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Review

The role of diet in migraine control: deconstructing myths

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Introduction
Migraine can be controlled through effective drug treatments, both during headache attacks, as a preventative measure, but also through non-drug treatments, including diet therapy. This treatment consists of eliminating food triggers and adding improvement factors.

Objective
To address the role of diet in controlling migraine, through the elimination of food triggers and the addition of improvement factors, in addition to demystifying some mistaken behaviors.

Method
This study was an integrative and retrospective review of articles on the relationship between food and migraine.

Results
Three relationships were found between diet and migraine attacks: 1) food may be a triggering factor; 2) food may be a mitigating factor; or 3) food may be an aggravating factor. There is no specific diet therapy for migraine, but diets that are based on the pathophysiological mechanisms of migraine.

Conclusions
Food can be a trigger or a factor in improving migraine attacks and diet therapy for controlling migraine consists of removing food triggers and replacing them with a healthy diet.

Keywords:
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Introduction

Although there is no definitive cure for migraine, it can be controlled through drug treatments that are effective, both during attacks, as is the case with triptans, especially when associated with a non-steroidal anti-inflammatory drug (1); and also preventively through a broad therapeutic arsenal (2). This control can also be achieved with non-drug measures, including diet therapy (3).

There are three relationships between diet and migraine attacks: 1) food can be a triggering factor; 2) food can be a mitigating factor; or 3) food can be an aggravating factor (4). In all these relationships, there is evidence and implications.

Our goal is to address the role of diet in controlling migraine, by eliminating food triggers and adding improvement factors, in addition to demystifying some mistaken behaviors.

Food Triggers of Migraine

Initially, it is necessary to define what a food trigger is. However, there are some difficulties in defining whether the ingestion of a certain food is actually a trigger for migraine attacks. The main difficulties are the following: a patient may have ≥ 2 triggering factors; some factors may potentiate each other; identifying a single trigger may be difficult; and some foods contain many ingredients, making it difficult to identify a specific ingredient as the trigger. There is consensus that a food is considered a trigger if headache occurred in ≥ 50% of cases within one day of exposure (5).

There is a vast literature on food triggers, but few experimental studies. The vast majority of these studies are review articles or observational studies. An example of this is the relationship between chocolate and migraine. Studies that have investigated chocolate as a migraine trigger over the past 30 years have all been observational. Their triggering frequency has ranged from 0% to 100%. Chocolate is the most popular food trigger, but the question still arises: is eating chocolate before a headache a consequence of a food craving or an actual trigger? (3, 6, 7).

Some researchers argue that many food triggers are actually prodromes and that the desire to eat chocolate, for example, is part of the premonitory phase and that it would not be the chocolate that causes the pain. However, there are some external factors that are recognized as triggers for headache attacks, such as odors and, certainly, some foods. Furthermore, triggers are individual (8, 9).

Watermelon consumption has always been associated with triggering headache attacks. It used to be just a popular belief, but a recent experimental study confirmed that watermelon is a fruit rich in citrulline and that it triggers headache attacks in migraine patients. In this study, there was headache triggered by watermelon ingestion in 23.7% of the migraine group and in none of the control group. The time of onset of the headache was 124 minutes. In both groups, there was an increase in serum nitrite levels after ingestion of watermelon (10).

Food Trigger Mechanisms

Some possible mechanisms of food triggers are known, including: 1) Vascular effect: foods containing histamine or nitrates and nitrites can lead to vasodilation; 2) Effect on neuroinflammation: some foods increase cytokines; 3) Effects on neuropeptides, neuroreceptors and ion channels: monosodium glutamate and aspartame can activate peripheral glatamate receptors; 4) Activation of the sympathetic nervous system: meals rich in fat or carbohydrates increase sympathetic function and decrease parasympathetic function; in addition, the intake of caffeine and tyramine can activate the sympathetic nervous system; and 5) Cortical effect: some foods induce cortical spreading depression, for example, ketones increase cortical GABAergic neurons and decrease glutamate release (11).

There is evidence that dietary factors may interfere with the pathogenesis of migraine, the gut-brain axis or the epigenetics of migraine. This has encouraged researchers to consider diet as a disease-modifying agent (3).

Adverse Reactions To Food

Adverse reactions to food can be toxic or non-toxic. Toxic reactions are independent of individual susceptibility. Non-toxic reactions depend on individual susceptibility and can be classified as immune-mediated (food allergies) and non-immune-mediated (food intolerances). Food allergy consists of an exaggerated response of the body to a certain substance present in food with activation of antibodies. Due to the compromised intestinal barrier, there is production of IgG against certain foods, with release of IL-1, production of PGE2 and release of CGRP by the caudal trigeminal nucleus. Food allergy is a common trigger for migraine. While food intolerance occurs when the body is unable to properly digest certain foods. It occurs due to the absence or reduced quantity of digestive enzymes in the body. Most common intolerances: lactose, gluten and histamine. Many food additives are linked to food intolerances (3).

Gut-brain axis and probiotics

Several studies have shown that different gastrointestinal

diseases are associated with migraine. Recently, the concept of a gut-brain axis has emerged, which explains a bidirectional relationship between the gastrointestinal system and the central nervous system. There are studies showing that modulating the intestinal microbiota can help control migraine. Due to the increased intestinal permeability that occurs in dysbiosis, pro-inflammatory substances can reach the trigeminovascular system and trigger migraine attacks. Therefore, certain probiotics (lactobacilli and bifidobacteria) may be useful in increasing the integrity of the intestinal epithelial barrier by altering the intestinal microbiota (12–15).

Specific diets for migraine

There is no specific diet for migraine. Most diets are proposed to act on a variety of pathophysiological mechanisms of migraine, such as mitochondrial dysfunction, effects on neuropeptides and ion channels, vascular effects, neuroinflammation and cortical spreading depression. In this context, migraine diets are based on the elimination of foods or food additives that trigger migraine and the inclusion of diets or food supplements that improve migraine (16).

Some general measures are important. As a rule, patients with migraine should avoid: prolonged fasting, glycemic fluctuations, ultra-processed foods, dehydration, foods considered triggers, alcohol intake and high fat diet. He should take care of: intestinal health (gut-brain axis) and healthy body weight (17).

Diet plays an important role in controlling migraines. To achieve this, some strategies were created, including the elimination diet. Evidence is needed to build a consensus. On the one hand, we have the popular belief that a certain food causes headaches. We often hear the phrase "If you have a migraine, you can't eat cheese or chocolate." On the other hand, scientific evidence is inconsistent, as most studies are observational, but the available data are quite promising in supporting dietary interventions for some patients with migraine (3).

Literature and popular belief point to several foods as triggers for migraine attacks. As a result, a large number of foods are labeled as prohibited, even without scientific evidence. In an elimination diet, there are some strategies, such as, identifying the food ingredients that trigger headache attacks and avoiding a food trigger, if you notice a high frequency of headache attacks after its exposure. However, there are also some problems, including difficulty in identifying the true triggers; several other triggers may be present in a patient, and some may potentiate others; exposure to a certain food may not always trigger a headache; and the amount of food or the time of exposure may influence the outcome (5, 18).

Food additives are not part of the food, they are added. Currently, >5,000 chemical compounds are used by the food industry to make their products more attractive. The most common are aspartame, monosodium glutamate and nitrates/nitrites. Monosodium glutamate and aspartame can activate peripheral glatamate receptors. A randomized, placebo-controlled study in patients with migraine demonstrated that dietary restriction is an effective strategy in reducing the frequency of migraine attacks. In this study, food additives were considered the main food triggers (19).

Biogenic amines have several functions in the body, including functioning as neurotransmitters. However, consuming foods with high concentrations of these amines can trigger migraine attacks by activating CGRP. The main biogenic amines related to migraine are tyramine, octopamine, synephrine, phenylethylamine and tryptamine (20).

It is necessary to establish adequate eating habits, and individualized nutritional supplementation with vitamins, minerals, omega-3, probiotics and other bioactive compounds may be necessary. Supplementation aims to improve digestive, immune, antioxidant, anti-inflammatory, mitochondrial functions and recovery from dysbiosis (3).

There is evidence that mitochondrial dysfunction is related to the pathophysiology of migraine. Abnormal mitochondrial function consists of increased intracellular Ca2+, excessive production of free radicals, and impaired oxidative phosphorylation. Improving mitochondrial function depends on reducing oxidative stress and increasing antioxidants. This occurs with Coenzyme Q10 and Riboflavin supplementation. A meta-analysis showed that CoQ10 appears to have beneficial effects in reducing the duration and frequency of migraine attacks. In this study, vitamin B2 supplementation 400mg/day for 3 months had a significant effect on the frequency, intensity and duration of migraine attacks (21).

In migraine patients, there is a deficiency of cerebral magnesium. Normally, magnesium binds to the calcium channel/NMDA receptor complex on neuronal membranes to maintain hemostasis. Magnesium deficiency causes calcium channels to open, increasing intracellular calcium, causing depolarization and releasing glutamate, aspartate and substance P. A recent study found that inadequate magnesium intake is associated with migraine in U.S. adults ages 20 to 50 (22).

Omega-3 polyunsaturated fatty acids modulate the immune system, have anti-inflammatory and anti-histamine action and control IgE. A balance between omega-6 and omega-3 fatty acid intake has also been suggested to reduce inflammatory responses, improve

platelet function, and regulate vascular tone. Therefore, a dietary strategy that reduces omega-6 and increases omega-3 fatty acid intake may be beneficial for migraine (16). It is important to note the proportion of EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). A double-blind, randomized, placebo-controlled clinical trial has shown that omega-3 polyunsaturated fatty acids are useful for the prophylaxis of migraine attacks (23).

Conclusions

Finally, we conclude that: food can be a trigger or an amelioration factor for migraine attacks; it is not always easy to identify a food trigger for migraine, especially when associated with other triggers; diet therapy for controlling migraine consists of removing food triggers and replacing them with a healthy diet; randomized placebo-controlled clinical trials are needed to investigate the efficacy of diet therapy for controlling migraine.

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