective effect at the cardiovascular level and its improvement in cognitive capacity, is a nutrient to be taken into account when recommending a dietary intervention to treat GAD. All three diets, VD, DBC and MD, well planned, reach adequate daily omega-3 levels.

A micronutrient capable of improving the composition of the microbiota, which is very influential in mental health due to the connections it has with the brain, is fiber (18). Authors such as Dalile et al (16) and Chen et al (18) recognize in their randomized triple-blind and double-blind clinical trials, respectively, the positive impact of this micronutrient on the intestinal bacterial population and, thus, on anxiety-related behaviors. Both VD and MD are fiber-rich interventions due to their high content of fruits, vegetables, whole grains, legumes and seeds. However, dietary interventions such as CBD restrict the amount of carbohydrates and, consequently, fiber, thus falling short of the recommended daily fiber intake.

Magnesium, on the other hand, acts as a modulator of the central nervous system, being an agonist of the GABAA receptor and an inhibitor of the NMDA receptor (21). Several studies have investigated its relationship with anxiety and whether its supplementation and/or optimal intake could improve GAD. Oddoux et al (19) and Noé et al (21) found in their randomized double-blind clinical trials an improvement of GAD symptomatology through magnesium supplementation with vitamin B6. Saba et al (20) analyzed in a randomized clinical trial magnesium supplementation in post-surgical patients, those who supplemented with the mineral reduced their anxiety. Although the studies presented are of high quality, we cannot affirm its supplementation as a treatment for GAD because the former are accompanied by vitamin B_6 and are not sufficient to establish magnesium as a treatment for the disease. Even so, it is advisable to achieve optimal magnesium intake through the diet because of its possible beneficial effects and the probable relationship of hypomagnesemia with the disease (19). Through properly planned VD and MD, magnesium requirements can be met thanks to its content in green leafy vegetables, legumes, nuts, seeds and whole grains. However, the CBD usually significantly limits some of these food groups because of their low HC content.

A relevant aspect in the interpretation of the results is the level of adherence to the respective dietary interventions. The lack of follow-up, especially in observational

studies, makes it very difficult to establish causal relationships in the results. Also, prolonged adherence to a dietary pattern such as CBD or VD is complicated due to its restrictive nature, whereas DM tends to have more long-term sustainability because it does not exclude any foods and the population recognizes its health benefits (52,53) (52,53).

Despite current limitations, MD is presented as the most practical and effective adjuvant option, thanks to its ample scientific evidence, the inexistence of studies that contraindicate it in GAD, its degree of adherence and its benefits in general health, including mental wellbeing. In addition, it contains the nutrients studied, namely fiber, omega-3 and magnesium, which exert a possible positive effect on overall mental health. Although there are not yet enough specific studies available on the effect of these nutrients on GAD, their benefits on general health and their impact on the mechanisms of the gut-brain axis are known.

In contrast, VD and CBD cannot currently be considered as nutritional treatment or adjuvant strategies. The VD lacks quality scientific literature, also showing a similar proportion of studies in favor and against its use as a dietary intervention in GAD. On the other hand, although there are clinical trials that recognize the positive effects of this dietary pattern, CBD has limitations in terms of adherence, numerous adverse effects if maintained over the long term, and difficulties in achieving the optimal requirements of nutrients of great importance in GAD, such as fiber and magnesium.

Likewise, it will be essential to investigate and determine the role of fiber, omega-3 and magnesium in GAD since the current evidence is still limited. These nutrients are involved in key physiological mechanisms such as the regulation of inflammation, neurotransmitter balance and gut microbiota health, all of which are implicated in mental health. However, the exact amount needed to exert a therapeutic effect is not yet established. Therefore, it is important to establish whether an adequate intake of these nutrients through diet is sufficient to achieve benefits in GAD and mental health in general or whether specific supplementation would be necessary.

In conclusion, MD could represent the most appropriate nutritional strategy as an adjuvant in the management of GAD due to the existence of research supporting it, its benefits in terms of general health and mental well-being, the high degree of adherence and the absence of known risks. Even so, future controlled clinical trials, with larger samples, rigorous nutritional follow-up and direct comparisons between the three diets, are required to establish more solid conclusions and determine whether a nutritional intervention could displace or reduce pharmacological treatment.

References

1. Xie X, Li Y, Zhang Y, Lin X, Huang M, Fu H, et al. Associations of diet quality and daily free sugar intake with depressive and anxiety symptoms among Chinese adolescents. J Affect Disord. april 1, 2024;350:550-8.
2. American Psychiatric Association. DSM-V Diagnostic and Statistical Manual of mental disorders [Internet]. 5th ed. Arlington (VA); 2013 [cited Feb 19, 2025]. Available at: https://drive.google.com/file/d/0Bwm2HQHfHsSYQ2x1MG1pRHlNQVE/view?resourcekey=0-32-1m1PQiELP5llRBtVaOA&usp=embed_facebook
3. Also Fontanet A, Echiburu Salinas N, Pinto Asenjo J. Pharmacological treatment of

anxiety disorders. Practical Primary Care [Internet]. january 1, 2024 [cited February 27, 2025];6(1). Available at: http://www.elsevier.es/es-revista-atencion-primaria-practica-24-articulo-tratamiento-farmacologico-trastornos-ansiedad-S2605073023000238?utm_source=chatgpt.com
4. Generalized anxiety disorder: When worry can't be controlled - National Institute of Mental Health (NIMH) [Internet]. [cited 2025 Feb 27]. Available at: https://www.nimh.nih.gov/health/publications/espanol/trastorno-de-ansiedad-generalizada-cuando-no-se-pueden-controlar-las-preocupaciones-new
5. Diet and the Microbiota-Gut-Brain Axis: Sowing the Seeds of Good Mental Health. Adv Nutr. july 1, 2021;12(4):1239-85.
6. González-Herrera M, García-García M, Díez-Arroyo C, Hernández-Ruiz Á. Dietary patterns and factors and their association with anxiety in adult population: proposed recommendations based on a scoping review of systematic reviews and meta-analyses. Nutr Hosp. Dec 2023;40(6):1270-89.
7. Borrego-Ruiz A, Borrego JJ. Human gut microbiome, diet, and mental disorders. Int Microbiol. 2025;28(1):1-15.
8. Luo G, Li Y, Yao C, Li M, Li J, Zhang X. Prevalence of overweight and obesity in patients with major depressive disorder with anxiety: Mediating role of thyroid hormones and metabolic parameters. J Affect Disord. aug 15, 2023;335:298-304.
9. Aucoin M, LaChance L, Naidoo U, Remy D, Shekdar T, Sayar N, et al. Diet and Anxiety: A Scoping Review. Nutrients. dec 10, 2021;13(12):4418.
10. Aucoin M, LaChance L, Naidoo U, Remy D, Shekdar T, Sayar N, et al. Diet and Anxiety: A Scoping Review. Nutrients. dec 10, 2021;13(12):4418.
11. Piperoglou M, Hopwood M, Norman TR. Adjunctive Docosahexaenoic Acid in Residual Symptoms of Depression and Anxiety. J Clin Psychopharmacol. Dec 2023;43(6):493.
12. Al Sinani M, Johnson M, Crawford M, Al Maqbali M, Al-Adawi S. Depression and anxiety in the pregnant Omani population in relation to their fatty acid intake and levels. Prostaglandins Leukot Essent Fatty Acids. april 1, 2025;204:102668.
13. Rajabi-Naeeni M, Dolatian M, Qorbani M, Vaezi AA. Effect of omega-3 and vitamin D co-supplementation on psychological distress in reproductive-aged women with pre-diabetes and hypovitaminosis D: A randomized controlled trial. Brain Behav. sep 2, 2021;11(11):e2342.
14. Dighriri IM, Alsubaie AM, Hakami FM, Hamithi DM, Alshekh MM, Khobrani FA, et al. Effects of Omega-3 Polyunsaturated Fatty Acids on Brain Functions: A Systematic Review. Cureus. 14(10):e30091.
15. Wang L, Liu T, Zhao T, Tang H. N-3 PUFA supplementation alleviates anxiety symptoms by manipulating erythrocyte fatty acid levels in depression | European Journal of Nutrition. 2024 [cited Mar 17, 2025];63. Available at: https://link.springer.com/article/10.1007/s00394-024-03421-y
16. Dalile B, Vervliet B, Bergonzelli G, Verbeke K, Van Oudenhove L. Colon-delivered short-chain fatty acids attenuate the cortisol response to psychosocial stress in healthy men: a randomized, placebo-controlled trial. Neuropsychopharmacology. december 2020;45(13):2257-66.
17. Wolever TMS, Rahn M, Dioum EH, Jenkins AL, Ezatagha A, Campbell JE, et al. Effect of Oat β-Glucan on Affective and Physical Feeling States in Healthy Adults: Evidence for Reduced Headache, Fatigue, Anxiety and Limb/Joint Pains. Nutrients. may 1, 2021;13(5):1534.
18. Chen L, Liu B, Ren L, Du H, Fei C, Qian C, et al. High-fiber diet ameliorates gut microbiota, serum metabolism and emotional mood in type 2 diabetes patients.

Front Cell Infect Microbiol. jan 30, 2023;13:1069954.
19. Oddoux S, Violette P, Cornet J, Akkoyun-Farinez J, Besnier M, Noël A, et al. Effect of a Dietary Supplement Combining Bioactive Peptides and Magnesium on Adjustment Disorder with Anxiety: A Clinical Trial in General Practice. Nutrients. june 10, 2022;14(12):2425.
20. Saba S, Faizi F, Sepandi M, Nehrir B. Effect of short-term magnesium supplementation on anxiety, depression and sleep quality in patients after open-heart surgery. Magnes Res. apr 1, 2022;35(2):62-70.
21. Noah L, Dye L, Bois De Fer B, Mazur A, Pickering G, Pouteau E. Effect of magnesium and vitamin B6 supplementation on mental health and quality of life in stressed healthy adults: Post-hoc analysis of a randomised controlled trial. Stress Health. Dec. 2021;37(5):1000-9.
22. Worthington A, Coffey T, Gillies K, Roy R, Braakhuis A. Exploring how researchers consider nutrition trial design and participant adherence: a theory-based analysis. Front Nutr. dec 17, 2024;11:1457708.
23. Zamani B, Daneshzad E, Siassi F, Guilani B, Bellissimo N, Azadbakht L. Association of plant-based dietary patterns with psychological profile and obesity in Iranian women. Clin Nutr. june 1, 2020;39(6):1799-808.
24. Wang X, Yin Z, Yang Y, Fu X, Guo C, Pu K, et al. Association of plant-based dietary patterns with depression and anxiety symptoms in Chinese older adults: A nationwide study. J Affect Disord. april 1, 2024;350:838-46.
25. Senturk E, Senturk BG, Erus S, Genis B, Sanli SG, Zorbozan EY, et al. Is meat-free diet related to anxiety, depression and disordered eating behaviors? A cross-sectional survey in a Turkish sample. Ann Med Res. may 26, 2023;30(5):569-75.
26. Conner TS, Gillies NA, Worthington A, Bermingham EN, Haszard JJ, Knowles SO, et al. Effect of Moderate Red Meat Intake Compared With Plant-Based Meat Alternative on Psychological Well-Being: A 10-Wk Cluster Randomized Intervention in Healthy Young Adults. Curr Dev Nutr. january 1, 2025;9(1):104507.
27. Haghighatdoost F, Mahdavi A, Mohammadifard N, Hassannejad R, Najafi F, Farshidi H, et al. The relationship between a plant-based diet and mental health: Evidence from a cross-sectional multicentric community trial (LIPOKAP study). PLOS ONE. may 31, 2023;18(5):e0284446.
28. Kohl IS, Luft VC, Patrão AL, Molina M del CB, Nunes MAA, Schmidt MI. Association between meatless diet and depressive episodes: A cross-sectional analysis of baseline data from the longitudinal study of adult health (ELSA-Brazil). J Affect Disord. january 1, 2023;320:48-56.
29. Saintila J, Carranza-Cubas SP, Serpa-Barrientos A, Carranza Esteban RF, Cunza-Aranzábal DF, Calizaya-Milla YE. Depression, Anxiety, Emotional Eating, and Body Mass Index among Self-Reported Vegetarians and Non-Vegetarians: A Cross-Sectional Study in Peruvian Adults. Nutrients. may 29, 2024;16(11):1663.
30. Bègue L, Shankland R. Is vegetarianism related to anxiety and depression? A cross-sectional survey in a French sample. J Health Popul Nutr. may 9, 2022;41:18.
31. Oh R, Gilani B, Uppaluri KR. Low-Carbohydrate Diet. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2025 Feb 22]. Available at: http://www.ncbi.nlm.nih.gov/books/NBK537084/
32. Danan A, Westman EC, Saslow LR, Ede G. The Ketogenic Diet for Refractory Mental Illness: A Retrospective Analysis of 31 Inpatients. Front Psychiatry. july 6, 2022;13:951376.
33. Tidman M. Effects of a Ketogenic Diet on Symptoms, Biomarkers, Depression, and Anxiety in Parkinson's Disease: A Case Study. Cureus. 14(3):e23684.

34. Calabrese L, Frase R, Ghaloo M. Complete remission of depression and anxiety using a ketogenic diet: case series. Front Nutr [Internet]. may 14, 2024 [cited February 23, 2025];11. Available at: https://www.frontiersin.org/journals/nutrition/articles/10.3389/fnut.2024.1396685/full
35. Tarragó DPB. TRABAJO FIN DE GRADO PARA OPTAR AL TÍTULO DE "GRADO EN ENFERMERÍA".
36. Daneshzad E, Keshavarz SA, Qorbani M, Larijani B, Azadbakht L. Association between a low-carbohydrate diet and sleep status, depression, anxiety, and stress score. J Sci Food Agric. 2020;100(7):2946-52.
37. Garner S, Davies E, Barkus E, Kraeuter AK. Ketogenic diet has a positive association with mental and emotional well-being in the general population. Nutrition. aug 1, 2024;124:112420.
38. Sangsefidi ZS, Salehi-Abarghouei A, Sangsefidi ZS, Mirzaei M, Hosseinzadeh M. The relation between low carbohydrate diet score and psychological disorders among Iranian adults. Nutr Metab. january 30, 2021;18:16.
39. Tabesh M, Hosseinzadeh M, Teymoori F, Mirzaei M, Nadjarzadeh A, Rahideh ST. Insulinemic potential of diet and psychological disorders: A cross-sectional, population-based study. J Affect Disord. nov. 15, 2023;341:349-57.
40. Masood W, Annamaraju P, Khan Suheb MZ, Uppaluri KR. Ketogenic Diet. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited Mar 28, 2025]. Available at: http://www.ncbi.nlm.nih.gov/books/NBK499830/
41. Flor-Alemany M, Baena-García L, Migueles JH, Henriksson P, Löf M, Aparicio VA. Associations of Mediterranean diet with psychological ill-being and well-being throughout the pregnancy course: The GESTAFIT project. Qual Life Res. 2022;31(9):2705-16.
42. Alshahwan M, Mathews A, Ahrens A, Triplett E, LaMontagne L, Doty J, et al. Adherence to a Mediterranean-style Diet Is Associated with Decreased Depression and Anxiety Severity Regardless of Food Security Status: a Cross-sectional Study of College Freshmen. J Acad Nutr Diet. sep 1, 2023;123(9, Supplement):A55.
43. El Mikkawi H, El Khoury C, Rizk R. Adherence to the Mediterranean diet and mental health among university students in Lebanon. Appl Food Res. june 1, 2024;4(1):100435.
44. Godos J, Grosso G, Ferri R, Caraci F, Lanza G, Al-Qahtani WH, et al. Mediterranean diet, mental health, cognitive status, quality of life, and successful aging in southern Italian older adults. Exp Gerontol. may 1, 2023;175:112143.
45. Jasmin GA, Fusco KN, Petrosky SN. Cross-Sectional Analysis of the Relationship Between Adherence to the Mediterranean Diet and Mental Wellness. Cureus [Internet]. february 11, 2023 [cited March 6, 2025]; Available at: https://www.cureus.com/articles/111874-cross-sectional-analysis-of-the-relationship-between-adherence-to-the-mediterranean-diet-and-mental-wellness
46. Casas I, Nakaki A, Pascal R, Castro-Barquero S, Youssef L, Genero M, et al. Effects of a Mediterranean Diet Intervention on Maternal Stress, Well-Being, and Sleep Quality throughout Gestation-The IMPACT-BCN Trial. Nutrients. January 2023;15(10):2362.
47. Martínez-Rodríguez A, Rubio-Arias JÁ, Ramos-Campo DJ, Reche-García C, Leyva-Vela B, Nadal-Nicolás Y. Psychological and Sleep Effects of Tryptophan and Magnesium-Enriched Mediterranean Diet in Women with Fibromyalgia. Int J Environ Res Public Health. April 2020;17(7):2227.
48. Foscolou A, Papandreou P, Gioxari A, Skouroliakou M. Optimizing Dietary Habits in Adolescents with Polycystic Ovary Syndrome: Personalized Mediterranean Diet

Intervention via Clinical Decision Support System-A Randomized Controlled Trial. Children. June 2024;11(6):635.
49. Esgunoglu L, Liaquat M, Gillings R, Lazar A, Leddy A, Brooks J, et al. Acute effect of a Mediterranean-style dietary pattern (MDP) on mood, anxiety and cognition in UK adults with mild to moderate anxiety and depression: the MediMood randomised controlled trial protocol. BMJ Open. dec 20, 2024;14(12):e082935.
50. Radkhah N, Rasouli A, Majnouni A, Eskandari E, Parastouei K. The effect of Mediterranean diet instructions on depression, anxiety, stress, and anthropometric indices: A randomized, double-blind, controlled clinical trial. Prev Med Rep. dec 1, 2023;36:102469.
51. Barfoot KL, Forster R, Lamport DJ. Mental Health in New Mothers: A Randomised Controlled Study into the Effects of Dietary Flavonoids on Mood and Perceived Quality of Life. Nutrients. july 13, 2021;13(7):2383.
52. Machado P, McNaughton SA, Livingstone KM, Hadjikakou M, Russell C, Wingrove K, et al. Measuring Adherence to Sustainable Healthy Diets: A Scoping Review of Dietary Metrics. Adv Nutr. january 1, 2023;14(1):147-60.
53. Li S, Du Y, Meireles C, Sharma K, Qi L, Castillo A, et al. Adherence to ketogenic diet in lifestyle interventions in adults with overweight or obesity and type 2 diabetes: a scoping review. Nutr Diabetes. september 14, 2023;13:16.