

The Impact of Lifestyle Factors on Migraine Frequency and Severity in Neurology

Oluwatosin B. Iyun¹, Okelue Edwards Okobi^{2*}, Nneka P. Sams³, Eleni Asfaw Kebede⁴, Oboatarhe Blessing Ezie⁵

¹Department of Public Health and Family Medicine, University of Cape Town, Cape Town, South Africa

²Larkin Community Hospital, PSC, Miami, FL, USA

³College of Health Sciences & Public Policy, Walden University, Minneapolis, MN, USA

⁴College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

⁵Department of Family Medicine, University of Benin, Benin City, Nigeria

Email: tosinjemd@gmail.com, *drokelue.e.okobi@gmail.com, npsams@gmail.com, eleniasfaw14@gmail.com, tarheezie@gmail.com

How to cite this paper: Iyun, O.B., Okobi, O.E., Sams, N.P., Kebede, E.A. and Ezie, O.B. (2024) The Impact of Lifestyle Factors on Migraine Frequency and Severity in Neurology. *Journal of Biosciences and Medicines*, 12, 301-313.

<https://doi.org/10.4236/jbm.2024.127028>

Received: June 10, 2024

Accepted: July 26, 2024

Published: July 29, 2024

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Abstract

Objective: This systematic review examines the impact of lifestyle factors on migraine frequency and severity through a comprehensive analysis of lifestyle factors such as diet, physical activity, sleep patterns, stress, mental health, and environmental influences. **Methods:** We thoroughly searched Google Scholar, PUBMED, Scopus, and Web of Science databases using keywords related to migraines and lifestyle factors. Keywords incorporated the Boolean operator “and” to narrow search results. Following the PRISMA guidelines, we identified, screened, and evaluated studies for inclusion, resulting in nine studies meeting the eligibility criteria. **Results:** A total of 4917 records were initially identified from Scopus (2786), PubMed (854), and Web of Science (1277). Following deduplication, 3657 records underwent title screening, with 382 additionally screened by abstract. Ultimately, 88 full-text articles were assessed, resulting in 9 studies meeting eligibility for qualitative synthesis: 7 prospective and 2 retrospective studies. Our findings highlight the multifaceted role of lifestyle factors in migraine pathophysiology and management. Dietary habits, such as high-calorie, high-fat, and gluten-containing diets were linked to migraine triggers. Moderate physical activity showed beneficial effects on migraine management, while intense exercise could exacerbate symptoms. Poor sleep hygiene and insomnia were strongly associated with increased migraine frequency and severity. Chronic stress and poor mental health significantly contributed to migraine exacerbation, with stress management techniques proving beneficial. Environmental factors, including light, sound, weather changes, and allergens, were also identified as significant migraine triggers. **Conclusions:** Personalized lifestyle modifications, tailored to individual patient profiles, are crucial in managing migraines. Evidence-based

recommendations include balanced diets, moderate physical activity, improved sleep hygiene, stress management techniques, and environmental adaptations.

Keywords

Migraine, Lifestyle Factors, Diet, Physical Activity, Sleep Patterns, Stress, Mental Health, Environmental Factors, Neurology

1. Introduction

Migraine, characterized by recurrent and debilitating headaches often accompanied by sensory disturbances known as “aura”, represents a significant global health challenge [1]. These headaches can manifest unilaterally or bilaterally and are frequently associated with visual disturbances, such as flashing lights and auditory symptoms [1]. The timing of the aura can vary, occurring either before the onset of a headache or even after it has begun.

According to surveys conducted in 2019, migraine stands as the most prevalent neurological disorder worldwide, affecting an estimated 1.1 billion individuals [1] [2]. This staggering figure underscores the widespread impact of migraine on global health systems and individuals’ quality of life. It is noteworthy that the majority of migraine sufferers are female, constituting 75% of all cases reported [1]. The incidence of migraine shows distinct patterns across different age groups: before puberty, migraine occurs more frequently in boys, whereas after puberty, girls tend to experience migraine more frequently than boys [1] [3]. The prevalence of migraine decreases significantly after menopause, with migraine attacks becoming rare beyond the age of 50 [1] [3].

The multifaceted nature of migraine has spurred numerous studies investigating its etiology, triggers, and treatment modalities. Research has established that migraine pathophysiology is influenced by a complex interplay of genetic, environmental, and lifestyle factors [2]-[4]. Lifestyle factors, in particular, have emerged as significant determinants of migraine frequency and severity. Factors such as diet, physical activity, sleep patterns, stress levels, and environmental triggers have been implicated in triggering or exacerbating migraine attacks [2]-[4].

Understanding the role of lifestyle factors in migraine management is crucial given the chronic nature of the condition and its profound impact on individuals’ daily lives. Effective management strategies not only aim to alleviate symptoms but also to prevent the recurrence of migraine attacks and reduce their severity. Lifestyle modifications, therefore, hold promise as non-pharmacological interventions that can complement traditional medical treatments [3] [5] [6].

This systematic review aims to synthesize current evidence on the impact of lifestyle factors on migraine frequency and severity within the field of neurology. By systematically reviewing and analyzing existing literature, this review seeks to

provide insights into the effectiveness of various lifestyle interventions in managing migraine symptoms. Key lifestyle factors to be examined include dietary habits, physical activity levels, stress management techniques, sleep hygiene practices, and environmental influences.

2. Methods

2.1. Search Strategy

A comprehensive systematic review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The search for relevant articles was performed across four major databases: Google Scholar, PUBMED, Scopus, and Web of Science. The search strategy involved using specific keywords to capture a wide range of relevant studies. These results of keywords were narrowed down with the use of the Boolean operator. The keywords used included “migraine”, “lifestyle factors”, “diet”, “nutrition”, “physical activity”, “sleep patterns”, “stress”, “mental health”, “environmental factors”, “integrative approaches”, and “migraine management”.

2.2. Eligibility Assessment

Articles were included if they provided empirical data on the relationship between lifestyle factors and migraine in adult populations. Exclusion criteria were as follows: unavailability of full text, systematic reviews or meta-analyses, case studies, irrelevance to the specific research question, or presenting incomplete data.

2.3. Data Extraction and Analysis

Finally, data from the eligible articles were extracted and analyzed. The extracted data included study design, sample size, population characteristics, interventions, outcomes, and key findings. The data synthesis involved qualitative and quantitative analysis, depending on the nature of the data. Descriptive statistics were used to summarize the characteristics of the included studies, while thematic analysis was applied to identify common themes and patterns across the studies. The entire process is summarized in the PRISMA flowchart (**Figure 1** below).

2.4. Ethical Considerations

This systematic review was conducted using publicly available data from previously published studies. As such, it did not involve direct contact with human subjects or the collection of primary data, and ethical approval was not required. However, ethical considerations were adhered to by ensuring the integrity and transparency of the research process, including a comprehensive and unbiased search strategy, careful screening, and selection of studies, and accurate reporting of findings.

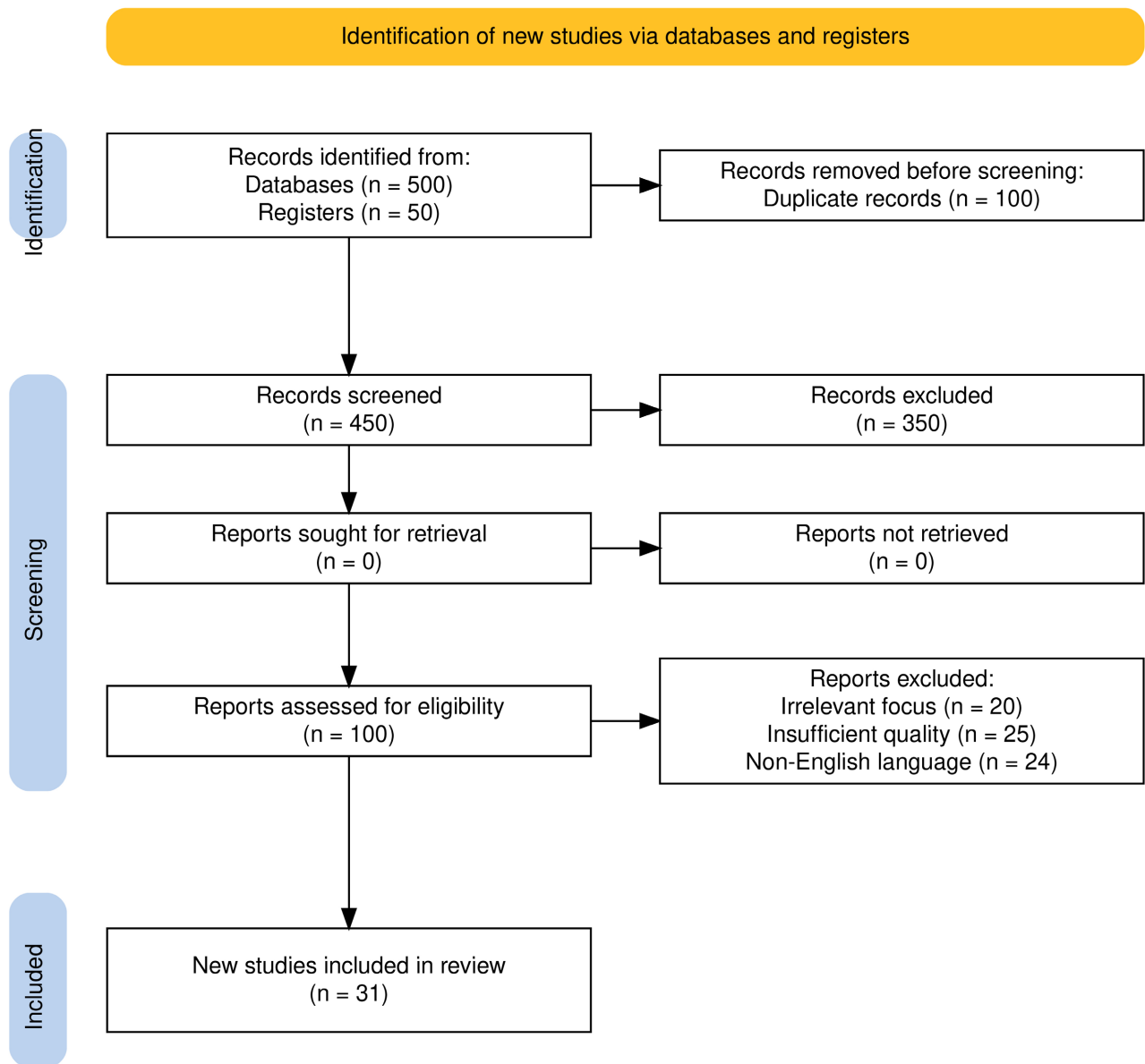


Figure 1. PRISMA flow chart diagram for systemic review.

3. Result and Discussion

3.1. Study Characteristics Results

A total of 4917 records were identified through database searching, comprising 2786 from Scopus, 854 from PubMed, and 1277 from Web of Science. Following removal of duplicates, 3657 records remained for screening. All 3657 records were initially screened by title, with 382 further screened by title and abstract. Ultimately, 3569 records were excluded during screening, with 3273 exclusions based on title and 296 based on abstract. Of the remaining records, 88 full-text articles were assessed for eligibility, resulting in the exclusion of 79 articles. Reasons for exclusion included relevance to operative documentation (63 articles), case reports (6 articles), and 6 systematic reviews, and unavailability of full text

(4 articles). A total of 9 studies met the eligibility criteria for qualitative synthesis, comprising 7 prospective studies, 2 retrospective studies.

3.2. Literature Review Findings

3.2.1. Diet and Nutrition

The impact of diet and nutrition on migraine has been a subject of extensive study, although specific dietary recommendations remain elusive. Various studies have explored the association between dietary components and migraine onset or severity, revealing mixed findings. While there is no conclusive evidence linking any specific diet to the prevalence of migraines, certain dietary patterns have been implicated as potential triggers.

High-calorie diets have been suggested to exacerbate migraines, particularly in obese individuals [5]. These high-calorie diets consisting of processed food, sweets, soda, and refined grains trigger pro-inflammatory mediators that increase the risk of migraine attacks, especially among obese individuals [6]-[10]. Strategies aimed at weight reduction have shown promise in reducing migraine frequency among obese patients. Additionally, there is anecdotal evidence suggesting that diets high in fat, oil, or carbohydrates may trigger migraine attacks in susceptible individuals. Dietary modifications, such as gluten elimination in patients with celiac disease, have also been explored as potential strategies to alleviate migraine symptoms.

Alcohol consumption has been identified as a significant trigger for migraines in a substantial proportion of patients, with mechanisms varying between individuals. Similarly, caffeine, known for its adenosine receptor antagonism, exhibits dual effects on migraines—both exacerbating symptoms in some and providing relief in others depending on usage patterns [5]. Maintaining proper hydration status has been associated with improved migraine severity, with dehydration often cited as a trigger for migraine attacks.

Eating disorders, including Bulimia Nervosa and Anorexia Nervosa, contribute as additional triggering factors for migraines [6]. Metabolic disturbances and malabsorption syndromes may also play a role in exacerbating migraine severity, though conclusive evidence remains sparse. Micronutrient deficiencies resulting from conditions such as malabsorption syndromes, diarrhea, or poor dietary intake have been implicated in worsening migraine symptoms.

Irregular eating patterns, such as skipping meals or prolonged fasting, as well as poor dietary habits, have been consistently linked to increased migraine frequency and severity [5]. Recent research has suggested potential benefits of ketogenic and modified Atkins diets in migraine management, underscoring the role of dietary adjustments in reducing migraine burden.

Overall, while the precise mechanisms linking diet and nutrition to migraine remain unclear, maintaining regular dietary patterns, avoiding alcohol, and promoting general physical fitness appear to play a crucial role in migraine prevention [2] [4]-[6].

3.2.2. Physical Activity

The relationship between physical activity and migraine is complex and not yet fully elucidated. Obesity, defined as a body mass index (BMI) over 30, has been identified as a significant risk factor for increased migraine frequency [7]. The association between obesity and migraine stems from its impact on various physiological pathways, including cytokine imbalance, neurotransmitter dysregulation, and hypothalamic dysfunction, all of which can predispose individuals to migraine headaches.

Studies have demonstrated a clear link between physical activity levels and migraine severity. Moderate physical activity has been associated with a reduction in migraine intensity and frequency, suggesting a beneficial effect of regular exercise [7]. However, intense or aggressive physical exertion may trigger migraines in susceptible individuals, highlighting the need for personalized exercise regimens tailored to patient tolerance levels.

Exercise-induced migraines represent a subset of cases where physical activity itself triggers migraine attacks. Management strategies typically involve gradually increasing physical activity levels while monitoring for migraine symptoms, with an emphasis on aerobic exercises over anaerobic activities for their perceived migraine-preventative effects [2]-[4].

Observational studies examining the impact of physical activity on migraine occurrence have yielded mixed results, with some indicating no significant difference between active and non-active days in migraine frequency [7]. The role of inflammatory states induced by physical exertion remains a topic of ongoing research, suggesting potential pathways linking exercise-induced inflammation to migraine pathogenesis.

In summary, while moderate physical activity appears beneficial for migraine management by potentially reducing headache severity, personalized exercise plans are crucial to avoid exacerbating symptoms. Further research is needed to better understand the mechanisms underlying the relationship between physical activity and migraine, particularly regarding the role of obesity, hormonal imbalances, and inflammatory processes.

3.2.3. Sleep Pattern

Sleep patterns have a profound impact on migraine incidence and severity, with disturbed sleep significantly increasing the risk of migraine attacks. Individuals with sleep disorders, including insomnia, are particularly vulnerable to migraines, with the frequency and intensity of attacks often paralleling the quality of sleep [8]. The association between poor sleep hygiene and migraine highlights the importance of addressing sleep-related factors in migraine management.

Effective sleep hygiene practices, such as maintaining regular sleep schedules, reducing stressors before bedtime, and optimizing dietary and exercise habits, have been advocated as essential strategies for improving migraine outcomes [8]. Behavioral interventions aimed at promoting healthy sleep patterns can play a pivotal role in reducing migraine morbidity.

Psychiatric disorders and substance abuse further complicate the relationship between sleep and migraine, with conditions like depression and anxiety contributing to both disrupted sleep and increased migraine susceptibility [8]. Pharmacological interventions may be necessary in cases where non-behavioral approaches are insufficient to improve sleep quality.

Overall, the regulation of sleep is crucial in mitigating migraine risk, and comprehensive management strategies should encompass lifestyle modifications that promote healthy sleep patterns. Further research is needed to elucidate the precise mechanisms linking sleep disturbances to migraine pathophysiology and to optimize therapeutic interventions targeting sleep-related triggers.

3.2.4. Stress and Mental Health

Stress and mental health play a pivotal role in the pathogenesis and exacerbation of migraine headaches. The intricate relationship between stress and migraine involves complex neurobiological pathways, though the exact mechanisms remain incompletely understood [6]. Stress management strategies are therefore integral to migraine prevention and treatment.

Chronic stressors, such as financial difficulties, relationship issues, and demanding daily routines, contribute significantly to migraine severity and frequency [6]. Effective stress management techniques, including regular exercise, yoga, mindfulness practices, and relaxation techniques, have been shown to mitigate migraine symptoms by reducing stress levels and improving overall mental well-being [9].

The bidirectional relationship between stress and migraine underscores the importance of holistic approaches that address both physiological and psychological factors contributing to migraine morbidity. Behavioral therapies aimed at stress reduction can complement pharmacological treatments, offering patients comprehensive strategies for managing their condition.

While studies have consistently demonstrated a correlation between stress and migraine, further research is warranted to elucidate the underlying mechanisms and optimize stress management interventions in clinical practice. Integrating stress management into migraine treatment plans is essential for improving patient outcomes and enhancing quality of life.

3.2.5. Environmental Factors

Environmental factors play a significant role as triggers for migraine headaches, with individual sensitivity to various stimuli contributing to migraine onset and severity. Light and sound sensitivity are commonly reported triggers during migraine attacks, necessitating environmental modifications to mitigate their impact [3]. Allergens and atmospheric pollutants can also exacerbate migraines, underscoring the importance of identifying and minimizing exposure to environmental triggers.

Weather changes, including extreme temperatures and atmospheric pressure variations, have been linked to increased migraine frequency in susceptible indi-

viduals [3]. Strategies to manage environmental triggers may include wearing protective eyewear or masks, avoiding noisy environments, and acclimatizing to weather fluctuations to reduce migraine susceptibility.

In conclusion, understanding and addressing environmental triggers are essential components of migraine management strategies. Personalized approaches that identify and mitigate individual triggers can significantly reduce the frequency and severity of migraine attacks. Continued research into environmental factors and their impact on migraine pathophysiology is crucial for developing targeted interventions that improve patient outcomes.

3.2.6. Integrative and Holistic Approaches

Given the multifactorial nature of migraine, a holistic and integrative approach to treatment is essential for optimizing patient care. Migraine management often requires a tailored combination of pharmacological therapies, lifestyle modifications, and behavioral interventions to address individual patient needs [1] [4]-[6]. While painkillers and triptans are commonly prescribed for acute migraine relief, addressing underlying causes such as hypertension, allergies, stress, and sleep disturbances is equally critical.

Alternative therapies like acupuncture, dietary adjustments, biofeedback, and relaxation techniques have shown promise in managing migraine symptoms, particularly in cases refractory to conventional treatments [1] [4]-[6]. The integration of these complementary therapies into mainstream migraine care underscores the importance of personalized medicine in achieving optimal outcomes.

Diagnostic approaches involving imaging studies and comprehensive laboratory evaluations may be necessary in severe or atypical cases of migraine to rule out secondary causes and inform treatment decisions. Multidisciplinary collaboration among healthcare providers, including neurologists, psychiatrists, and dietitians, is often essential in developing comprehensive care plans that address the diverse needs of migraine patients.

Despite significant advancements in migraine research and treatment, the exact pathophysiological mechanisms driving the disease remain incompletely understood. Further investigation into the genetic basis of migraine and the mechanisms underlying lifestyle factors is warranted to refine treatment strategies and improve patient outcomes.

3.3. Discussion

The results of this systematic review underscore the intricate interplay of various lifestyle factors in migraine pathophysiology and management. Each factor—diet and nutrition, physical activity, sleep patterns, stress, mental health, environmental factors, and integrative approaches—individually influences migraine susceptibility and severity. However, their combined impact emphasizes the necessity for personalized treatment strategies tailored to the unique profiles of migraine patients.

Our systematic review provides comprehensive insights into the multifaceted nature of lifestyle factors in migraine pathophysiology and management, integrating findings from previous studies to elucidate common themes and discrepancies. While individual lifestyle factors—diet and nutrition, physical activity, sleep patterns, stress, mental health, environmental triggers, and integrative approaches—each exert influence on migraine susceptibility, their combined impact necessitates personalized treatment strategies tailored to individual patient profiles.

The literature on the relationship between diet and migraine is marked by conflicting evidence, highlighting the complexity of dietary influences on migraine. Our review indicates that while some studies suggest high-calorie diets exacerbate migraine symptoms, others find no such association. Moreover, the role of specific dietary components like fats, carbohydrates, and gluten remains contentious.

A study by Gazerani *et al.* reported that high-fat diets might trigger migraines, but this finding is inconsistent across different populations and methodologies [10]. Conversely, another study found no significant link between fat intake and migraine frequency, suggesting that individual variability plays a crucial role in dietary triggers [11]. This discrepancy might be attributed to differences in study designs, such as sample sizes, dietary assessment methods, and population characteristics. Comparatively, previous studies have similarly reported on the role of diet in migraine management, highlighting inconsistent associations between specific dietary components and symptom exacerbation or alleviation. The variability in dietary triggers underscores the need for personalized dietary recommendations in clinical practice [12] [13].

The relationship between physical activity and migraine is similarly nuanced, with studies producing conflicting results. While moderate exercise appears beneficial in reducing migraine frequency and severity, intense physical activity can trigger migraines in some individuals. A study by Irby *et al.* (2011) demonstrated that aerobic exercise significantly reduced migraine frequency, likely due to its impact on cardiovascular health and stress reduction [14]. However, another study found that high-intensity exercise could trigger migraines, particularly in those with a predisposition to exercise-induced migraines [15]. These conflicting findings could stem from methodological differences, such as variations in exercise protocols, intensity levels, and participant characteristics.

Similarly, the protective effects of physical activity against migraine attacks have been well-documented, with moderate exercise recommended as a beneficial intervention [16]. However, conflicting findings regarding the optimal exercise intensity and duration highlight the complexity of this relationship, emphasizing the importance of personalized exercise regimens tailored to patient tolerance levels [17].

The bidirectional relationship between sleep disturbances and migraine has been consistently observed in previous research, with poor sleep quality identi-

fied as a significant risk factor for migraine onset and exacerbation [18]. Strategies promoting healthy sleep hygiene and addressing psychiatric comorbidities have shown promise in improving migraine outcomes, aligning with our findings on the integral role of sleep management in migraine treatment.

Stress management strategies have been extensively explored in previous studies, underscoring the detrimental effects of chronic stressors on migraine severity and frequency [19]. Interventions targeting stress reduction have demonstrated efficacy in improving migraine outcomes by modulating neurovascular responses and enhancing coping mechanisms [20].

Environmental triggers, including light sensitivity and weather changes, have consistently been identified as precipitants of migraine attacks in susceptible individuals [21]. Personalized environmental modifications have been recommended to minimize trigger exposure and improve patient quality of life, aligning with our emphasis on individualized trigger management strategies.

Integrative and holistic approaches to migraine management, incorporating both conventional pharmacological therapies and CAM interventions, have been increasingly recognized in previous literature [22]-[24]. The integration of acupuncture, dietary adjustments, biofeedback, and relaxation techniques offers patients additional therapeutic options tailored to individual preferences and treatment responses.

3.4. Limitations and Future Directions

While this systematic review provides valuable insights into the multifaceted nature of lifestyle factors in migraine pathophysiology and management, several limitations warrant consideration. The heterogeneity of study designs, patient populations, and outcome measures across included studies limits the generalizability of findings.

Potential methodological biases, such as reliance on self-reported data, small sample sizes, and short follow-up periods, could contribute to the conflicting outcomes observed in the literature. Future research should prioritize large-scale, prospective studies with standardized methodologies to elucidate the precise mechanisms underlying lifestyle factors in migraine pathogenesis.

Further investigation into the genetic basis of migraine susceptibility and the interactions between lifestyle factors is needed to optimize treatment strategies and improve patient outcomes. Advances in neuroimaging and biomarker research hold promise for identifying biomarkers of migraine risk and treatment response, facilitating personalized medicine approaches in clinical practice.

3.5. Evidence-Based Recommendations for Lifestyle Modifications Tailored to Migraine Types, Frequency, Severity, and Patient Lifestyles

Based on the evidence reviewed, personalized lifestyle modifications can significantly improve migraine management. For those with frequent migraines, maintaining a consistent sleep schedule and practicing good sleep hygiene are

crucial. Patients should aim for 7 - 8 hours of sleep per night, avoid caffeine and prolonged use of electronics before bedtime, and establish a relaxation routine that promotes sleep. For dietary management, patients should keep a food diary to identify and avoid individual triggers like alcohol, caffeine, and high-fat foods. Regular, balanced meals and adequate hydration are essential. Incorporating moderate physical activity, such as walking or yoga, can reduce migraine frequency and severity, especially for patients with tension-type migraines. Stress management techniques like mindfulness, meditation, and cognitive-behavioral therapy can help alleviate chronic stress that exacerbates migraines. Environmental modifications, including using sunglasses to reduce light sensitivity and creating a quiet, calming space, can mitigate external triggers. Tailoring these strategies to individual lifestyles and migraine patterns is critical for effective management.

4. Conclusion

The literature has already addressed that the most effective management of migraine is through changes in lifestyle factors. The triggering factors need to be identified and addressed critically by the patient and clinician. A healthy and complete diet, avoidance of alcohol, smoking, and caffeine, regular exercise, sleep hygiene, and avoiding stress are some of the most effective measures in avoiding the incidence of migraine. Functional diseases of neurology are usually deeply connected to the lifestyle of individuals, so they need to be addressed critically. These diseases pose a great stigma on the patients, and their prevalence is also very high, so community education and counseling are as important as any other treatment.

Authors' Contribution

All authors made several overlapping contributions in the conceptualization, design, data collection, scholarly review, and appraisal of this research study. Their roles include the application of methods to test the validity of reliability of the data collected through literature search, and the interpretation of data and analysis of research. Moreover, there was oversight and internal review in the procurement of data collated to ensure quality control.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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