

# Plant-Based Diets and Migraine Management

Parisa Gazerani

<sup>1</sup>Department of Life Sciences and Health, Faculty of Health Sciences, Oslo Metropolitan University, Norway

<sup>2</sup>Department of Health Science and Technology, Faculty of Medicine, Aalborg University, Denmark

## INTRODUCTION & AIM

### Introduction:

Plant-based diets, rich in fruits, vegetables, whole grains, and legumes, are known for their anti-inflammatory properties and potential to improve overall health. Chronic inflammation has increasingly been recognized as a contributor to the pathophysiology of migraine, a common and often debilitating neurological disorder. Migraine is characterized by recurrent, severe headaches, typically one-sided, lasting from a few hours to several days. In addition to headache pain, migraine is frequently accompanied by nausea, vomiting, and sensitivity to light (photophobia) and sound (phonophobia), as well as aura, a visual or sensory disturbance that precedes headaches in some individuals. The exact cause of migraines remains unknown, but they are believed to involve a complex interaction between genetic, environmental, and neurological factors. Migraines are thought to arise from abnormal brain activity that temporarily affects nerve signals, chemicals, and blood vessels in the brain. Inflammatory processes, vascular dysfunction, and mitochondrial abnormalities have all been implicated in migraine pathogenesis, which may explain the potential role of diet in managing this condition. A plant-based diet reduces inflammatory markers and provides essential nutrients such as magnesium, riboflavin, and coenzyme Q10, which are critical for maintaining mitochondrial function and vascular health, both key areas involved in migraine. For instance, magnesium deficiency is common among individuals with migraines, and supplementation has been shown to reduce both the frequency and severity of attacks. Moreover, plant-based diets may support a healthy gut microbiome, which has gained attention for its role in regulating brain health through the gut-brain axis. Gut dysbiosis, or an imbalance in the gut microbiome, has been linked to several neurological conditions, including migraine. Emerging evidence suggests that the composition of the gut microbiota might influence migraine susceptibility by affecting inflammation, immune responses, and even neurotransmitter production.

**Aim of Study:** This review aims to assess the current evidence on the relationship between plant-based diets and migraine management, focusing on the impact of these diets on migraine frequency, severity, and associated inflammatory markers. Through a comprehensive analysis of available studies, this review seeks to identify the current evidence and the potential mechanisms by which plant-based diets may influence migraine outcomes. Additionally, it aims to highlight areas for future research, such as the role of the gut-brain axis and vascular health. Given the multi-dimensional benefits of plant-based diets, it is proposed that they may represent a promising, non-pharmacological approach to managing migraine. Such diets could eventually complement existing pharmacological treatments and offer a sustainable, long-term solution for reducing migraine frequency and severity.

## METHOD

A narrative literature review was conducted to evaluate the current evidence on the effects of plant-based diets on migraine management. The review aimed to identify and synthesize relevant clinical studies, observational studies, and case reports published up to 2024. The databases PubMed and Web of Science were systematically searched using a combination of relevant keywords, including "migraine," "diet," "headache," "plant-based," "vegetarian," and "vegan." Additional terms such as "anti-inflammatory," "gut-brain axis," and "nutrition" were used to capture studies addressing the proposed mechanisms of action.

The inclusion criteria for studies were: 1) Clinical studies involving human participants diagnosed with migraine. 2) Studies specifically evaluating plant-based or vegetarian/vegan dietary patterns. 3) Studies reporting quantitative outcomes related to migraine frequency, severity, or duration. 4) Studies published in peer-reviewed journals in English. Exclusion criteria included studies with animal models, studies focusing on other headache disorders, and studies lacking sufficient dietary information or outcome measures relevant to migraine.

A total of 72 articles were initially identified. After screening the titles and abstracts for relevance, 36 articles were reviewed in full text. Of these, 16 studies met the inclusion criteria and were selected for detailed analysis. Data extracted from each study included sample size, participant characteristics, type of plant-based diet (vegetarian, vegan, or low-fat plant-based), duration of dietary intervention, and outcomes related to migraine (frequency, severity, and duration of attacks). Where available, information on inflammatory markers, vascular health parameters, and gut microbiota composition was also collected.

The risk of bias in each study was assessed using established tools such as the Cochrane Risk of Bias Tool for randomized controlled trials (RCTs) and the Newcastle-Ottawa Scale for observational studies. This assessment ensured the quality and reliability of the included studies, with particular attention given to study design, participant selection, and outcome measurement. Data synthesis involved both a qualitative summary and, where applicable, a quantitative synthesis of outcomes. Due to heterogeneity in study designs and dietary interventions, a meta-analysis was not performed. Instead, the findings were narratively summarized to highlight patterns and themes in the data, as well as potential mechanisms through which plant-based diets may influence migraine outcomes.

### Steps taken in the literature review

- Records identified through database searches (n = 72)
  - PubMed and Web of Science using keywords: "migraine," "diet," "headache," "plant-based," "vegetarian," "vegan."
- Titles and abstracts screened (n = 72)
- Records excluded based on abstract/title (n = 36)
  - Reasons for exclusion: Irrelevant to diet or migraine.
- Full-text articles assessed for eligibility (n = 36)
- Full-text articles excluded (n = 20)
  - Reasons for exclusion: Animal studies, studies on other headache disorders, studies lacking relevant outcomes.
- Studies included in the review (n = 16)

## RESULTS & DISCUSSION

### Results:

The review of the included studies provided promising, though preliminary, evidence regarding the role of plant-based diets in managing migraine symptoms.

Key findings included:

- Migraine Frequency Reduction:** Several studies indicated that adherence to a plant-based diet, particularly a low-fat, vegan or vegetarian diet, was associated with a reduction in the frequency of migraine attacks. One study demonstrated a 50% reduction in migraine days among participants following a low-fat plant-based diet over a 12-week period.
- Migraine Severity and Duration:** A small number of studies suggested that the severity of migraine attacks was reduced in participants consuming plant-based diets. In one study, participants reported a decrease in the duration of migraine episodes, with some cases showing up to 30% shorter attacks after dietary intervention.
- Nutrient Impact:** The beneficial effects of plant-based diets were proposed to be multi-dimensional. Magnesium, riboflavin, and coenzyme Q10, nutrients abundant in plant-based foods, were highlighted as playing important roles in reducing migraine severity. For example, magnesium supplementation was shown to be particularly effective in individuals with known deficiencies.
- Inflammation and Gut-Brain Axis:** One study reported that individuals on a plant-based diet had reduced serum nitric oxide levels, which are often elevated during migraine attacks. Additionally, several studies noted improvements in gut health, with plant-based diets promoting a healthier microbiome, which may influence brain function and migraine outcomes through the gut-brain axis.

**Discussion:** The findings of this review highlight the potential of plant-based diets as a complementary, non-pharmacological approach to migraine management. The anti-inflammatory effects of these diets, combined with the nutrient density of plant-based foods, suggest multiple pathways through which migraines could be alleviated. By reducing systemic inflammation, promoting vascular health, and supporting the gut microbiome, plant-based diets can potentially offer a multi-faceted strategy for migraine prevention and relief.

### Study Limitations:

This review is narrative in nature, and while efforts were made to include relevant studies, selection bias may be present. A systematic review is needed to determine whether these findings hold up across a broader range of studies. Despite the potential benefits of plant-based diets, the current body of evidence is limited by several factors: 1) Many of the reviewed studies were small-scale with short follow-up periods, limiting our understanding of the long-term effects of plant-based diets on migraine. 2) Most studies relied on self-reported migraine outcomes, which can introduce bias and affect the accuracy of the data. 3) There was significant variability in how plant-based diets were defined across studies, ranging from strict vegan to more flexible vegetarian patterns. This variation makes it difficult to pinpoint which components of the diet are most beneficial for migraine management.

### Future Directions:

To solidify the role of plant-based diets in migraine management, large, well-designed, and long-term randomized controlled trials (RCTs) are necessary. These studies should investigate not only migraine outcomes but also the underlying mechanisms, including changes in inflammatory markers, gut microbiota composition, and vascular health. Additionally, comparative studies between plant-based diets and other dietary interventions, such as ketogenic or Mediterranean diets, could offer valuable insights into the relative efficacy of different dietary approaches for managing migraine.

**Clinical Implications:** The current evidence supports the recommendation of plant-based diets as part of an individualized migraine management plan for clinicians. While the results are encouraging, patients should be informed of the importance of maintaining a balanced plant-based diet to avoid nutrient deficiencies, especially in vegan diets. Careful planning and monitoring of essential nutrients such as B12, omega-3 fatty acids, and protein are crucial to ensure the diet remains nutritionally adequate for migraine sufferers.

## CONCLUSION

Plant-based diets show promise in reducing migraine frequency and severity, likely due to their anti-inflammatory effects, nutrient density, and positive impact on gut health. However, the current evidence is limited by small sample sizes and short study durations. Larger, well-controlled trials are needed to confirm these findings and clarify the underlying mechanisms. While plant-based diets may offer a valuable, non-pharmacological option for migraine management, careful consideration of nutrient intake is crucial for long-term success.

## REFERENCES

- Brunner AE, Agarwal U, Gonzalez JF, Valente F, Barnard ND. Nutrition intervention for migraine: a randomized crossover trial. *J Headache Pain*. 2014 Oct 23;15(1):69.
- Di Lorenzo C, Pinto A, Ienca R, Coppola G, Siliani G, Di Lorenzo G, Parisi V, Serrao M, Spagnoli A, Vestri A, Schoenen J, Donini LM, Pierelli F. A Randomized Double-Blind, Cross-Over Trial of very Low-Calorie Diet in Overweight Migraine Patients: A Possible Role for Ketones? *Nutrients*. 2019 Jul 28;11(8):1742.
- Sidhu SRK, Kok CW, Kunasegaran T, Ramadas A. Effect of Plant-Based Diets on Gut Microbiota: A Systematic Review of Interventional Studies. *Nutrients*. 2023 Mar 21;15(6):1510.
- Arab A, Khorvash F, Kazemi M, Heidari Z, Askari G. Effects of the Dietary Approaches to Stop Hypertension (DASH) diet on clinical, quality of life and mental health outcomes in women with migraine: a randomised controlled trial. *Br J Nutr*. 2022 Oct 26;126(8):1535-1544.
- Bongiovanni D, Benedetto C, Corvisieri S, Del Favero C, Orlandi F, Allais G, Sinigaglia S, Fadda M. Effectiveness of ketogenic diet in treatment of patients with refractory chronic migraine. *Neurol Sci*. 2021 Sep;42(9):3865-3870.
- Medawar E, Huhn S, Villringer A, Veronika Witte A. The effects of plant-based diets on the body and the brain: a systematic review. *Transl Psychiatry*. 2019 Sep 12;9(1):226.
- Bakirhan H, Yildiran H, Uyar Cankay T. Associations between diet quality, DASH and Mediterranean dietary patterns and migraine characteristics. *Nutr Neurosci*. 2022 Nov;25(11):2324-2334.
- Hindiyeh NA, Zhang N, Farrar M, Banerjee P, Lombard L, Aurora SK. The Role of Diet and Nutrition in Migraine Triggers and Treatment: A Systematic Literature Review. *Headache*. 2020 Jul;60(7):1300-1316.
- Haslam RL, Bezzina A, Herbert J, Spratt N, Rollo ME, Collins CE. Can Ketogenic Diet Therapy Improve Migraine Frequency, Severity and Duration? *Healthcare (Basel)*. 2021 Aug 26;9(9):1105.
- Bongiovanni D, Benedetto C, Corvisieri S, Del Favero C, Orlandi F, Allais G, Sinigaglia S, Fadda M. Effectiveness of ketogenic diet in treatment of patients with refractory chronic migraine. *Neurol Sci*. 2021 Sep;42(9):3865-3870.
- Karimi E, Tirani SA, Azimi ES, Askari G, Ashabi A, Arab A. Is there an association between a plant-based eating pattern and clinical findings of a migraine headache? *Front Nutr*. 2023 Jul 4;10:1117740.
- Morton O, Shehata M, Gabbias N, Kassam S. A Whole Food Plant-Based Approach for Migraine: A Case Series. *American Journal of Lifestyle Medicine*. 2022;0(0).
- Askarpour, M., Sheikhi, A., Khorsha, F., Setayesh, L., Togha, M., Mirzaei, K. Association of Plant-Based Dietary Patterns with Migraine Headache Severity and Duration among Women. *Journal of Iranian Medical Council*. 2021; 4(1): 12-24.
- Perzia BM, Dunstiel JL. Dunsieff DMChronic migraine reversal and prevention with the LIFE diet: a nutrient dense whole food plant-based diet (WFPBD)BMJ Case Reports CP 2021;14:e243987.
- Gazerani P. A Bidirectional View of Migraine and Diet Relationship. *Neuropsychiatr Dis Treat*. 2021;17:435-451.
- Arzani M, Jahromi SR, Ghorbani Z, et al. Gut-brain axis and migraine headache: a comprehensive review. *J Headache Pain*. 2020;21(1):15.
- Medawar, E., Huhn, S., Villringer, A. et al. The effects of plant-based diets on the body and the brain: a systematic review. *Transl Psychiatry* 9, 226 (2019)