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The Relationship Between Physical Activity and Migraines: Research on Prevention and Supportive Treatment

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Abstract

Introduction and Purpose

Migraine is a chronic neurological disorder characterized by recurring headaches and associated symptoms, such as nausea, sensitivity to light and sound. Migraine significantly impacts the daily functioning of individuals affected by the condition. This article explores the relationship between physical activity and migraines, focusing on how regular exercise may influence the frequency, intensity, and overall management of migraine attacks. Through a review of existing studies, the article aims to uncover the underlying mechanisms, assess the effectiveness of physical activity as both a preventive and therapeutic tool and provide practical guidance for healthcare professionals and patients. The goal is to highlight the potential of exercise as a non-pharmacological approach to improving migraine treatment outcomes.

State of Knowledge

Migraine is a complex neurological disorder influenced by genetic, environmental and lifestyle factors. Understanding its pathophysiology, including neurovascular and inflammatory mechanisms, is crucial for developing effective treatment strategies. While pharmacotherapy remains the cornerstone of migraine treatment, recent studies suggest that physical activity may play a significant role in reducing both the frequency and intensity of attacks. Furthermore, exercise offers additional benefits, such as stress relief and improved sleep quality, which are known triggers for migraines.

Materials and Methods

A detailed literature review was conducted covering the years 1993-2023, using databases such as PubMed, ScienceDirect, and Google Scholar. Relevant studies were identified using keywords such as "migraine," "physical exercise," "physical activity," "migraine therapy," and "non-pharmacological treatment." Special attention was given to peer-reviewed articles,

including primary research studies and systematic reviews, to ensure a comprehensive understanding of the topic.

Summary

The literature review highlights the growing recognition of physical activity as a valuable non-pharmacological intervention in the treatment of migraines. Regular exercise appears not only to reduce the frequency and intensity of migraine attacks but also to improve overall well-being by mitigating associated factors such as stress and sleep disturbances. These findings emphasize the importance of integrating physical activity into a holistic approach to migraine treatment, offering a promising pathway for both patients and healthcare professionals.

Keywords

Migraine; physical exercise; physical activity; migraine therapy; non-pharmacological treatment

Introduction

Migraine is a common and debilitating neurological disorder characterized by recurring headaches and associated symptoms such as nausea, photophobia and phonophobia. These episodes can significantly reduce the quality of life for individuals affected, leading to widespread implications for both personal well-being and public health. Recent decades have witnessed increased attention toward identifying effective management strategies for migraines, highlighting the potential of non-pharmacological interventions.

Purpose

The aim of this article is to examine how physical activity impacts migraine management. Specifically, it seeks to explore how regular exercise influences the frequency, intensity and associated symptoms of migraines. By synthesizing findings from existing research, this article aims to provide healthcare professionals and patients with practical insights into incorporating physical activity into holistic migraine care plans as an effective, non-pharmacological approach.

Material and methods

A detailed literature review was conducted covering the years 1993-2023, using databases such as PubMed, ScienceDirect, and Google Scholar. Relevant studies were identified using keywords such as "migraine," "physical exercise," "physical activity," "migraine therapy," and "non-pharmacological treatment." Special attention was given to peer-reviewed articles, including primary research studies and systematic reviews, to ensure a comprehensive understanding of the topic.

Results

This review underscores the emerging role of physical activity in managing migraines. Evidence suggests that regular exercise can significantly reduce the frequency and severity of migraine attacks while also improving overall well-being. By addressing common migraine triggers such as stress, poor sleep, and vascular dysregulation, exercise presents a promising adjunctive therapy. Furthermore, integrating physical activity into daily routines offers long-term benefits beyond migraine relief, enhancing physical and mental health.

Migraine

Migraine is a neurological disorder characterized by recurrent headaches of moderate to severe intensity, often accompanied by symptoms such as nausea, vomiting, and sensitivity to light and sound. These headaches can last from 4 to 72 hours and significantly impact the quality of life of individuals affected by this condition. Migraine has a multifactorial etiology, with both genetic and environmental factors playing key roles. People with migraines often experience difficulties in daily functioning, such as problems with concentration, reduced work performance and limited social activity due to the intensity of the headache attacks.

Epidemiology

Migraine is a condition that affects between 14% and 15% of the population, depending on the results of various epidemiological studies.[1,2] Before puberty, migraine occurs more frequently in boys than in girls, but this changes significantly after puberty. Women are up to twice as likely to suffer from migraines as men. The highest prevalence of migraine is observed between the ages of 25 and 55. Additionally, studies conducted in the United States indicate that this condition is more common among individuals with lower socioeconomic

status. This may result from both limited access to healthcare and greater exposure to stress within this social group. [3]

Diagnosis and Classification

Diagnosis is primarily based on a detailed medical history and the application of criteria from the International Classification of Headache Disorders (ICHD-3). To diagnose migraine, a patient must report at least five episodes of headache lasting from 4 to 72 hours. The pain characteristic of migraine is typically unilateral, pulsating and of moderate or severe intensity, with its severity increasing during daily physical activity. Additionally, the occurrence of nausea or sensitivity to external stimuli, such as light and noise, is a key element of diagnosis. In the diagnosis of migraine, it is crucial to exclude other causes of headaches, such as tension-type or cluster headaches. Neuroimaging studies, such as magnetic resonance imaging (MRI) or computed tomography (CT) are not routinely recommended unless atypical symptoms suggest other neurological conditions.[4,5]

The classification of migraine distinguishes several primary types. The most common form is migraine without aura, which manifests solely as headache accompanied by associated symptoms. The second important type is migraine with aura, which is preceded by transient neurological disturbances, such as visual phenomena (e.g., spots or flashes of light), numbness or in some cases, speech disturbances. There is also chronic migraine, which is diagnosed when migraine headaches occur on at least 15 days per month for three consecutive months, with at least 8 of those days meeting the criteria for migraine.[4,5]

Pathophysiology

The pathophysiology of migraine is a complex process that involves multiple factors. One of the key mechanisms in migraine is cortical spreading depression (CSD), which is considered the primary process triggering migraine attacks. CSD is a wave of depolarization that spreads across the cerebral cortex, leading to disturbances in blood flow, changes in the ionic balance in the brain, efflux of excitatory amino acids from nerve cells, and enhanced energy metabolism.[6] This phenomenon is especially observed in individuals with migraine with aura, where visual disturbances precede the headache. Evidence suggests that CSD may trigger intracranial neurogenic inflammation and activation of trigeminal afferents, which leads to the intensification of migraine pain.[7]

Another important mechanism is the activation of the trigeminovascular system, which plays a significant role in the pathogenesis of migraine. The stimulation of neurons innervating cerebral blood vessels leads to the release of neuropeptides, such as calcitonin gene-related peptide (CGRP). CGRP is a potent vasodilator and elevated levels of this peptide are observed during migraine attacks.[8]

Genetic factors play a significant role in the occurrence of migraines, particularly in rare forms such as hemiplegic migraine, which is caused by mutations in genes regulating ion channels and transport proteins. Furthermore, the results of genome-wide association studies (GWAS) indicate that genetic variants related to neuronal function and blood vessel regulation increase susceptibility to developing migraines.[9]

Environmental factors also play an important role in migraine pathogenesis. Stress, sleep disturbances, fasting and sensory stimuli can promote the transition from episodic to chronic migraine, particularly in genetically predisposed individuals, underscoring the mutual influence of genetic and environmental factors in disease progression.[10]

Treatment

Acute migraine treatment aims to terminate attacks quickly and effectively, enabling individuals to resume daily activities. The most widely used acute medications include triptans, nonsteroidal anti-inflammatory drugs (NSAIDs) and antiemetics. Triptans, serotonin receptor agonists are highly effective in aborting migraines by constricting cranial blood vessels and inhibiting inflammatory neuropeptides.[11] NSAIDs, such as ibuprofen and naproxen are particularly useful for mild to moderate migraine attacks, reducing pain and inflammation.[12] Antiemetics, like metoclopramide play a crucial role in managing nausea and vomiting, which are common during migraine episodes, and they may also enhance the efficacy of other treatments.[13]

Preventive pharmacotherapy is recommended for individuals experiencing frequent or debilitating migraines. The goal is to reduce attack frequency, severity and associated disability. Beta-blockers, such as propranolol and metoprolol are among the most established options for migraine prevention, demonstrating efficacy in reducing attack frequency. Anticonvulsants, including topiramate and valproate have shown significant benefits, particularly in individuals with chronic migraines.[14] Antidepressants, such as amitriptyline also contribute to migraine prophylaxis, although their use may be limited by side effects.[15]

Recent advances in migraine research have led to the development of targeted therapies, particularly those focusing on calcitonin gene-related peptide (CGRP) pathways. CGRP is a neuropeptide implicated in migraine pathophysiology. Monoclonal antibodies, such as erenumab and fremanezumab, target CGRP or its receptor and have revolutionized preventive migraine treatment by offering high efficacy and favorable tolerability.[16] Gepants, small-molecule CGRP receptor antagonists like ubrogepant and rimegepant have emerged as promising options for both acute and preventive treatment, providing an alternative to traditional therapies.[17,18]

In addition to pharmacological interventions, non-drug therapies are increasingly recognized as valuable adjuncts in migraine management. Techniques such as biofeedback, cognitive-behavioral therapy and regular physical activity can complement pharmacotherapy, addressing triggers and promoting overall well-being. These approaches are particularly beneficial for patients, who prefer non-pharmacological options or those with contraindications to certain medications.[19,20]

The management of migraine has significantly evolved, with a growing arsenal of pharmacological treatments tailored to individual needs. Traditional therapies like triptans, beta-blockers and anticonvulsants remain critical, while emerging treatments targeting CGRP pathways offer hope for more effective and personalized care.

Correlation between migraine and physical activity

Regular physical activity is one of the most effective methods for promoting overall health. In addition to improving cardiovascular function and reducing stress levels, it contributes to enhanced mental well-being.[21] Importantly, for individuals suffering from migraines, moderate and regular exercise can be a crucial element in preventive strategies. Studies have shown that physical activity can reduce the frequency, intensity, and duration of migraines. This mechanism is largely attributed to the release of endorphins during exercise. These natural pain relievers not only alleviate migraine symptoms but also promote overall relaxation.[22]

Physical activity also benefits the regulation of neurotransmitters, such as serotonin, which play a critical role in pain perception and mood regulation. Improved circulation and reduced inflammation, driven by systematic exercise, further support the mechanisms preventing

migraines.[23] Aerobic exercises, such as walking, jogging, swimming or cycling are particularly recommended due to their comprehensive impact on the body.[24]

Stress, as one of the most common migraine triggers is another area where physical activity plays a key role. By reducing cortisol levels and enhancing the body's ability to cope with tension, regular exercise can significantly lower the risk of migraine episodes.[25] Additionally, physical activity positively affects sleep quality, which is especially important in the context of migraines. Both insufficient and excessive sleep can increase the likelihood of episodes, making the circadian rhythm improvements brought by exercise particularly valuable in prevention.[26]

However, it is important to note that in certain cases, physical activity can act as a migraine trigger. Intense exercise, particularly when performed without proper preparation can lead to dehydration, hypoglycemia or sudden spikes in blood pressure- factors commonly associated with migraine onset.[27,28] Furthermore, environmental factors such as high temperatures, bright lights or loud music in exercise settings can exacerbate the risk of triggering an episode.[29]

These observations highlight the need for an individualized approach when incorporating physical activity into migraine prevention programs. [30,31] Gradual introduction of low-intensity exercises, such as yoga or tai chi can be especially beneficial for individuals sensitive to vigorous activity. Proper hydration, a balanced diet and adequate warm-ups before exercising are fundamental measures to minimize the risk of adverse effects. [32,33] Monitoring individual migraine patterns and identifying potential triggers can also facilitate more effective alignment of physical activity with a person’s specific needs.[34]

An important aspect is the necessity for further research into the mechanisms of how physical activity impacts migraines. While current studies provide promising findings, there is a need for more detailed exploration of differences in responses to exercise based on gender, age and comorbid conditions such as depression or anxiety, which are often associated with migraines. Better understanding of these relationships may contribute to developing more precise recommendations for individuals managing this condition.[35]

Discussion

The relationship between physical activity and migraine management is a rapidly evolving area of research, with increasing evidence supporting the beneficial effects of regular exercise

in preventing and alleviating migraine attacks. This review highlights how physical activity, particularly moderate aerobic exercises like walking, jogging, and swimming can reduce the frequency and intensity of migraine episodes. The positive impact of exercise is primarily attributed to the release of endorphins, which act as natural pain relievers and the modulation of neurotransmitters like serotonin, which play a crucial role in pain perception and mood regulation.

Additionally, physical activity addresses common migraine triggers such as stress and poor sleep quality. Regular exercise has been shown to lower cortisol levels and enhance the body's ability to cope with stress, which is a well-known precipitant of migraine attacks. Furthermore, exercise contributes to the improvement of circadian rhythms, promoting better sleep quality, which is critical in migraine prevention. These findings underscore the importance of integrating physical activity into a holistic approach to migraine treatment, particularly for patients who seek non-pharmacological options or those who may be unable to tolerate certain medications.

However, it is essential to recognize that physical activity may not always be beneficial for individuals with migraines, particularly if not carefully tailored to the individual's needs. Intense physical exertion or exercise without proper preparation can trigger migraine attacks by causing dehydration, hypoglycemia or sudden changes in blood pressure. Environmental factors, such as bright lights or loud sounds in exercise settings can also exacerbate the risk. These considerations highlight the necessity for a personalized approach to exercise recommendations, where the type, intensity and environment of physical activity are adapted to the specific needs of the individual patient.

Furthermore, while current studies offer valuable insights into the positive role of exercise in migraine management, more research is needed to understand the underlying mechanisms in greater detail. Studies exploring how factors such as gender, age and comorbid conditions (e.g., depression or anxiety) influence the response to physical activity would be valuable. This knowledge could further refine exercise recommendations, ensuring that they are tailored to enhance treatment outcomes for different patient populations.

Conclusion

The relationship between physical activity and migraine management represents a promising area of research and clinical application. Regular, moderate exercise offers multiple benefits

for individuals with migraines, including reducing attack frequency and intensity, improving overall well-being, and addressing key migraine triggers such as stress and sleep disturbances. However, to optimize the effectiveness of exercise as a non-pharmacological intervention, it is essential to adopt a personalized approach that considers the patient's unique characteristics and migraine patterns.

While further research is required to deepen our understanding of the specific mechanisms by which exercise influences migraine, current evidence supports the integration of physical activity into comprehensive migraine care plans. Healthcare professionals should consider recommending tailored exercise programs, particularly for patients seeking alternative treatments or those with contraindications to pharmacological therapies. With continued investigation, exercise could become an indispensable component of migraine management, offering patients a holistic and accessible means of improving their condition.

DISCLOSURE

Author's contribution

Conceptualization, Wiktoria Belcarz and Magdalena Balwierz; methodology, Jan Karczmarz; software, Joanna Orzechowska; check, Karolina Kalinowska and Marika Gutowska; formal analysis, Michał Orzechowski and Aleksandra Paprocka; investigation, Paulina Fijałek and Urszula Świrk; resources, Jan Karczmarz; data curation, Joanna Orzechowska; writing - rough preparation, Karolina Kalinowska; writing - review and editing, Marika Gutowska; visualization,Michał Orzechowski; supervision and Aleksandra Paprocka, Paulina Fijałek and Urszula Świrk; project administration, Wiktoria Belcarz and Magdalena Balwierz; receiving funding - no specific funding.

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The data presented in this study is available upon request from the correspondent author.

Conflict of interest

The authors deny any conflict of interest

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