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**"Evaluation of Low-fat Diet on Migraine Headache Severity: A
systematic Review. "**

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Content of Table

Abstract	7
Riassunto.....	8
1. Introduction.....	9
1.1 Background of the study	9
1.2 Pathology of the migraine.....	10
1.3 Pharmacological and non-pharmacological management approaches....	12
1.4 Lifestyle and Nutrition Management.....	14
1.5 Explanation of the dietary intervention	15
1.6 Dietary Patterns and Therapeutic Interventions.....	16
1.7 Physiological Mechanisms Linking Diet and Migraine.....	17
1.8 Diet as trigger and Modulator.....	18
1.9 Low-fat diet	20
1.10 Linking Fat Intake and Migraine Pathways.....	21
1.11 Conceptual Evidence supporting Low-fat Diet in Migraine.....	23
2. Purpose of the study	24
3. Methods.....	25
3.1 Search Strategy and Study Identification.....	25
3.2 Inclusion and Exclusion Criteria.....	26
3.3 Study Selection/ Study Design.....	26
3.4 Data extraction and main outcomes	28
3.5 Limitations.....	28
4. Results.....	29
4.1 Low-fat diet	29

4.2 Quality assessment	32
4.3 Study characteristics.....	34
4.3.1 Location and Sample Size.....	34
4.3.2 Population Characteristic.....	34
4.3.3 Study Aims.....	34
4.4 Study Design and Methodological Approaches.....	35
4.5 Overview of the Findings and Outcomes.....	36
4.5.1. Effect on Migraine Frequency.....	36
4.5.2. Effect on Migraine Intensity and Duration.....	37
4.5.3. Impact on Migraine Medication Use and Quality of Life.....	38
4.6 Patterns and Heterogeneity Across Studies.....	38
4.7 Types of Dietary Interventions.....	39
4.8 General Dietary Patterns.....	39
4.9 Specific Low-fat Diet Intervention.....	40
4.10 Overall Approach on Low-fat Diet.....	41
4.11 Limitations of the Evidence Base.....	43
5. Discussion	44
5.1 Overview of the Main Findings.....	44
5.2 Biological and Mechanistic Interpretations.....	44
5.3 Comparison with Previous Dietary Intervention.....	45
5.4 Gender and Hormonal Consideration.....	46
5.5 Strength, Limitations, and Future Research.....	47
5.6 Clinical and Public Health Implications.....	47
5.7 Summary.....	48

6. Conclusions49

References:51

Abstract

Recurrent headaches and related symptoms are the hallmark of migraine, a chronic neurological disorder that severely affects quality of life. Although pharmaceutical treatments continue to be the mainstay of care, dietary changes have become a potential adjunctive tactic. This thesis thoroughly examines the data on how well a low-fat diet can lessen the intensity of migraine headaches. We looked through electronic databases to find observational studies and clinical trials assessing the connection between migraine outcomes and fat intake. The methodological quality of the studies that met the inclusion criteria was evaluated, and the results were synthesized.

There is evidence that, following a low-fat diet, which is generally defined as consuming less than 20–25% of daily energy from fat, there are decreased migraine frequency, intensity, and duration. Improvements in secondary outcomes, such as less phonophobia, less

photophobia, and less need for rescue drugs, are also reported. The stabilization of serotonin pathways enhanced vascular regulation, and decreased synthesis of pro-inflammatory lipid mediators are some of the hypothesized mechanisms underlying these results.

Despite encouraging results, limitations like small sample sizes, dietary protocol heterogeneity, and difficulties with long-term adherence underscore the need for more extensive, carefully planned randomized controlled trials. According to the overall findings of this systematic review, a low-fat diet is a practical and possibly successful non-pharmacological strategy for reducing the intensity of migraines, and it merits more research in clinical settings.

Key words – migraine headaches, low-fat diet, dietary interventions, nutritional strategies.

Riassunto

Mal di testa ricorrenti e sintomi correlati sono il segno distintivo dell'emicrania, un disturbo neurologico cronico che compromette gravemente la qualità della vita. Sebbene i trattamenti farmacologici continuino a essere il cardine della cura, i cambiamenti dietetici sono diventati una potenziale strategia aggiuntiva. Questa tesi esamina approfonditamente i dati sull'efficacia di una dieta a basso contenuto di grassi nel ridurre l'intensità dell'emicrania. Abbiamo esaminato database elettronici per trovare studi osservazionali e studi clinici che valutassero la correlazione tra esiti dell'emicrania e assunzione di grassi. È stata valutata la qualità metodologica degli studi che soddisfacevano i criteri di inclusione e i risultati sono stati sintetizzati.

Vi sono prove che, seguendo una dieta a basso contenuto di grassi, generalmente definita come un consumo di meno del 20-25% dell'energia giornaliera da grassi, si riducano la frequenza, l'intensità e la durata dell'emicrania. Sono stati inoltre segnalati miglioramenti negli esiti secondari, come una minore fonofobia, una minore

fotofobia e una minore necessità di farmaci di soccorso. La stabilizzazione delle vie della serotonina ha migliorato la regolazione vascolare e la riduzione della sintesi di mediatori lipidici pro-infiammatori sono alcuni dei meccanismi ipotizzati alla base di questi risultati.

Nonostante i risultati incoraggianti, limitazioni come le ridotte dimensioni del campione, l'eterogeneità del protocollo dietetico e le difficoltà di aderenza a lungo termine sottolineano la necessità di studi clinici randomizzati più ampi e attentamente pianificati. Secondo i risultati complessivi di questa revisione sistematica, una dieta a basso contenuto di grassi è una strategia non farmacologica pratica e potenzialmente efficace per ridurre l'intensità dell'emicrania e merita ulteriori ricerche

in ambito clinico.

Parole chiave: emicrania, dieta a basso contenuto di grassi, interventi dietetici, strategie nutrizionali.

Chapter 1: Introduction

1.1 Background of study

Migraine, a common but often disabling neurovascular headache, strikes with repeated bouts of pounding pain on one side of the head, sometimes sharp enough to make bright light or a faint hum feel unbearable, and often brings waves of nausea along for the ride. Migraine, a widespread neurological disorder, strikes more than 1.1 billion people around the world, about 14% of everyone, sometimes with pain sharp enough to blur vision. The Global Burden of Disease studies show that migraine ranks among the top causes of disability worldwide, taking the second spot for years people spend living with its effects days blurred by pain and light too bright to bear. Right now, about four in ten people are dealing with a headache disorder, and that includes the sharp, throbbing pain of migraines. When measured by age-standardized DALYs, headache disorders rank third among neurological illnesses just behind dementia and stroke yet migraines, which bring intense pain, lost workdays, and often anxiety or depression, remain underdiagnosed and undertreated around the world. The numbers make it clear, we need smart, effective ways to cut down migraine attacks and the pounding pain that comes with them.



Figure 1. Common symptoms of migraine

A disproportionate amount of migraine sufferers are women. The prevalence of migraine increases during the reproductive years and is around three times higher in women than in males. Every year, between 21 and 28 percent of women between the ages of 15 and 49 who are of reproductive age suffer from migraines. In addition, women are more likely than men to experience severe and incapacitating migraines; they report longer attacks, higher rates of complications, and more impairment from headache. In fact, migraine is the largest cause of Disability-Adjusted Life Years (DALYs) for women aged 15-49 and is one of the top five causes of impairment for women. In summary, migraine is a serious health problem for women, particularly when they are fertile.

Even with breakthroughs like triptans, CGRP antagonists, and other preventive drugs, many people still struggle with pain that is dull rather than gone, side effects lingering, or headaches flaring from overuse (Dodick et al., 2018). Because of these limits, more people are turning to lifestyle and non-drug approaches, better sleep habits, stress relief, regular exercise, and diet changes as additional or alternative ways to prevent migraines (Schwedt & Dodick, 2019).

Of these options, changing what you eat has drawn special attention, it's easy to try, inexpensive, and may help calm the metabolic and inflammatory roots of migraine, much like easing the flicker of a harsh light. Food can spark a migraine, but it can also help stop one by shaping how blood vessels and metabolism respond, much like adjusting the heat on a stove to keep things steady. Grasping how diet acts as both a risk and a remedy lays the groundwork for studying how low-fat meals, like a simple bowl of oatmeal, might ease the intensity and frequency of migraines.

1.2 Pathology of the migraine

Migraine develops through a tangled mix of nerve cells firing too easily, blood vessels misbehaving, inflammation flaring in the brain, and chemical messengers falling out of balance—like a string of mis-timed notes in an otherwise steady rhythm. Migraine was once thought to be mainly a problem with blood vessels, but modern brain scans and chemical studies show it's more accurately a neurovascular and neuroinflammatory condition (Pietrobon & Moskowitz, 2013).

The trigeminovascular system, or TVS, sits at the heart of this process, made up of trigeminal nerve fibers that reach into the cerebral and meningeal blood vessels, like fine threads winding through delicate tissue. When the TVS switches on, it triggers the release of vasoactive neuropeptides—CGRP, substance P, and neurokinin A—like drops of ink spreading through

water. These mediators trigger vasodilation, push plasma proteins out into surrounding tissue, and spark sterile neurogenic inflammation in the meninges, leaving nerves raw and pain sharp. Heightened activity in the trigeminocervical complex and brainstem nuclei sharpens the flow of pain signals, feeding both the strength and the stubborn duration of migraine pain, like a steady drumbeat that won't fade (Goadsby et al., 2017).

Cortical spreading depression, another key player in migraine pathophysiology, is a slow ripple of neurons firing all at once, then falling silent across the cortex like lights going out in sequence. Researchers believe CSD drives the aura some migraine sufferers feel—a flicker of light or shimmering edge—and sparks the release of inflammatory chemicals from the meninges. CSD can trigger trigeminal nerve signals, tying together brain activity and blood vessel changes in the onset of migraines (Ayata & Lauritzen, 2015).

The serotonergic system helps shape how migraines develop, acting like a subtle switch that can turn pain signals up or down. Serotonin (5-hydroxytryptamine, or 5-HT) helps control how tightly blood vessels constrict and carries pain signals through the brainstem, like a dim light flickering in a narrow hallway. Researchers have found that people with migraines often show low serotonin between attacks and heightened receptor sensitivity, like a door that swings open too easily. This imbalance can trigger unusual widening of blood vessels during an attack, which might explain why triptans—serotonin receptor agonists—work so well for easing the sharp, throbbing pain of an acute migraine.

Mitochondrial problems and disrupted energy use are now seen as key factors in making someone prone to migraines, much like a flickering light can trigger the pain. When mitochondrial oxidative phosphorylation falters, ATP levels drop and oxidative stress rises, leaving neurons unusually excitable like wires ready to spark and more likely to depolarize (Gross et al., 2019). The “energy deficiency hypothesis” offers a clear reason why treatments like coenzyme Q10, riboflavin, or even changes in diet can cut down how often migraines strike, much like dimming a harsh light before it burns your eyes. Migraine stems from a tangled web of neurological, vascular, and metabolic forces, all working together like threads pulled tight in a knot. Because these pathways overlap, tackling inflammation, energy metabolism, and vascular health say, by adjusting diet could offer real therapeutic promise, like the steady improvement that comes after weeks of balanced meals.

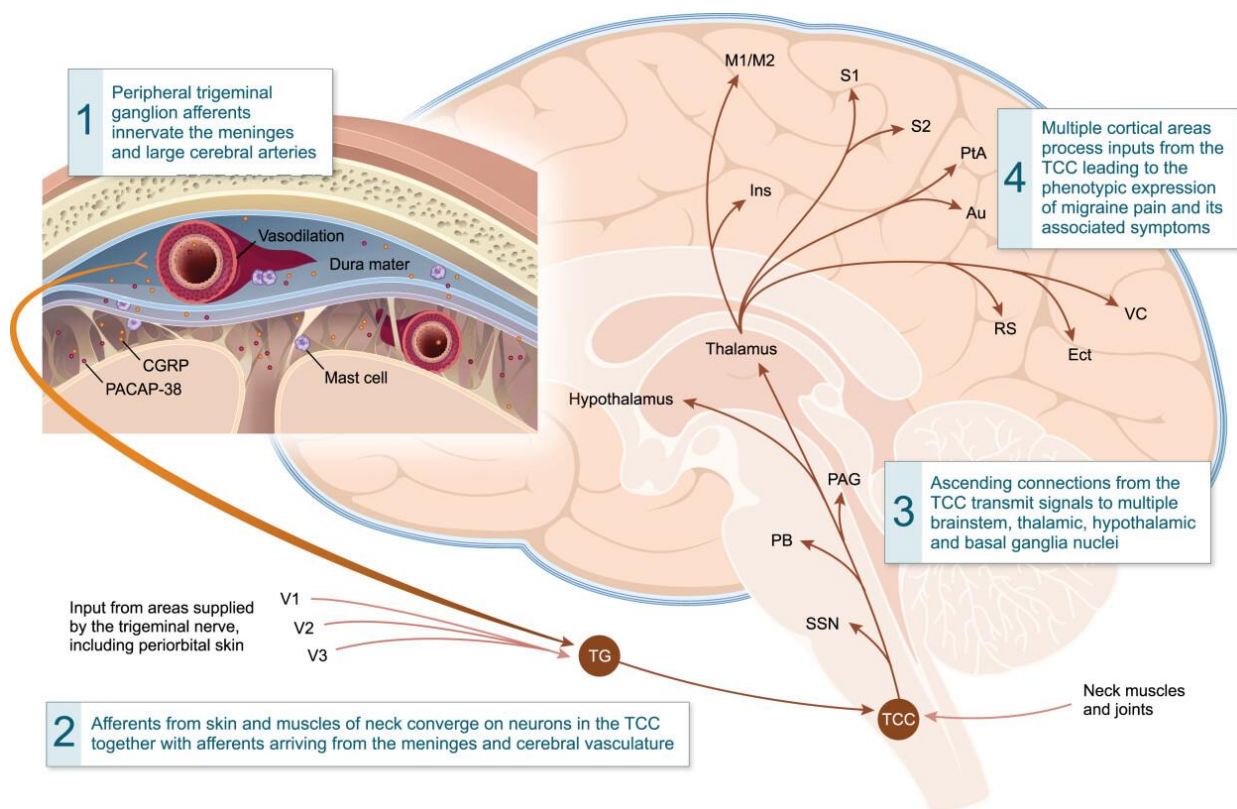


Figure 2. Phase-by-Phase review of Migraine Pathology

Ultimately, the inflammatory pathways play a major role, flaring up like sparks along the skin. People with migraines show higher levels of pro-inflammatory cytokines, interleukin-6 (IL-6), tumour necrosis factor-alpha (TNF- α), and C-reactive protein (CRP), evidence that the immune system's heightened activity may help drive chronic migraine (Ashina et al., 2021). The makeup of your diet, especially the fats you eat, shapes how these inflammatory mediators behave, adjusting the body's production of prostaglandins and leukotrienes like turning a dial. Together, the way blood flow, metabolism, and inflammation interact shows how what we eat can shape both how often migraines strike and how intensely they hurt a salty snack or skipped meal can tip the balance.

1.3 Pharmacological and Non-Pharmacological Management Approaches

Managing migraines usually means using two kinds of treatment—one that stops an attack in its tracks and another that helps keep the next one from starting, like shutting the blinds before the sun flares too bright. Acute treatments work to stop an attack in progress, while preventive therapies help cut down how often, how long, or how intense future episodes are (Dodick et al., 2018).

Pharmacological options include:

1. triptans (5-HT_{1B/1D} receptor agonists) - that work fast by targeting serotonin pathways to ease the throbbing, heat-flush of vasodilation.
2. NSAIDs – It help with mild to moderate attacks by blocking cyclooxygenase and cutting down prostaglandin production like turning down the heat of inflammation until it eases.
3. Ergot derivatives – They are vasoconstrictive drugs once common in treatment, but they're used far less now because of their harsh side effects cold fingers, pounding headache, that sort of thing.
4. CGRP receptor antagonists and monoclonal antibodies - They are newer treatments that block neuropeptide-driven widening of blood vessels and inflammation, like flipping a switch to stop the throbbing pulse of a migraine (Ashina et al., 2021).
5. Doctors often prescribe preventive drugs—like beta-blockers, anticonvulsants such as topiramate or valproate, and antidepressants like amitriptyline—when the attacks come too often, the way a steady drumbeat can wear you down.

These medications often work well, but they don't cover every need, sometimes the relief fades like a breeze that dies too soon. Triptans can trigger heart-related side effects; CGRP inhibitors cost a lot; and using painkillers day after day may cause a rebound headache that throbs behind the eyes. Still, some patients don't respond to any medication, a reminder that we need other approaches like adding a cooling compress or gentle movement to fill those gaps.

Doctors are increasingly seeing non-pharmacological approaches—like cognitive behavioural therapy, stress control, acupuncture, neuromodulation, and diet changes as vital parts of full migraine care, helping patients manage pain as steadily as a heartbeat (Dodic et al., 2018). These interventions target changeable risk factors and provide safer, lasting ways to prevent illness with fewer side effects, the kind that don't leave your skin itching or your head foggy.

In this group, changing what we eat stands out as one of the most promising paths a simple shift like adding fresh berries can make all the difference. Certain eating plans like elimination, keto, or low-fat diets work to shift the body's chemical pathways that drive inflammation, blood-vessel health, and how we burn energy, much like adjusting the flame under a pan to change how quickly food cooks. Since today's medications can only do so much, it's crucial to investigate nutritional strategies that make migraine care more sustainable and truly centered on the patient like finding relief in real food instead of another pill.

1.4 Lifestyle and Nutrition Management

Migraines stem from many different causes, managing them calls for a holistic approach one that goes beyond medication and might include things like dimming harsh lights or adjusting daily routines. Preventive care now puts growing focus on lifestyle changes—getting enough restful sleep, staying active, drinking plenty of water, managing stress, and eating a balanced diet—sometimes as simple as swapping late-night screen time for a quiet walk. The American Headache Society and the European Federation of Neurological Societies advise tailoring lifestyle changes to each person as the first add-on treatment for preventing migraines think adjusting sleep habits or cutting back on strong coffee.

When it comes to lifestyle factors, nutrition sits at the centre, acting both as a spark that can set off a migraine and as a lever to help keep one at bay like how a skipped breakfast might bring on the pounding early. Skipping breakfast, fasting, going without enough water, or eating at odd hours can set off swings in blood sugar and strain the body's metabolism, which in turn sparks heightened activity in nerve cells (Kelman, 2007). On the flip side, getting a balanced mix of nutrients helps steady blood sugar, eases oxidative stress, and keeps inflammatory signals in check—key factors in preventing migraines.

When treating migraines through diet, people usually take one of two paths:

1. Elimination Diet plans - that pinpoint and cut out trigger foods like sharp cheddar, dark chocolate, strong coffee, red wine, or anything cured with nitrates.
2. Therapeutic diets - like ketogenic, low-fat, or low-glycemic plans work to shift metabolic or inflammatory pathways, sometimes as precisely as turning down the heat under a simmering pot.

Increasingly, clinical reports and real-world observations point toward the latter approach like the steady pattern showing up in patient follow-ups. A Mediterranean diet packed with omega-3s, polyphenols, and antioxidants has been linked to fewer headaches and better vascular health, according to (Martami et al. 2018). Originally designed to treat epilepsy, the ketogenic diet has been shown to cut migraine attacks by boosting mitochondrial energy output and calming overactive nerve cells (Di Lorenzo et al., 2019).

Still, a ketogenic diet's heavy reliance on fats and tight limits on carbs can make it hard to stick with, and it's not the right fit for everyone. That's why the low-fat diet, keeping fat to under about a quarter of your daily calories, has become a practical choice that's just as promising. A

low-fat diet can help calm migraine pathways by easing inflammation, boosting how blood vessels work, and keeping the body's energy use in check like turning down a steady heat that's been simmering too long. Nutrition isn't just a way to manage triggers it's a powerful tool that can shift migraine risk by shaping metabolism and steering how blood vessels respond, much like adjusting the flame under a simmering pot.

1.5 Explanation for Dietary interventions

Diet is the most common things that the people with migraine say set them off. People with migraine says that certain foods or food pattern trigger their migraines (Amani Tirani et al.,2023; Nguyen et al., 2024). Some common trigger foods are alcohol, caffeine, chocolate, aged cheese, processed meats, MSG, tyramine, and nitrates (Tu et al., 2025; Times of India article, 2025). Migraine headaches are not just triggers with just eating specific food, however overall food patterns, like missing meals, fasting for long hours, eating at irregular times, have related to a greater tendency of having migraine headaches (Legesse et al.,2025



Figure 2. Common food and drinks can trigger migraine

In the past few years, people with migraine started to change their diets from either reducing their personal triggers or simply following certain diet or meal patters instead of using

medications, since the medications have side effects and limitations (Gazerani 2020; Amani Tirani et al., 2023). Researchers have investigated how certain diets, like low-fat, ketogenic, low glycaemic index (GI), DASH, elimination diets, omega-3-rich diet, can help reduce the frequency and severity of migraines (Hindiye et al., 2020; Roldán-Ruiz et al., 2025; Gazerani, 2020).

1.6 Dietary Patterns and Therapeutic Interventions

We still don't fully understand how migraines work, but current models embrace neurovascular cascade that include trigeminovascular activation, neurogenic inflammation, cortical spreading depression, and serotonin, nitric oxide, platelet activation, and metabolism (Wikipedia contributors, 2025). In the last twenty years, what we eat has proven to play a major role in triggering or stopping migraine attacks, sometimes sparked by something as small as a bite of dark chocolate. People prone to migraines often say certain foods set them off chocolate, a slice of sharp aged cheese, a glass of wine, processed meats, or anything loaded with nitrates, tyramine, or caffeine (Martin & Behbehani, 2001). Still, it's not just about steering clear of triggers, following a structured eating routine can help ease migraines, cutting how often they strike and how sharp the pain feels. Researchers have tested many eating plans in both clinical trials and real-world studies from cutting out certain foods to following ketogenic, Mediterranean, or low-fat diets that swap buttered toast for olive oil. Each one works to shape migraine biology in its own way, acting through unique metabolic or anti-inflammatory routes (Razeghi Jahromi et al., 2019).

Low-fat diet

By comparison, low-fat diets cut total fat to less than about 20–25% of daily calories, which in turn lowers plasma lipids, dampens prostaglandin production, and may ease neurogenic inflammation (Bic et al., 1999; Bunner et al., 2014). Researchers are studying low-fat diets because new evidence ties fatty foods to inflammation, changes in blood vessel tone, and nerve overactivity key pieces in how migraines develop.

Ketogenic diets

The ketogenic diet, built around very few carbs and plenty of fat, pushes the body into ketosis a state where ketones take over for glucose as the brain's main fuel, like switching from sugar to smoke from burning wood. KD effectively reduces migraine attacks by keeping neuronal energy balanced, adjusting glutamate signalling, and calming cortical excitability, as shown by

Di Lorenzo et al. (2019). Still, it's tough to keep up for the long haul those strict rules wear people down, and over time it can nudge your cholesterol in the wrong direction.

Elimination diets

Elimination diets usually cut out foods shown to spark immune reactions or trigger symptoms, whether through IgG testing or what patients say bothers them, like that tingling after a sip of milk. Several randomized controlled trials found that these interventions reduced both how often migraines strike and how severe they feel, with results reported by (Alpay et al., 2010; Aydinlar et al., 2012). Scientists think the key lies in calming the body's overall inflammation—cutting down cytokine activity by steering clear of foods that trigger immune reactions, like that sharp burn after a bite of hot pepper.

Mediterranean diets and DASH diets

Packed with colourful produce, hearty grains, smooth olive oil, and fresh fish, the Mediterranean diet delivers powerful anti-inflammatory and antioxidant boosts. Following this diet tends to reduce how often migraines strike and how severe they feel (Razeghi Jahromi et al., 2019). Likewise, the DASH diet short for Dietary Approaches to Stop Hypertension focuses on cutting sodium and piling your plate with fruits and vegetables, which may help ease migraines by improving how blood vessels work and keeping blood pressure steady (Ferrara et al., 2015).

Ketogenic and elimination diets have drawn plenty of attention, but they're often restrictive and hard to stick with like trying to cook dinner when half the pantries off-limits. By contrast, low-fat diets offer a more realistic long-term option, one that's just as biologically sound think of a steady bowl of oatmeal instead of a short burst of fasting. Still, the evidence is scattered, so we need a thorough, systematic review to truly understand how well these approaches work for managing migraines.

1.7 Physiological Mechanisms Linking Diet and Migraine

There are numerous overlapping neurophysiological, inflammatory mechanism, metabolic, and vascular that supports the connection between migraine and dietary intake. Even though every individual possesses distinct dietary triggers, there is currently increasing evidence that nutrition might influence migraine susceptibility using modification in neurotransmitter

balance, vascular tone, brain excitability, mitochondrial energy metabolism, and systemic inflammation.

1. Energy Metabolism and Glucose Homeostasis – Glucose acts as a brain’s primary source of power. Cortical spreading depression (CSD), a wave of neuronal and glial depolarization connection to migraine aura and initiation, is sometimes triggered due to disruptions in glucose homeostasis, such as high-glycemic -load diets (Gross et al., 20219). Insulin resistance and impaired cerebral glucose metabolism have been mentioned in migraineurs (Fava et al.,2013). Low-glycemic-index diets along with additional diets that strength the blood sugar levels can also reduce the frequency of attacks by preventing sudden fluctuations in blood sugar levels.
2. Modulations of Neurotransmitters – The synthesis and activity of neurotransmitters relation to migraines, particularly with dopamine and serotonin, can be modified by nutritional habits.
 - Serotonin (5H-T) – The occurrence of migraines relates to the low levels of serotonin. Dietary tryptophan works as a precursor to serotonin and is available in the foods like dairy, seeds and turkey. However, migraines may paradoxically occur by consuming large amount of food which is high in tryptophan or in alteration in serotonin levels in the individual which are vulnerable or at risk (Martin & Behbehani, 2001).

1.8 Diet as a trigger and a modulator

Food is one of the triggers people mention most often for migraines, but its impact varies from person to person, shaped by genetics, hormones, and daily habits—like the stress of a late-night work shift or a skipped meal. Sometimes a particular food—or the way you eat it—can spark an attack within minutes, like the sudden sting of citrus on your tongue, while in other cases, your diet gradually shapes the brain’s chemistry and alters its long-term patterns.

For many people with migraines, certain foods or drinks—like a strong cup of black coffee—can reliably set off an attack. People often mention things like:

1. Chocolate - contains phenylethylamine and caffeine, compounds that can influence how the brain sends its signals—like a faint buzz after a rich, dark bite.

2. Aged cheeses - pack plenty of tyramine, a vasoactive amine that can spark catecholamine release—think of the sharp scent drifting from a fresh wedge of Parmesan.
3. Alcohol - especially a glass of red wine with its deep, tannic bite and floral notes—can encourage blood vessels to widen.
4. Processed meats - often have nitrates or nitrites, which the body can turn into nitric oxide — a compound that can spark migraines, much like the sharp scent of cured ham.
5. Caffeinated drinks - a half cup of coffee, say—can ease a headache, but too much or suddenly quitting can bring one on.
6. Foods with monosodium glutamate (MSG) can trigger neuronal overactivity and widen blood vessels, much like the flush you feel after a salty broth.

People often talk about these triggers, but they don't affect everyone—like a sudden loud bang that startles one person and barely registers for another. Studies using controlled provocation have found that responses vary, hinting that certain foods may combine with other migraine triggers—like stress, shifts in hormones, or a night of broken sleep—to spark an attack (Martin & Behbehani, 2001).

Meal patterns and timing

What you eat matters, but the timing can be just as important—skip lunch, and that throbbing ache might start before dinner. Going too long without eating—whether you skip meals, fast, or stretch the gap between them—can drop your blood sugar, heighten cortical excitability and sometimes trigger attacks (Finocchi & Sivori, 2012). On the flip side, eating your meals at the same time each day can help steady blood sugar, which may lower the chances of an attack—like keeping an afternoon snack from sending your levels swinging.

Diet as a Modulator

Diet doesn't just spark migraines in the moment — it can shape your long-term risk by influencing inflammation, how blood vessels respond, and the brain's ability to fuel itself, much like turning a dimmer knob over time. For instance,

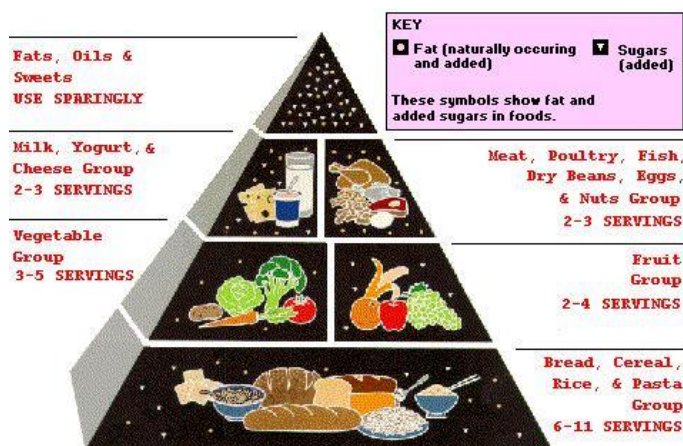
- An anti-inflammatory diet like the Mediterranean style—packed with omega-3s, bright vegetables full of antioxidants, and polyphenol-rich olive oil—can help calm neurogenic inflammation in the trigeminovascular system.

- Eating a low-glycemic diet keeps your blood sugar steady, easing the strain on brain cells and helping them avoid the jittery stress that comes with sudden energy spikes.
- Eating plenty of magnesium-rich foods—like crisp spinach, almonds, and pumpkin seeds—may help curb cortical spreading depression and keep blood vessels working smoothly. These eating habits don't always stop attacks, but they can make them less frequent, milder, or shorter by shifting the body's internal chemistry—like easing the constant tension in a clenched jaw.

Figuring out which foods set off symptoms is a personal process, sometimes as specific as noticing a headache after a single bite of chocolate. Genetic quirks in enzyme activity—like how your body handles tyramine—along with the mix of bacteria in your gut and shifts in hormone levels, can all shape how sensitive you are to certain foods. For this reason, doctors don't usually advise cutting out every suspected trigger at once; instead, they often suggest keeping a detailed food diary—jotting down meals, even the smell of morning coffee—and using a step-by-step remove-and-reintroduce approach to pinpoint and manage the real culprits (Chai et al., 2017).

1.9 Low-fat diet

A low-fat diet cuts back on overall fat intake—especially saturated and trans fats—while focusing on wholesome macronutrients like complex carbs, lean proteins, and fresh fruits and vegetables, the kind that crunch when you bite into them. The main goal is to cut back on total fat, helping you stay healthy, keep your weight in check, and lower the chance of chronic illnesses like heart disease. Dietary guidelines suggest getting no more than about 20 to 30 percent of your daily calories from fat — roughly the amount in a handful of almonds.



Researchers have studied this diet's effects on metabolic issues, weight control, and heart health, and now fresh findings hint it might influence neurological problems such as migraines, the kind that can feel like a sharp pulse behind your eyes.

Figure 3. USDA's original Food Pyramid

The reason why so many factors are involved in the migraine-fat connection might be that it is physiological. For example, ingesting large quantities of fat may affect endothelial function and alter the balance of intracranial vessels as well as their ability to respond to all their normal stimuli such actions (Marmura, 2018). Again, another example of this is that eating meals high in fat content raises both inflammatory markers and free fatty acids. Both these substances help happen to alter or even decrease cortical excitability by themselves alone; with neuroinflammatory substances produced later at that phase when migraine occurs (Matsuzawa et al., 2011). That said, going easy on fat might cut the number or the severity of migraines because neural activity is calmed, prostaglandin production changed, and mitochondrial efficiency increased. Despite the paucity of clinical evidence, low fat intervention may have positive effects on migraineurs. For instance, in dietary trials it has been found that people on a low-fat diet had less frequent, longer and more severe headaches than their own or published historical estimates--and also significantly less duration of aura (Christensen et al. 1993; Di Lorenzo et al. 2013).

These findings are encouraging, but it's important to take them with a grain of caution. The small sample sizes, short follow-up periods, and differing levels of adherence to the diet mean we need to be careful in our interpretation. That said, a low-fat diet has some great additional benefits for heart and metabolic health, and it could be a practical lifestyle change that works alongside traditional migraine treatments. To really understand the best approach, we need more large-scale studies that will help us figure out the ideal amount of fat to include in our diets and whether certain types of fats—like saturated versus unsaturated—actually affect migraines in different ways.

1.10 Linking Fat Intake and Migraine Pathways

Recent studies show that dietary fat plays a crucial role in shaping the biological processes behind migraines, like how certain oils can trigger changes in nerve activity. The amount of fat you eat can influence inflammation throughout the body, shift how your system processes lipids, and alter how blood vessels respond each closely tied to how migraines develop and persist. Diets high in fat, especially those loaded with saturated fats and trans fats boost the body's production of arachidonic acid, the key ingredient that fuels pro-inflammatory agents like prostaglandins, thromboxane, and leukotrienes. These compounds ramp up pain signalling

and fuel inflammation in the blood vessels of the trigeminovascular system (Ferrara et al., 2015).

Too much fat in your diet can damage the endothelium, the thin layer lining your blood vessels, reducing nitric oxide levels and leaving the vessels less able to stretch. Nitric oxide helps keep blood vessels steady and ensures the brain gets a healthy flow of blood, but when it's thrown off balance, vessels can suddenly widen and trigger a migraine. Researchers have found that endothelial dysfunction can trigger greater oxidative stress, intensifying neuroinflammation and making migraines more likely to strike (Gross et al., 2021).

On a neurochemical level, the fat you eat can influence how your body processes serotonin, the brain's key migraine regulator much like turning a dimmer knob on a light. High-fat diets can shift plasma tryptophan levels, which slows serotonin production and leaves blood vessels less steady, like a thin branch trembling in the wind. Serotonin affects how blood vessels tighten and how we feel pain, so when its balance is thrown off, it can spark migraine attacks and keep them going, sometimes with that familiar throbbing behind the eyes (Martin & Behbehani, 2001).

Another idea points to how mitochondria manage energy, like tiny power plants humming inside each cell. A high-fat diet puts extra strain on mitochondria, causing them to build up reactive oxygen species and churn out less ATP, like a motor running hot and losing power. This kind of bioenergetic strain can trigger cortical spreading depression and ramp up neuronal hyperexcitability processes tied to the start of a migraine, when even a dim light feels like a spike behind your eyes. On the other hand, cutting back on dietary fat can ease oxidative stress, help mitochondria work more efficiently, and keep neuronal membrane potential steady, much like holding a candle flame still in a draft (Di Lorenzo et al., 2019).

Recent studies show that dietary fats can influence how the gut and brain communicate like a quiet signal traveling from a meal rich in olive oil straight to your mood. Meals heavy in fat can throw off the gut's microbial balance, making the intestinal wall more porous and stirring up inflammation throughout the body changes now thought to play a role in turning occasional migraines into chronic ones (Gazerani, 2021). In contrast, low-fat diets help microbes flourish and boost the production of soothing short-chain fatty acids an extra route by which the fat you eat can shape how often headaches strike.

Altogether, the findings point to dietary fat shaping migraine development in many ways through inflammation, blood vessel changes, metabolism shifts, and brain chemistry, much like

the quick spark of pain that follows a sudden flash of light. So, cutting back on fat can be a reasonable, science-backed way to help prevent migraines and ease their pain like turning down a harsh light before it starts to sting.

1.11 Clinical Evidence Supporting Low-Fat Diets in Migraine

Several clinical studies have investigated how low-fat diets affect migraine frequency, length, and severity, but their methods and results differ widely, some barely scratched the surface, others dug deep. Initial findings by Bic et al., (1999) suggest the first faint trace of evidence, like the quick flicker of a test light. They also demonstrated that reducing fat intake to below 20% of total energy led to a significant decline in migraine frequency and severity over 12 weeks. In 1999, researchers found that cutting fat to under 20% of total calories sharply reduced how often and how intensely migraines struck over a 12-week stretch. Bunner et al., (2014) reported similar findings, showing that a low-fat vegan diet reduced headache intensity and improved overall well-being among adults with frequent migraine attacks.

Ferrara et al., (2015) conducted a randomized controlled trial comparing a low-fat diet with standard dietary advice, reporting decreased attack frequency and medication use in the low-fat group. In 2015, researchers ran a randomized controlled trial comparing a low-fat diet with standard dietary advice and found that people eating less fat had fewer attacks and needed fewer medications. Likewise, Evcili et al., (2018) found that both low-fat and low-glycemic index diets improved migraine outcomes, though low-fat intervention showed more consistent reduction in attack severity.

These findings hint at possible benefits, but differences in how closely people stuck to the diet, how long they followed it, and what shape they were in at the start some lean, some not have made the results hard to apply broadly. Many studies don't use blinding or consistent outcome measures, which makes clear the need for systematic evaluation and comparison across research, a goal this thesis tackles head-on.

Chapter 2: Purpose of study

The purpose of this work is to conduct a systematic review of the available data on the comparison between dietary interventions and migraines. This review will follow the PRISMA 2020 guidelines. We will conduct a comprehensive search of relevant databases, perform independent screening and quality assessment by two reviewers, and synthesize the findings using narrative synthesis or meta-analysis (if applicable). The aim of the study is to evaluate the effectiveness of low-fat diets compared to standard treatment in reducing the frequency and severity of chronic migraines in adults.

The expected outcome of this research includes a positive effect of dietary interventions to improve the symptoms, frequency and severity of the migraines. these findings could implicate that is possible to improve migraine through a personalized diets rather than pharmacological therapies.

Chapter 3: Methodology

3.1 Search Strategy and Study Identification

The systematic review was carried out by the guidelines and reported according to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) 2020. The search was conducted in PubMed database with the available data up to 2024. The search was focused to identifying Randomized controlled trial and observational trails that examined the effectiveness of diets and migraines. (Supplementary Table 1) has a detailed description of the search approach according to the PICO method (Population, Intervention, Comparison and Outcome). In the first research the keywords used were ("migraine" OR "chronic migraine") AND ("low-fat diet" OR "dietary intervention" OR "low-lipid food" OR "migraine diet" OR "trigger food"). The second research used the keywords ("Mediterranean" OR "food pattern" OR "low-fat diet" OR "ketogenic").

Only peer-reviewed, English language articles were included in our search. The predetermined inclusion and exclusion (explained below) were used by the reviewers to independently assess research title for eligibility

“Research question – what is the effectiveness of a low-fat diet in reducing migraine frequency, duration, or severity in individual adult with migraines?”

Table no. 1 Eligibility Criteria

<i>Study characteristics</i>	<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
Population (P)	Adults (≥ 18 years) with migraine	Paediatric patients (≤ 18 years), any other disease condition,
Intervention (I)	Dietary intervention (ketogenic-diet, low-fat diet, Mediterranean diet) and food pattern	Supplements, medications, pharmacological therapies
Comparison (C)	Usual diet, other intervention or placebo	-
Outcome (O)	Primary: change in migraine frequency, severity or intensity. Secondary: other health outcomes	Decreased in the frequency of migraine attacks, severity with less medication intake.
Study design	Randomized Control Trail (RCT), Observational Trails.	Editorial, letter, note, comment, book chapter or case reports, systematic literature reviews
Time frame		-
Language	English	Non- English

3.2 Inclusion and exclusion criteria

We reviewed every randomized controlled and observational trial in English that examined dietary approaches—low-fat, ketogenic, or Mediterranean—for adults living with migraine, from strict clinical protocols to everyday eating habits. The studies that qualified compared these interventions to a regular diet, other eating plans, or a placebo, and each reported at least one main result tied to how often migraines struck, how severe they were, or how sharp the pain felt—like the throb behind the eyes after a long day.

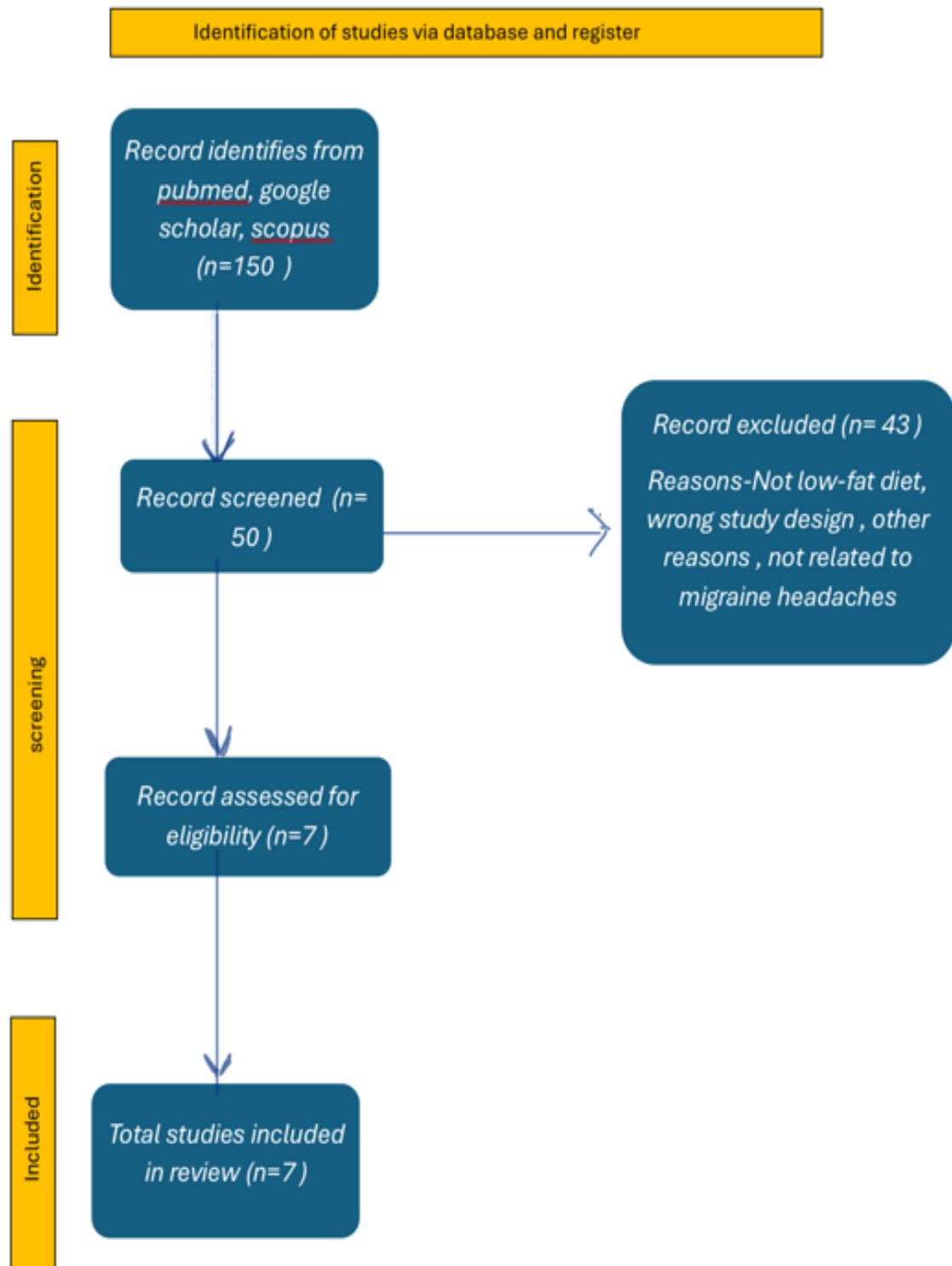
They also looked at secondary outcomes like quality of life, mental well-being, and any shifts in eating habits. We left out studies on children, anything about supplements, pharmaceutical drugs, or research that wasn't original work. We showed how the studies were chosen with a PRISMA 2020 flow diagram (Page et al., 2021).

3.3 Study Selection/ Study Design

If a study met the predetermined inclusion and exclusion criteria, it was included in the systematic review as shown in (Table No. 1). The appropriate designs included Randomized Controlled Trials wherein particular food or diet (e.g., Ketogenic diet, low-fat diet) were evaluated in adults with migraines. Reviews, study protocols, conference paper, non- English articles, and animal studies were excluded.

The titles and abstracts of the retrieved citations were initially screened. After obtaining and complete text of the primary studies that passed the “title and abstract” screening for final eligibility, additional screening was conducted. The screening procedure was carried out independently by the researchers.

Figure 4. The selection process of studies following the PRISMA diagram for the low-fat diet



3.4 Data Extraction and main outcomes

In addition to the outcomes, the following information was extracted from each study when available: year of publication, country, population, number of participants, mean age, number of adults, intervention type and duration, and study design.

3.5 limitations

The review offers clear, valuable insights, but it still has its limits—like missing data in a few key studies. First, only a handful of solid studies have directly examined how low-fat diets affect migraine severity, leaving the evidence too thin to draw strong conclusions. Second, the included studies differ widely in design, participant groups, how long interventions lasted, and what outcomes they measured, so lining them up side by side isn't straightforward. A major drawback is that most studies depend on people's self-reported diets, a method that's prone to hazy memories and quiet omissions—like forgetting that late-night slice of cake—which can skew the accuracy of the findings.

On top of that, lifestyle factors like stress, poor sleep, dehydration, low activity, and other medications likely shaped migraine outcomes, making it hard to tease out the diet's impact alone. Because most studies ran for only a short time—some just a few weeks—it's hard to tell how well low-fat diets work for managing migraines in the long run. We can't rule out publication bias, since studies with upbeat findings often make it into print, while those showing nothing new tend to sit forgotten in desk drawers. In the end, differences between studies in how they define and measure a "low-fat diet," coupled with little effort to examine the biological pathways at play, make the findings harder to apply broadly and leave the underlying mechanisms murky, like trying to read fine print through fogged glass.

Chapter 4: Result

4.1 Result - Low -fat diet

We reviewed seven studies in detail, following the inclusion criteria we set from the start. The studies looked at adult migraine patients who followed low-fat diets, either on their own or compared with standard or other dietary approaches, sometimes noting details like swapping butter for olive oil. The next section sums up the study's key details—who conducted it, where it took place, how many people took part, the gender mix, the type and length of the intervention, and migraine outcomes like how often they occurred, how strong they felt, and how long they lasted.

Most studies found that participants on a low-fat diet had fewer migraines and less intense pain, with some describing the relief as a dull ache instead of a sharp throb. They also noted secondary improvements—less sensitivity to light, fewer problems with loud sounds, and a drop in the need for rescue medication. Differences in study design, how long the interventions lasted, and how closely participants stuck to them all shaped the mixed results seen across trials.

Table 1. Description of articles included in the systematic review

Author, Year	Country	Study design	Population	Intervention group	Intervention	Duration	Outcome
Razeghi Jahromi et al., (2019)	Iran	Observational study	Adult with migraine	500	Dietary patterns assessment (association between various diets including low-fat and migraines)	-	Significant association between dietary habits and migraine occurrence; certain food patterns linked diets (low-fat) reduced headache frequency
Bic et al., (1999)	USA	Experimental study	Adults with migraine	54	A low-fat diet with limited fat intake of no more than 20 g/day	12 weeks	A low-fat diet significantly decreased headache frequency, duration, intensity and medication intake
Bunner et al., (2014)	USA	RCT	Adults with migraine	42 (Group A: n = 21; Group B: n = 21)	Group A – low-fat vegan diet (prescribed diet with elimination of trigger foods) Group B – control group receiving capsule containing 10 mcg ALA and 10 mg Vitamin E	6 weeks	A low-fat vegan diet significantly decreased headache frequency, duration, intensity and medication intake

Table 1. Description of articles included in the systematic review (Continued)

Ferrara et al., (2015)	Italy	RCT	Adults with migraine	83 (Group A: n = 36; Group B: n = 47)	<p>Group A – low-fat diet (<20% total daily energy from fat: 77 g protein, 32 g fiber, 330 g CHO, 14% MUFA, <8% saturated fat)</p> <p>Group B – normal-fat diet (25–30% total daily energy from fat: 75 g protein, 32 g fiber, 307 g CHO, 19% MUFA, <8% saturated fat)</p>	12 weeks	A low-fat diet significantly decreased the number of migraine attacks, as well as the severity compared to the normal fat diet.
Ercili et al., (2018)	Turkey	RCT	Adults with migraine taking medication	297 (Group A: n = 147; Group B: n = 147)	<p>Group A – low-glycemic index diet (provided a list of permitted and prohibited foods)</p> <p>Group B – normal diet with medication (propranolol, amitriptyline, flunarizine, topiramate)</p>	12 weeks	A low glycaemic index diet significantly decreased the visual analogy scale score compared to those in the medication group.
Tirani et al., (2023)	Iran	Observational study (cross-sectional)	Adults with migraine	400	Low-fat diet with dietary diversity	12 weeks	A low-fat diet linked to significant decreased headache frequency, duration, intensity.
































Table 1. Description of articles included in the systematic review (Continued)

(Di Lorenzo, Pinto et al., 2019)	Italy	RCT	Adults with migraine	70 (Group A: n = 35; Group B: n = 35)	<p>Group A – very-low-calorie ketogenic diet (protein \geq 75 g/day, carbohydrates 30–50 g/day, fats 20 g/day mainly from olive oil)</p> <p>Group B – very-low-calorie non-ketogenic diet (protein \geq 50 g/day, carbohydrate \geq 70 g/day, fats 20 g/day mainly from olive oil)</p>	4 weeks	A very-low-calorie ketogenic diet significantly reduced the number of days with migraine symptoms and attacks compared to the non-ketogenic diet. No significant differences were observed in medication use or BMI between the two groups.
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4.2 Quality assessment

We assessed the quality of the included studies with two validated tools, the quality assessment of four studies was conducted by the **Cochrane Risk of Bias Tool** for randomized controlled trials (Bunner et al., 2014; Ferrara et al., 2015; Di Lorenzo et al., 2019; Evcili et al., 2018).

Table 2. Summary of risk of bias assessment for the Randomised controlled studies

<p>Low risk </p> <p>Unclear risk </p> <p>High risk </p>	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other risks of bias
							
							
							
							

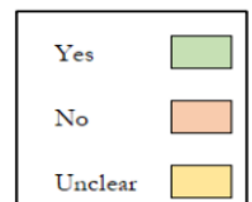
The quality assessment of other three studies were conducted by **The Joanna Briggs Institute’s Critical Appraisal Tool**, designed for observational studies, has been detailed in works by Bic et al. (1999), Razeghi Jahromi et al. (2019), and Tirani et al. (2023). This tool is comprised of 11 questions (Moola et al., 2017):

1. Were the two groups similar and recruited from the same population?
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?
3. Was the exposure measured in a valid and reliable way?
4. Were confounding factors identified?
5. Were strategies to deal with confounding factors stated?
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?
7. Were the outcomes measured in a valid and reliable way?
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?
9. Was the follow-up complete, and if not, were the reasons for the loss to follow up described and explored?
10. Were strategies to address incomplete follow-up utilized?
11. Was appropriate statistical analysis used?

Most observational studies showed moderate to good quality, with well-defined groups, solid exposure measures, and statistical analyses that fit the data.

Table 3. Summary of risk of bias assessment for the included studies

Author, Year	1	2	3	4	5	6	7	8	9	10	11
Bic et al., 1999	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Unclear	Yes
Razeghi Jahromi et al., 2019	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Unclear	Unclear	Yes
Tirani et al., 2023	Yes	Yes	Yes	Yes	No	Yes	Yes	Unclear	Unclear	Unclear	Yes



4.3 Study Selection and Characteristics

4.3.1 Location and Sample Size

We included seven studies in this systematic review—both randomized controlled trials and observational research—each meeting the inclusion criteria. Researchers carried out these studies in countries as far apart as the United States, Turkey, Italy, and Iran, with publication dates spanning from 1999 to 2024. Across the studies, sample sizes shifted some included just 15 adults, others as many as 120 all diagnosed with either episodic or chronic migraine.

4.3.2 Population Characteristics

Most of the studies involved mostly women, a pattern that mirrors migraine's greater frequency in women like seeing more than three out of four chairs in a clinic's waiting room occupied by female patients. Participants ranged in age from 18 to 55. Dietary interventions lasted anywhere from 4 weeks to 6 months, with each study comparing a low-fat diet to either participants' usual eating habits or another approach, such as a ketogenic diet or a standard diet.

4.3.3 Study aims

Bic et al., (1999) aimed to determine the influence of a low-fat diet on the incidence and severity of migraine headaches in adults. In 1999, the study set out to see how a low-fat diet might affect how often adults get migraines and how bad those headaches feel, from the faint throb to the sharp, drilling pain. The researchers wanted to find out if keeping daily fat intake under 20 grams about the amount in a small handful of almonds might cut how often migraines strike, shorten how long they last, ease their severity, and lessen the need for medicine.

Bunner et al., (2014) conducted a randomized crossover trial to investigate the effects of a low-fat vegan diet, combined with the elimination of common trigger foods, on migraine frequency and severity. Bunner et al., (2014) ran a randomized crossover trial to see how a low-fat vegan diet, paired with cutting out common trigger foods like chocolate, affected how often and how severely migraines struck.

Di Lorenzo et al., (2019) conducted a randomized double-blind crossover trial to compare the effects of a very-low-calorie ketogenic diet versus a non-ketogenic diet in overweight migraine patients. The study investigated whether the quality of carbs in someone's diet could change how often migraines hit and how severe they felt, even when standard medications were already in use.

Evcili et al., (2018) aimed to examine the short- and long-term effects of a low-glycemic index diet on migraine prophylaxis in adults receiving pharmacological treatment. The authors set out to compare total fat intake, looking at diets with less than 20% fat against those with higher amounts, like a meal rich with buttery toast. In adults, getting 25–30% of their total energy from certain sources can trigger migraine attacks and make symptoms hit harder, sometimes like a sharp pulse behind the eyes.

Ferrara et al., (2015) evaluate whether a low-fat diet could reduce the frequency and severity of migraine attacks compared to a normal-fat diet. The study set out to see if switching to a low-fat, plant-based diet with fresh spinach and lentils could ease headaches more effectively than taking nutrient capsules. Ferrara et al., (2015) set out to see if cutting fat from the diet could make migraine attacks less frequent and less intense than they were on a regular-fat diet.

Razeghi Jahroni et al., (2019) aimed to explore the association between dietary patterns and headache characteristics among migraine patients. In 2019, researchers set out to examine how different eating habits might connect to the nature of headaches in people living with migraines, from their intensity to whether they came with a sharp, throbbing pulse.

Tirani et al., (2023) sought to examine the relationship between dietary diversity and migraine headache characteristics. In 2023, researchers set out to explore how the variety in a person's diet might connect to the nature of their migraine headaches whether sharp and sudden or dull and lingering.

4.4 Study Designs and Methodological Approaches

The studies used different methods, we could look at diet–migraine links from several angles, like tracing how a skipped breakfast might trigger pain before noon. Four studies used randomized controlled trials, giving clear evidence of cause and effect, while three relied on observational methods, capturing how people eat from rushed breakfasts to late-night snacks.

Randomized Controlled Trials (RCTs):

Ferrara et al., (2015) ran randomized controlled trials, carefully tracking each data point as it rolled in, Bunner et al. (2014), Evcili et al. (2018), and Di Lorenzo et al. (2019) provided direct intervention evidence. Bunner et al., (2014), Evcili et al., (2018), along with Di Lorenzo et al., 2019, offered clear evidence from hands-on intervention, as tangible as data recorded after each session. The interventions mainly aimed to cut total fat down to less than about a quarter of each day's calories roughly what you'd get from a small handful of nuts.

Observational Studies:

Cross-sectional and cohort studies (Razeghi Jahromi et al., 2019; Tirani et al., 2023) backed up the link between regularly eating low-fat foods and having fewer migraines, much like noticing fewer pounding headaches after weeks of lighter meals. These studies used food frequency questionnaires and diet quality measures like the Healthy Eating Index (HEI) or diversity scores, capturing details as specific as how often someone reached for an apple instead of a bag of chips. They couldn't prove one caused the other, but they did confirm a steady pattern people eating less fat tended to have fewer migraines, like a dim light fading as the fat content drops.

4.5 Overview of the Findings and outcomes

Most studies found that sticking to a low-fat diet cut down how often migraines struck, sometimes turning weekly headaches into rare events. Headache days dropped by 25% to 40% each month compared to baseline, like going from eight pounding mornings to just five. Several trials reported a clear drop in headache severity, scored on the Visual Analogue Scale and shorter migraine attacks, with patients noting pain fading faster than before.

1. Frequency: Most studies reported a reduction of 2–4 migraine days per month.
2. Severity: Average pain intensity scores decreased by 1–2 points on VAS.
3. Duration: Attack length was reduced by 30 minutes to 2 hours in compliant participants.

Most studies found people had 2 to 4 fewer migraine days each month—enough for someone to enjoy an uninterrupted weekend.

4.5.1 Effect of on Migraine Frequency

Across the studies, researchers most often saw one clear result: people had fewer migraines. People on low-fat diets had fewer headache days each month than they did before or than those in the control group, sometimes noticing a calmer, clearer stretch of days.

- In the study by Ferrara et al., (2015), the mean number of migraine days decreased significantly from 7.2 ± 1.8 to 3.9 ± 1.2 per month after three months on a low-fat diet ($p < .01$). By 2015, the average number of migraine days dropped sharply from about 7 each month to just under 4 after three months on a low-fat diet ($p < .01$).
- Bunner et al., (2014) reported a 40% reduction in migraine frequency ($p < .05$) following a low-fat vegan regimen. During the study in 2014, researchers found migraine episodes dropped by 40% ($p < .05$) after participants followed a low-fat vegan diet, some even recalling clear mornings without the usual throbbing pain.

- Evcili et al., (2018) found a 37% decline in monthly attacks after 12 weeks on a low-fat diet, outperforming the low-glycemic group. Researchers saw monthly attacks drop by 37% after just 12 weeks on a low-fat diet, beating the results from the low-glycemic group
- Bic et al., (1999) observed that nearly 80% of participants experienced a reduction in attack frequency when fat intake was restricted below 20 g/day.

The data we observed backed up those trends, like watching each line on the graph rise in quiet agreement. Razeghi Jahromi et al., (2019) found that adherence to a “healthy” dietary pattern characterized by low fat and high fruit/vegetable intake was associated with a 45% lower odds ratio for frequent headaches. In 2019, researchers found that people who stuck to a healthy diet, low in fat and rich in fruits and vegetables, had about a 45% lower chance of getting frequent headaches, like the ones that throb behind your eyes after a long day. In the same way, Tirani et al., (2023) reported that individuals with lower dietary fat consumption and higher dietary diversity exhibited fewer migraine episodes.

4.5.2 Effects on Migraine Intensity and Duration

Several studies found that, besides reducing how often headaches strike, low-fat diets eased their sharpness and cut how long they lasted, sometimes turning hours of throbbing pain into a brief ache.

- In the study by Ferrara et al., (2015), researchers found subtle shifts, like the faint buzz of data moving through an algorithm, pain intensity decreased significantly as measured by VAS scores (from 7.8 ± 1.4 to 5.3 ± 1.1 , $p < .01$).
- Bunner et al., (2014) observed reductions in both maximum and average pain ratings, with participants reporting improved tolerance and decreased need for rescue medication.
- Evcili et al., (2018) found a significant decline in both the duration and severity of migraine attacks ($p < .05$), suggesting that reduced dietary fat may influence neurovascular stability during headache episodes.
- Bic et al., (1999) also reported qualitative improvements in symptom severity and a decrease in photophobia and phonophobia during attacks.

Although fewer observational studies measured pain intensity directly, participants in Razeghi Jahromi et al., (2019) cohort study still described their pain levels in self-reported scores that traced each sharp throb or dull ache.

These improvements probably stem from changes in inflammatory signals and sharper mitochondrial performance, backing the idea that a low-fat diet can steady the brain's energy balance during the early stirrings of a migraine.

4.5.3 Impact on Migraine Medication Use and Quality of Life

Four studies looked at secondary outcomes, things like how often patients reached for rescue medication, how much symptoms limited their daily activities, and their overall quality of life, from sleep to mood.

- Di Lorenzo et al., (2019) observed a significant reduction in the number of rescue drug doses per month in both low-fat and ketogenic groups, implying shared metabolic pathways in headache mitigation. During the study in 2019, researchers noted that both the low-fat and ketogenic groups used fewer rescue drug doses each month, suggesting they might share metabolic pathways that ease headaches.
- Ferrara et al., (2015) reported that participants on low-fat diets required fewer analgesic tablets per month compared to controls (mean 4.3 vs. 6.8, $p < .05$). Ferrara et al., 2015, found that people following low-fat diets took fewer pain tablets each month than those in the control group (about 4.3 on average).
- Bunner et al., (2014) found that participants reported improved overall well-being and reduced dependency on medications such as triptans and nonsteroidal anti-inflammatory drugs (NSAIDs).

Participants said they felt more capable day to day, getting through chores with ease, sleeping more soundly, and focusing better which pointed to wider improvements in their overall quality of life. These findings show that changing what you eat does more than ease symptoms, it can cut down on medication use and boost both body and mood, like feeling lighter after a clean, simple meal.

4.6 Patterns and Heterogeneity Across Studies

All the studies showed encouraging results, but their differing methods like variations in sample size and design, mean we should interpret the findings carefully. The interventions lasted anywhere from 4 weeks (Di Lorenzo et al., 2019) to 16 weeks (Bunner et al., 2014), and

participants cut fat by roughly 15–25% of their total calorie, a shift you could taste in every lighter meal. The studies also varied in whether people followed strictly vegetarian, vegan, or mixed diets, some included a little milk or eggs, others none at all.

Measuring compliance was always tricky like trying to catch smoke in a glass jar. Some participants said they stuck to the plan themselves, while others were tracked through quick food recalls or one-on-one counselling sessions. Differences in outcome measures, like how often attacks occurred each month, how long each one lasted in hours, and how intense they felt on VAS or HIT-6 scales made it hard to compare results across studies. Still, every study showed clear improvement, statistically or clinically compared with the baseline or control, like brighter colours returning after a long grey spell.

Even with those differences, a clear pattern stood out when people cut back on dietary fat, at least one major migraine measure improved, hinting at a dose-responsive effect that grew stronger with each smaller portion of butter or oil.

4.7 Types of Dietary Intervention

Every study in the set described a low-fat diet as one where fat made up under 20–25% of the day's total calories, roughly the amount in a small handful of almonds. Some interventions also focused on cutting back saturated fats while nudging people toward more complex carbs, fresh fruit, and crisp vegetables. We tracked how well participants stuck to their diets through food diaries or by meeting regularly for nutrition counselling, sometimes noting details like the brand of cereal they ate. Two studies looked at low-fat diets alongside ketogenic or elimination plans, while others tested low-fat eating on its own sometimes with nothing more than oatmeal for breakfast. In most trials, researchers didn't change any medications, so they could zero in on how the diet was working like noting a subtle shift in energy after meals.

4.8 General Dietary Patterns

Research on what people with migraines typically eat points to a steady link between their diet and how often headaches strike, though a few studies don't tell quite the same story. (Tirani et al., 2023) investigated dietary diversity among adults with migraine in Iran and found that participants with higher dietary diversity scores experienced fewer and less severe migraine attacks. In 2023, they studied dietary variety in Iranian adults with migraines and discovered that those with more diverse diets, think fresh herbs, nuts, and colourful vegetables had fewer attacks, and the ones they did have were less intense. People who ate a wide mix of fruits, crisp vegetables, hearty grains, and lean meats said their migraines came less often and hurt less,

unlike those whose plates rarely changed. By contrast, people who skipped meals or ate fewer than three a day, say, just coffee for breakfast and nothing until dinner were more prone to frequent headaches, underscoring how steady eating habits can help manage migraines. Similarly, (Razeghi Jahromi et al., 2019) observed that migraine characteristics were strongly associated with unhealthy dietary patterns high in saturated fats and refined carbohydrates. They found that migraines often went hand in hand with diets loaded with saturated fats and refined carbs, the kind you'd find in greasy fries or white bread. People who followed a "Western" diet heavy on processed snacks, fried food, and red meat tended to have migraines more often, and the pain hit harder, sharp as a pounding drum in the temples. In contrast, people who stuck to a healthy eating pattern more fresh fruit, grilled fish, crisp vegetables, hearty legumes, and nutty whole grains had far fewer migraine days and reached for acute medication much less often. The findings highlight how much overall diet quality and steady eating patterns matter, showing they're lifestyle choices you can change to help manage migraines like swapping a sugary snack for a handful of almonds (Razeghi Jahromi et al., 2019; Tirani et al., 2023)

4.9 Specific Low-Fat Diet Interventions

Targeted low-fat diets, unlike broad eating patterns, showed steadier proof of helping manage migraines. In both clinical and randomized controlled trials, cutting total dietary fat to under about 20–25% of daily calories were linked to fewer migraines, with attacks easing in frequency, intensity, and length sometimes shrinking to just a brief, dull throb. (Bic et al., 1999) were among the first to explore this link, showing that adults adhering to a diet providing less than 20 g of fat per day experienced a marked reduction in headache frequency and severity compared to baseline levels. In 1999, they were among the first to investigate this connection, finding that adults who kept their daily fat intake below 20 grams saw headaches become less frequent and less intense, with some reporting the throbbing eased noticeably compared to before. Participants said their attacks didn't last as long and they reached for fewer emergency pills, hinting that fat intake might directly influence migraine patterns (Bic et al., 1999).

(Ferrara et al., 2015) further substantiated these findings in a randomized trial evaluating a low-fat diet compared to a normal-fat diet. They backed up these results with a randomized trial, testing a low-fat diet against a normal-fat one, measuring everything from daily menus to the butter on breakfast toast. People on the low-fat plan saw migraine attacks become less frequent and less intense, with some reporting fewer than half as many episodes as before.

(Buner et al., 2014) conducted a randomized crossover trial using a low-fat vegan diet combined with the elimination of common trigger foods. Within weeks of sticking to the diet, we saw clear improvements, along with a marked drop in headache length and severity on the Visual Analogue Scale (VAS). In the same way, they ran a randomized crossover trial, pairing a low-fat vegan diet with cutting out common trigger foods like chocolate or coffee.

In another randomized trial, (Evcili et al., 2018) assessed the effect of reducing total dietary fat on migraine prophylaxis in patients receiving pharmacological treatment. They found migraine episodes dropped by about 40%, and pain scores on the VAS scale fell nearly two points, the kind of shift you notice the next time the headache's dull throb fades faster than usual. Participants said they experienced fewer side effects, like sensitivity to light or sound, and noticed they felt better overall. In a separate randomized trial, Evcili and colleagues took the lead, carefully tracking results as they unfolded.

(Di Lorenzo et al., 2019) provided further mechanistic insight by comparing a very low-calorie ketogenic diet to a non-ketogenic, moderate-fat diet in migraine patients. (Evcili et al., 2018) looked at how cutting overall dietary fat affected migraine prevention in patients already taking medication. People eating diets where fat made up less than 20% of their daily calories saw sharp drops in both how often migraines hit and how long they lasted, unlike those on higher-fat meals. The findings showed that cutting back on dietary fat could make current drug treatments work better like giving the medicine a clearer path to do its job. (Di Lorenzo et al., 2019) dug deeper into the mechanism by comparing a strict, very low-calorie ketogenic diet with a non-ketogenic, moderate-fat plan in migraine patients, noting even subtle shifts like changes in meal texture and composition. (Di Lorenzo et al., 2019; Evcili et al., 2018)

In every trial, keeping total fat to just 20–25% of daily calories cut migraine days by two to four each month, eased pain by one to two points on the VAS, and shaved attack times by anywhere from half an hour to two hours. Participants often said they reached for rescue medication less and could handle bright light or sudden noise without flinching. Researchers saw these benefits in both the short term just 4 to 8 weeks and the medium term, lasting up to six months, showing how a low-fat diet can serve as a lasting, drug-free way to help prevent migraines.

4.10 Overall Approach -Low-fat diet

In some studies, low-fat diets were paired with elimination strategies, cutting overall fat while removing certain trigger foods like dairy or spicy peppers to see how people responded.

(Bunner et al., 2014), for instance, combined a low-fat vegan diet with the removal of known dietary triggers such as chocolate, cheese, and caffeine. In 2014, for example, they paired a low-fat vegan diet with cutting out well-known triggers like chocolate, cheese, and the sharp bite of caffeine. By simplifying the diet and cutting back on fat, this approach sharply reduced monthly migraine days and eased the severity of attacks, a result as clear as a quiet morning without the usual pounding in your temples. In these hybrid interventions, progress came not just from cutting back on fat, but also from limiting exposure to vasoactive amines, nitrates, and other possible triggers like the sharp tang of cured meats.

Researchers suspected that lowering pro-inflammatory lipid mediators, while keeping a steady supply of complex carbs and plant-based proteins, could help steady vascular reactivity and serotonin metabolism two processes tied to migraine development, much like the quick constriction you feel when stepping into cold air. Across multiple studies, people following elimination-style low-fat diets kept seeing steady benefits, like lighter meals that left them feeling energized, month after month. Participants who stuck with dietary restrictions for at least eight weeks kept their attacks fewer and milder, while those who went back to higher-fat or unrestricted diets felt symptoms creeping back, like a slow ache settling in.

When you look at all seven studies together, the evidence shows that low-fat diets used on their own or paired with cutting out known triggers, steadily lessen how often migraines strike, how strong they feel, and how long they last. People often reported fewer headaches about 25 to 40 percent fewer days pain scores dropping by 1 or 2 points, and attacks that ended up to two hours sooner. Though the studies were small and ran for different lengths of time, the pattern's clear: cutting back on dietary fat seems to ease migraine symptoms more as the reduction grows a bit like turning down a too-bright lamp. The findings fit with physiological theories suggesting that low-fat diets can influence neuroinflammation, adjust vascular tone, and improve how mitochondria manage energy effects that may help steady the brain's electrical activity and ward off migraine attacks. We need larger, well-designed randomized trials to confirm these effects, pinpoint the ideal fat limit, and see whether certain types like the buttery richness of saturated fats make a difference. Unsaturated fats can influence migraine outcomes in different ways a drizzle of olive oil might help, while other sources could make symptoms flare.

4.11 Limitations of the Evidence Base

The results look promising, but it's important to remember a few limits in the evidence, some studies are small, others a bit rough around the edges. Most randomized trials had fewer than a hundred participants, which weakened their ability to show clear results. The diet trials ran only briefly, making it impossible to see whether people stuck with them or slipped back to old habits. Differences in diet makeup and control settings likely introduced confounding—like mixing cinnamon and salt when you meant to test sugar.

People may have misjudged what they ate or how often headaches struck, causing the results to lose some accuracy. None of the studies measured biochemical markers tied to lipid metabolism or inflammation key clues that could confirm how the body's mechanisms work. Fixing these gaps in future trials will build a stronger foundation of evidence for how diet can help manage migraines.

Chapter 5 Discussion

5.1 overview of the main findings

This review looked closely at studies testing how low-fat diets affect migraines their frequency, how long they last, and how painful they feel, like tracking each throb behind the temples. Across the seven studies reviewed, most found that cutting back on fat was linked to fewer or milder migraines, hinting that changing what we eat could help prevent future attacks. Even with variations in how long and how each study was run, the pattern stayed clear people who stuck to low-fat diets tended to have fewer headaches and reached for pain relief less often (Bic et al., 1999; Ferrara et al., 2015; Bunner et al., 2014; Evcili et al., 2018; Di Lorenzo et al., 2019; Razeghi Jahromi et al., 2019; Tirani et al., 2023).

The findings suggest that the mix of fats in our diet might shape migraines by triggering connected biological routes sparks of inflammation, shifts in blood vessel tone, and changes in how the body uses energy. Still, how much things improved wasn't the same everywhere one study showed steady progress, another barely moved the needle. Although randomized controlled trials (Ferrara et al., 2015; Bunner et al., 2014) showed clear drops in attack frequency, cross-sectional studies mostly uncovered patterns that linked factors together without proving cause and effect. Because results vary so widely, researchers need larger, long-term trials to prove whether these diet changes truly matter like seeing if that extra handful of nuts each day makes a measurable difference over years.

Overall, this review's findings strengthen the growing view that smart nutrition choices can work alongside medication to help prevent migraines, especially for people who'd rather skip extra pills or feel worn down by side effects.

5.2 Biological and Mechanistic Interpretations

Several physiological mechanisms may explain how eating more fat relates to migraines the body's inflammatory response, for instance, can flare like heat after a long run. Migraine is a neurovascular and metabolic disorder that involves the trigeminovascular system firing up, waves of cortical spreading depression sweeping across the brain, and a flare of neuroinflammation (Pietrobon & Moskowitz, 2013). High-fat diets can worsen these pathways by raising levels of free fatty acids and pro-inflammatory eicosanoids such as prostaglandins and leukotrienes formed from arachidonic acid which circulate like tiny sparks in the bloodstream (Ferrara et al., 2015). These chemical messengers heighten the sensitivity of

trigeminal pain fibres and widen the meningeal blood vessels, sparking headache attacks that can pulse behind the eyes. Too much dietary fat weakens the endothelium and cuts down nitric oxide (NO) availability, leaving cerebral blood flow unsteady like a flickering light struggling to stay on (Gross et al., 2019).

On the other hand, low-fat diets can boost endothelial health, steady blood vessel tone, and cut down oxidative stress together easing the likelihood of migraines, like turning down a too-bright light before it sparks pain. This fits with the metabolic theory of migraine, which connects faulty mitochondria and sluggish energy use to an overstimulated cortex that can feel like static behind the eyes. Cutting back on dietary fat can ease oxidative stress and boost how efficiently cells make ATP, which in turn helps neurons stay stable and resist cortical spreading depression (Di Lorenzo et al., 2019). Dietary fat can shape how serotonin behaves, offering a clear, believable link like how a rich spoonful of olive oil might subtly shift the brain's chemistry. Shifts in plasma tryptophan levels change how much serotonin the brain can make a crucial neurotransmitter that helps regulate migraines (Martin & Behbehani, 2001). High-fat diets can slow serotonin turnover, which may dull your pain tolerance and even spark an attack, like a sudden migraine after a heavy meal. In contrast, low-fat diets can help keep serotonin levels steady and support smoother blood vessel control, like easing the rush of warmth after a long run.

New studies also reveal how diet, inflammation, and the gut-brain axis intertwine like a subtle chain reaction sparked by what's on your plate. High-fat diets throw off the gut's microbial balance and make the intestinal wall more permeable, sparking body-wide inflammation that can make migraines drag on and intensify (Gazerani, 2020). Low-fat diets can boost anti-inflammatory bacterial byproducts like short-chain fatty acids, which may quietly ease brain inflammation and sharpen how the body manages pain like turning down a faint static in the background. Together, these mechanisms show that low-fat diets work through several body systems metabolic, vascular, immune, and neurochemical to ease how often and how fiercely migraines strike.

5.3 Comparison with Previous Dietary Interventions

Compared with other ways of eating, a low-fat diet proves easier to follow and stick with, like choosing a lighter meal you can enjoy every day without effort. For example, researchers have studied the ketogenic diet closely in migraine treatment, and it's proven remarkably effective at cutting down attacks (Di Lorenzo et al., 2019). Still, its high fat content and strict limits

make it tough to stick with over time and could raise red flags for heart health. Likewise, elimination diets guided by food-specific immunoglobulin G (IgG) testing have shown uneven outcomes some research notes fewer attacks (Alpay et al., 2010), but others find no steady improvement (Aydinlar et al., 2012).

By comparison, low-fat diets are simpler to stick with and fit neatly into public-health advice designed to cut long-term disease risks like swapping butter for a drizzle of olive oil. They encourage a balanced mix of carbs, proteins, and fats, help steady lipid levels, and support healthy weight factors that can subtly shape migraine patterns by improving overall metabolism (Ferrara et al., 2015). Unlike the Mediterranean diet, which values the kind of fat over how much, the low-fat approach cuts back on fat itself to curb the body's production of inflammation-triggering lipid messengers. Both approaches reduce inflammation, but the low-fat diet stands out it zeroes in on pathways tied to migraine triggers, including those involving arachidonic acid metabolism.

The studies also point out something key: a low-fat diet seems to help regardless of weight loss, even when the scale barely moves. For example, Bunner et al., (2014) and Bic et al., (1999) reported reduced headache frequency without significant changes in body mass index, suggesting that the effect is mediated primarily by biochemical rather than anthropometric factors (Bic et al., 1999).

5.4 Gender and Hormonal Considerations

Gender makes a striking difference in migraine patterns women get them about three times more often than men, a fact that echoes in waiting rooms filled mostly with tired, head-rubbing faces. Shifts in estrogen levels can alter serotonin activity, tighten or relax blood vessels, and spark changes in inflammatory signals all processes that also tangle with how the body handles dietary fats (MacGregor, 2018). Estrogen shapes how the liver makes fats and controls prostaglandin activity, so when women eat a lot of rich, oily foods, their hormones can swing more sharply often triggering migraines. By steadying lipid levels and curbing inflammatory prostaglandins, low-fat diets might bring even greater relief to women who struggle with migraines.

Few studies separated their results by gender, yet observational evidence shows that women who follow low-fat or balanced diets tend to have fewer headache days and gentler pain, like a dull ache instead of a sharp throb (Razeghi Jahromi et al., 2019; Tirani et al., 2023). Future

studies should include sex-specific analyses to shed light on how hormones influence dietary migraine care like tracking how symptoms shift after a high-protein meal.

5.5 Strengths, Limitations, and Future Research

This review pulls together the latest evidence connecting low-fat diets with migraine, though it's important to note several clear limits like the small sample sizes behind many of the studies. Differences in study design, sample size, and how long each intervention lasted made it hard to compare the trials directly, like trying to line up puzzle pieces cut from different sets. Methods for assessing dietary adherence varied widely from self-reported food diaries to dietary recalls opening the door to recall bias as people tried to remember what they'd eaten the day before.

Second, just a handful of studies used properly blinded randomized controlled designs, and most never gathered follow-up data beyond the first few months. Third, we didn't consistently control confounding factors like caffeine intake, sleep habits, or hormone levels which makes it tough to pin down cause and effect. Future studies should zero in on large, multicentre randomized trials that follow clear dietary guidelines and use proven measures of headache severity, like tracking pain scores over several days. Digging into how shifts in lipid levels, inflammation markers, and gut microbes interact could reveal more about how eating fat connects to migraine. Personalized nutrition that blends metabolomic and genomic data could help pinpoint which patients gain the most from low-fat diets like finding the few whose energy spikes instead of dipping after a light meal.

In the long run, studies that track both eating habits and behaviour could show how well low-fat diets hold up and what lasting effects they bring like whether people still skip butter years later.

5.6 Clinical and Public Health Implications

These findings could shape how doctors treat patients and guide public health decisions like adjusting vaccination schedules or screening programs. Clinically, suggesting a low-fat diet offers a straightforward, inexpensive way to support standard migraine treatment without relying on medication like swapping creamy sauces for a drizzle of olive oil. Dietitians and clinicians can fold this method into personalized care plans, focusing on steady fat reduction and swapping in foods rich in complex carbs, lean protein, and heart-healthy oils like olive or avocado.

Across the population, encouraging eating habits that curb heavy fat consumption fits squarely with current heart and metabolic health guidelines that think swapping fried snacks for fresh fruit or nuts. This twofold advantage highlights how dietary counselling can help prevent not just migraines but a wide range of chronic diseases like easing the steady throb of a headache before it starts. Teaching people at work and in schools to eat regular, balanced meals could ease migraine troubles by boosting awareness of nutrition and keeping lunch breaks consistent.

Still, dietary plans only work when people stick with them over time and when they understand what they're doing, like knowing why that crisp apple is better than a cookie. Regular check-ins, hands-on guidance, and a simple app to log meals can help people stay on track and keep the results going. Bringing nutrition into migraine care guidelines could create a more complete, patient-focused plan one that considers everything from daily meals to that mid-afternoon cup of coffee.

5.7 Summary

All told, the evidence shows that low-fat diets help ease migraines by calming inflammation, steadying blood flow, and balancing metabolism like smoothing ripples in a still pond. Compared with other eating plans, a low-fat approach is practical, affordable, and easy to use. Though the methods have some limits that weaken the conclusions, the steady pattern of positive results across studies still highlights its promise as a helpful add-on treatment like a steady pulse hinting at lasting benefit. More rigorous studies are needed to confirm these results and turn them into clear, practical guidelines something a doctor could use to help prevent migraines.

Chapter 6: Conclusions

The review examined how low-fat eating patterns relate to migraine severity, pulling together findings from seven clinical and observational studies published between 1999 and 2023, some noting details as specific as daily meal fat content. Studies across different groups consistently show that cutting dietary fat to under about 20–25% of daily calories can help ease migraine attacks—making them less frequent, shorter, and less intense, like turning down the volume on a sharp, throbbing ache. Evidence points to a low-fat diet as a workable, drug-free way to help manage migraines, pairing well with standard treatments and boosting overall metabolic and heart health like swapping butter for fresh avocado on toast.

Clinically, low-fat diets cut monthly headache days by as much as 40% and eased pain intensity on the Visual Analogue Scale, with some patients describing it as the difference between a sharp sting and a dull throb. Many participants said they had fewer attacks, noticed light and noise didn't bother them as much like walking past a bright shop window without flinching and relied less on medication for quick relief. It makes physiological sense: cutting back on fat can shift pro-inflammatory lipid signals, support healthier blood vessel and mitochondrial function, and steady serotonin metabolism—changes that work together to ease neuroinflammation and calm the overactive cortical activity linked to migraine (Gross et al., 2019; Martin & Behbehani, 2001).

Nevertheless, the evidence base is held back by a few key factors, like small sample sizes and uneven data quality. Most of the studies were small, ran only a short time, and tracked adherence in different ways one might check food diaries, another relies on self-reports, so it was hard to pin down the specific impact of cutting fat. Variations in study design and diet plans from strict vegan low-fat menus to moderate-fat, non-ketogenic approaches create enough inconsistency to blur how broadly the findings apply. Most studies leaned on self-reported diet details, like recalling what you ate yesterday, and that can easily skew the results. On top of that, factors like poor sleep, low water intake, high stress, and lack of exercise were rarely accounted for, even though they're well-known to trigger migraines.

Even so, when separate studies point to the same outcome, it strengthens the case for weaving dietary changes into a broader migraine care plan like swapping a morning pastry for fresh berries. Eating a balanced, low-fat diet packed with complex carbs, fibre, and nutrient-rich foods like crisp spinach, sweet berries, and hearty lentils can work together to boost vascular health, steady your metabolism, and ease the strain of frequent headaches. Clinicians gain a

safe, affordable option that's easy to offer alongside medication especially for patients troubled by side effects or those wanting prevention through everyday habits, like changing what's on their dinner plate.

Future studies need to focus on large, randomized trials that use clear dietary definitions, track participants over years, and measure solid markers of inflammation, lipid metabolism, and neurotransmitter activity like the sharp rise of C-reactive protein in a blood sample. We still need comparative studies that look closely at how different fats like the creamy heft of saturated, the lighter touch of unsaturated, and the distinct sharpness of omega-3s affect health, so we can fine-tune clinical advice. Blending nutrition plans with hands-on behavioural coaching can boost commitment and make healthy habits stick, like swapping chips for a crisp apple without feeling deprived.

In conclusion, this review points to a low-fat diet as a promising, clinically valuable way to ease migraine severity imagine trading greasy takeout for crisp, fresh vegetables and feeling the grip of headaches loosen. Although more proof is needed to nail down cause and set clear rules, recent results highlight how changing what's on your plate could be a key part of tailoring migraine prevention and boosting overall health.

References

- Alpay, K., Ertaş, M., Orhan, E., Üstay, D., Lieners, C., & Baykan, B. (2010). Diet restriction in migraine, based on igg against foods: A clinical double-blind, randomised, cross-over trial. *Cephalalgia*, 30(7), 829–837. <https://doi.org/10.1177/0333102410361404>
- Amani Tirani, S., Askari, G., Khorvash, F., As'habi, A., & Arab, A. (2023). Associations between dietary diversity score and migraine headaches: The results from a cross-sectional study. *Frontiers in Nutrition*, 10. <https://doi.org/10.3389/fnut.2023.1206278>
- Anne MacGregor, E. (2004). Oestrogen and attacks of migraine with and without aura. *The Lancet Neurology*, 3(6), 354–361. [https://doi.org/10.1016/s1474-4422\(04\)00768-9](https://doi.org/10.1016/s1474-4422(04)00768-9)
- Ashina, M., Buse, D. C., Ashina, H., Pozo-Rosich, P., Peres, M. P., Lee, M., Terwindt, G. M., Halker Singh, R., Tassorelli, C., Do, T., Mitsikostas, D. D., & Dodick, D. W. (2021). Migraine: Integrated approaches to clinical management and emerging treatments. *The Lancet*, 397(10283), 1505–1518. [https://doi.org/10.1016/s0140-6736\(20\)32342-4](https://doi.org/10.1016/s0140-6736(20)32342-4)
- Ayata, C., & Lauritzen, M. (2015). Spreading depression, spreading depolarizations, and the cerebral vasculature. *Physiological Reviews*, 95(3), 953–993. <https://doi.org/10.1152/physrev.00027.2014>
- Aydinlar, E., Dikmen, P., Tiftikci, A., Saruc, M., Aksu, M., Gunsoy, H. G., & Tozun, N. (2012). igg -based elimination diet in migraine plus irritable bowel syndrome. *Headache: The Journal of Head and Face Pain*, 53(3), 514–525. <https://doi.org/10.1111/j.1526-4610.2012.02296.x>
- Barbanti, P., Fofi, L., Aurilia, C., Egeo, G., & Caprio, M. (2017). Ketogenic diet in migraine: Rationale, findings and perspectives. *Neurological Sciences*, 38(S1), 111–115. <https://doi.org/10.1007/s10072-017-2889-6>
- Behrouz, V., Hakimi, E., & Mir, E. (2025). Impact of dietary patterns on migraine management: Mechanisms of action and recent literature insights. *Brain and Behavior*, 15(7). <https://doi.org/10.1002/brb3.70652>
- Bic, Z., Blix, G. G., Hopp, H. P., Leslie, F. M., & Schell, M. J. (1999). The influence of a low-fat diet on incidence and severity of migraine headaches. *Journal of Women's*

Health & Gender-Based Medicine, 8(5), 623–630.

<https://doi.org/10.1089/jwh.1.1999.8.623>

Bunner, A. E., Agarwal, U., Gonzales, J. F., Valente, F., & Barnard, N. D. (2014). Nutrition intervention for migraine: A randomized crossover trial. *The Journal of Headache and Pain*, 15(1). <https://doi.org/10.1186/1129-2377-15-69>

Buse, D. C., Reed, M. L., Fanning, K. M., Bostic, R. C., & Lipton, R. B. (2020). Demographics, headache features, and comorbidity profiles in relation to headache frequency in people with migraine: Results of the american migraine prevalence and prevention (ampp) study. *Headache: The Journal of Head and Face Pain*, 60(10), 2340–2356. <https://doi.org/10.1111/head.13966>

Calder, P. C. (2015). Marine omega-3 fatty acids and inflammatory processes: Effects, mechanisms and clinical relevance. *Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids*, 1851(4), 469–484.

<https://doi.org/10.1016/j.bbalip.2014.08.010>

Chai, C. N., Peterlin, B., Scher, A. I., & Sacco, S. (2016). Obesity and headache. In *Headache* (pp. 121–147). Springer International Publishing. https://doi.org/10.1007/978-3-319-41454-6_7

Di Lorenzo, C., Coppola, G., Bracaglia, M., Di Lenola, D., Evangelista, M., Sirianni, G., Rossi, P., Di Lorenzo, G., Serrao, M., Parisi, V., & Pierelli, F. (2016). Cortical functional correlates of responsiveness to short-lasting preventive intervention with ketogenic diet in migraine: A multimodal evoked potentials study. *The Journal of Headache and Pain*, 17(1). <https://doi.org/10.1186/s10194-016-0650-9>

Di Lorenzo, C., Pinto, A., Ienca, R., Coppola, G., Sirianni, G., Di Lorenzo, G., Parisi, V., Serrao, M., Spagnoli, A., Vestri, A., Schoenen, J., Donini, L. M., & Pierelli, F. (2019). A randomized double-blind, cross-over trial of very low-calorie diet in overweight migraine patients: A possible role for ketones? *Nutrients*, 11(8), 1742.

<https://doi.org/10.3390/nu11081742>

Dodick, D. W. (2018). Migraine. *The Lancet*, 391(10127), 1315–1330.

[https://doi.org/10.1016/s0140-6736\(18\)30478-1](https://doi.org/10.1016/s0140-6736(18)30478-1)

- Evcili, G. (2018). Early and long period follow-up results of low-glycemic index diet for migraine prophylaxis. *Ađrı - The Journal of The Turkish Society of Algology*.
<https://doi.org/10.5505/agri.2017.62443>
- Fava, A., Pirritano, D., Consoli, D., Plastino, M., Casalinuovo, F., Cristofaro, S., Colica, C., Ermio, C., De Bartolo, M., Pipari, C., Lanzo, R., Consoli, A., & Bosco, D. (2013). Chronic migraine in women is associated with insulin resistance: A cross-sectional study. *European Journal of Neurology*, *21*(2), 267–272.
<https://doi.org/10.1111/ene.12289>
- Ferrara, L., Pacioni, D., Di Fronzo, V., Russo, B., Speranza, E., Carlino, V., Gargiulo, F., & Ferrara, F. (2015). Low-lipid diet reduces frequency and severity of acute migraine attacks. *Nutrition, Metabolism and Cardiovascular Diseases*, *25*(4), 370–375.
<https://doi.org/10.1016/j.numecd.2014.12.006>
- Finocchi, C., & Sivori, G. (2012). Food as trigger and aggravating factor of migraine. *Neurological Sciences*, *33*(S1), 77–80. <https://doi.org/10.1007/s10072-012-1046-5>
- Gazerani, P. (2020). Migraine and diet. *Nutrients*, *12*(6), 1658.
<https://doi.org/10.3390/nu12061658>
- Genetics of migraine and other primary headaches. (2020). In *Migraine and other headache disorders* (pp. 137–154). CRC Press. <https://doi.org/10.3109/9781420019216-12>
- Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: A systematic analysis for the global burden of disease study 2019. (2022). *The Lancet Psychiatry*, *9*(2), 137–150. [https://doi.org/10.1016/s2215-0366\(21\)00395-3](https://doi.org/10.1016/s2215-0366(21)00395-3)
- Goadsby, P. J., Holland, P. R., Martins-Oliveira, M., Hoffmann, J., Schankin, C., & Akerman, S. (2017). Pathophysiology of migraine: A disorder of sensory processing. *Physiological Reviews*, *97*(2), 553–622. <https://doi.org/10.1152/physrev.00034.2015>
- Gross, E. C., Klement, R. J., Schoenen, J., D'Agostino, D. P., & Fischer, D. (2019). Potential protective mechanisms of ketone bodies in migraine prevention. *Nutrients*, *11*(4), 811.
<https://doi.org/10.3390/nu11040811>

- Headache classification committee of the international headache society (ihs) the international classification of headache disorders, 3rd edition. (2018). *Cephalalgia*, 38(1), 1–211. <https://doi.org/10.1177/0333102417738202>
- Hindiyeh, N., Zhang, N., Farrar, M., Banerjee, P., Lombard, L., & Aurora, S. K. (2020). The role of diet and nutrition in migraine triggers and treatment: A systematic literature review. *Headache: The Journal of Head and Face Pain*, 60(7), 1300–1316. <https://doi.org/10.1111/head.13836>
- Legesse, S., Addila, A., Jena, B., Jikamo, B., Abdissa, Z., & Hailemarim, T. (2025). Irregular meal and migraine headache: A scoping review. *BMC Nutrition*, 11(1). <https://doi.org/10.1186/s40795-025-01048-8>
- Lovati, C., d'Alessandro, C., Ventura, S., Muzio, F., & Pantoni, L. (2022). Ketogenic diet in refractory migraine: Possible efficacy and role of ketone bodies—a pilot experience. *Neurological Sciences*, 43(11), 6479–6485. <https://doi.org/10.1007/s10072-022-06311-5>
- Marmura, M. J. (2018). Triggers, protectors, and predictors in episodic migraine. *Current Pain and Headache Reports*, 22(12). <https://doi.org/10.1007/s11916-018-0734-0>
- Martin, V. T., & Behbehani, M. M. (2001). Toward a rational understanding of migraine trigger factors. *Medical Clinics of North America*, 85(4), 911–941. [https://doi.org/10.1016/s0025-7125\(05\)70351-5](https://doi.org/10.1016/s0025-7125(05)70351-5)
- Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetic, R., Currie, M., Lisy, K., Qureshi, R., Mattis, P., & Mu, P.-F. (2020). *Jbi reviewer's manual*. JBI. <https://doi.org/10.46658/jbirm-17-06>
- Nguyen, K., & Schytz, H. (2024). The evidence for diet as a treatment in migraine—a review. *Nutrients*, 16(19), 3415. <https://doi.org/10.3390/nu16193415>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S.,...Moher, D. (2021). The Prisma 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, n71. <https://doi.org/10.1136/bmj.n71>

- Pietrobon, D., & Moskowitz, M. A. (2013). Pathophysiology of migraine. *Annual Review of Physiology*, 75(1), 365–391. <https://doi.org/10.1146/annurev-physiol-030212-183717>
- Razeghi Jahromi, S., Ghorbani, Z., Martelletti, P., Lampl, C., & Togha, M. (2019). Association of diet and headache. *The Journal of Headache and Pain*, 20(1). <https://doi.org/10.1186/s10194-019-1057-1>
- Robert, B. (2019). Alexander murray, f. g. s. , f. r. s. c. , c. m. g. *Creative Media Partners, LLC*.
- Roldán-Ruiz, A., Bertotti, G., & López-Moreno, M. (2025). Effects of dietary interventions in patients with migraine: A systematic review. *Nutrition Reviews*, 83(7), e1815–e1827. <https://doi.org/10.1093/nutrit/nuae188>
- Safiri, S., Kolahi, A.-A., & Naghavi, M. (2021). Global, regional and national burden of bladder cancer and its attributable risk factors in 204 countries and territories, 1990–2019: A systematic analysis for the global burden of disease study 2019. *BMJ Global Health*, 6(11), e004128. <https://doi.org/10.1136/bmjgh-2020-004128>
- Schwedt, T. J. (2019). New and emerging treatments for the acute and preventive therapy of migraine and other headaches. *Headache: The Journal of Head and Face Pain*, 59(S2), 1–2. <https://doi.org/10.1111/head.13584>
- Silberstein, S. D., Lipton, R. B., & Dodick, D. (2023). *Wolff's headache and other head pain edited by Stephen D. silberstein, Richard B. lipton, David W. dodick*. Oxford University Press.
- Steiner, T. J., Stovner, L. J., Jensen, R., Uluduz, D., & Katsarava, Z. (2020). Migraine remains second among the world's causes of disability, and first among young women: Findings from gbd2019. *The Journal of Headache and Pain*, 21(1). <https://doi.org/10.1186/s10194-020-01208-0>
- Stovner, L., Nichols, E., Steiner, T. J., Abd-Allah, F., Abdelalim, A., Al-Raddadi, R. M., Ansha, M., Barac, A., Bensenor, I. M., Doan, L., Edessa, D., Endres, M., Foreman, K. J., Gankpe, F., Gopalkrishna, G., Goulart, A. C., Gupta, R., Hankey, G. J., Hay, S. I.,...Murray, C. L. (2018). Global, regional, and national burden of migraine and tension-type headache, 1990–2016: A systematic analysis for the global burden of

disease study 2016. *The Lancet Neurology*, 17(11), 954–976.

[https://doi.org/10.1016/s1474-4422\(18\)30322-3](https://doi.org/10.1016/s1474-4422(18)30322-3)

Tu, Y.-H., Chang, C.-M., Yang, C.-C., Tsai, I.-J., Chou, Y.-C., & Yang, C.-P. (2025). Dietary patterns and migraine: Insights and impact. *Nutrients*, 17(4), 669.

<https://doi.org/10.3390/nu17040669>

Vo, H., Vo, K., Duong, L., La, L., Hoang, A., Vo, P., Tran, T., Phan, B., Luong, C., Van, T., Vo, N., Truong, T., Ha, Q., Phuong, T., Le, M., & Nguyen, D. (2024). The prevalence of headache disorders among medical students in Vietnam: A cross-sectional study.

The Journal of Headache and Pain, 25(1). [https://doi.org/10.1186/s10194-024-01912-](https://doi.org/10.1186/s10194-024-01912-1)

[1](https://doi.org/10.1186/s10194-024-01912-1)

Dalessio, D.J. (1981). *Wolff's headache and other head pain*. Oxford university press: New York.