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IMPACT OF PHYSICAL EXERCISE ON REDUCING THE FREQUENCY AND SEVERITY OF MIGRAINE WITHOUT AURA: A MULTI-CENTER CROSS-SECTIONAL STUDY

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ABSTRACT

Background and Objective:
Migraine without aura is the most common subtype of migraine and causes significant distress to its sufferers. The objective of this study was to evaluate the role of physical exercise in reducing the frequency and severity of attacks in patients with migraine without aura.

Methods:
This multicenter cross-sectional study was conducted from March 2024 to February 2025 in departments of neurology and medicine in two tertiary care hospitals in Quetta and Khuzdar. A total of 384 adults age 18–60 years with migraine without aura, diagnosed using ICHD-3 criteria, were selected through consecutive sampling. Patients with other headache types or neurological disorders were excluded. Data were collected via data collection tool. Exercise was defined as aerobic activity for 30 minutes, three times weekly. Pain severity was measured using the Visual Analog Scale. Data were analyzed using SPSS 25.

Results:
In this study, 288 (75%) were females and 96 (25%) were males, with a mean age of 31.6 ± 8.7 years. Among 384 participants, 143 (37.2%) engaged in exercise, most commonly walking 101 (70.6%), and 92 (64.4%) exercised ≥3 times/week. Stress was reported in 294 (76.6%), irregular sleep in 121 (31.5%), and dietary triggers in 103 (26.8%). Regular exercisers had significantly fewer migraine attacks per month (3.1 ± 1.6) as compared with non-exercisers (4.9 ± 2.3) with p-value < 0.001.

Conclusion:
Regular physical exercise was associated with a significant reduction in both the frequency and severity of migraine without aura attacks.

Keywords: Aerobic exercise, Migraine without aura, Non-pharmacological treatment, Physical activity.

INTRODUCTION

Migraine is a common and disabling neurological condition marked by repeated moderate to severe headaches, often with nausea, light, and sound sensitivity.[1] It greatly affects quality of life and daily functioning, disrupting work, school, and social life. It usually causes one-sided, throbbing pain lasting four to 72 hours, often worsened by physical activity. Migraine is broadly classified into migraine without aura, migraine with aura, chronic migraine, and less common variants such as hemiplegic migraine and retinal migraine.[2] Migraine has a strong genetic predisposition and is influenced by environmental and lifestyle factors, including stress, sleep disturbances, dietary habits, and hormonal changes. Understanding migraine classification and triggers is essential for accurate diagnosis, effective management, and reduction of disease-related disability.[3]

Migraine without aura (MWA) is defined as a recurrent primary headache disorder characterized by moderate to severe, usually unilateral, pulsating headache attacks lasting 4–72 hours, without preceding focal neurological symptoms. MWA is the most common form of migraine,

making up about 70–80% of all cases. Migraine affects 15–18% of the global population. It is more common in females, with a female-to-male ratio of about 3:1. This difference is likely due to hormonal changes, especially estrogen, which affects pain and nerve sensitivity.[4]

In South Asia, especially Pakistan, migraine rates are higher than global averages, with studies estimating up to 22% of adults affected. MWA is the dominant type, often underdiagnosed due to symptom overlap and limited diagnostic accuracy in routine practice.[4] Despite its impact, MWA remains largely untreated due to low awareness, stigma, limited access to care, and self-medication.[5]

Non-drug options like physical exercise are gaining interest. Regular aerobic activity is seen as a low cost, accessible method to reduce migraine frequency and severity. Exercise boosts endorphins, balances serotonin, and improves blood flow in the brain. It also lowers stress, improves sleep, and helps with weight control, all of which relate to migraine.[6] Some international trials support moderate aerobic exercises like walking or cycling to reduce attacks, though vigorous or unfamiliar exertion may trigger migraines in sensitive people. These mixed findings stress the need for local studies that consider cultural and lifestyle factors.[7]

In Pakistan, research on exercise in migraine care is limited, with most studies focused on drug treatments. Given the high disease burden and limited healthcare access, studying exercise as a lifestyle intervention is important. This research aims to assess MWA prevalence and its link to aerobic exercise, providing insights for public health strategies and cost effective migraine management in low resource settings.[8]

METHODS

This descriptive cross-sectional study was conducted at the Department of Medicine and Neurology, in two tertiary care hospitals at Quetta, and Khuzdar (Bolan University Hospital and Jhalawan Teaching Hospital respectively). The study duration was one year from March 2024 to February 2025. The study began after approval from the Institutional Review Board (IRB) of Bolan University of Medical and Health Sciences, approval number 1048/BUMHS/IRB/24, dated February 22, 2024. Ethical guidelines were followed. Written informed consent was obtained from each participant using a standard form. Confidentiality and privacy were maintained throughout the study.

Patients were selected from both outpatient and inpatient departments. A total of 384 patients were included. The sample size was calculated using the WHO calculator. It used a 95% confidence level, 5% margin of error, and 50% expected prevalence5. Non-probability consecutive sampling was used. Adults aged 18 to 60 years were included. Only individuals with a confirmed MWA diagnosis were included. It was diagnosed using the ICHD-3 criteria.[11] The exclusion criteria for the study include patients diagnosed with migraine with aura or secondary headache disorders, individuals with known psychiatric or neurological disorders, and participants outside the age range of 18 to 60 years.

All participants were interviewed using a data collection tool specifically designed by the authors for this study. Data were collected on age, sex, MWA history, exercise habits, as well as the frequency and severity of migraine attacks. The frequency of migraine attacks was recorded as the number of attacks per month. The overall duration of migraine history was recorded in years. Exercise was defined as aerobic activity for at least 30 minutes, three times per week for three months.

The Visual Analog Scale, a simple and useful tool for assessing the severity of pain, was used in MWA. It helps patients rate their pain by marking a point on a 10 cm line, where one end means "no pain" and the other means "worst possible pain." This allows healthcare providers to measure pain intensity, monitor changes over time, and evaluate the effectiveness of treatment. Though VAS does not diagnose migraine, it is valuable in tracking how severe the headache is during and after attacks.

Data were collected using printed forms. Each form was checked for completeness. Data were then entered into SPSS version 25. Descriptive statistics were applied to calculate means and frequencies. Chi-square test was used for comparing categorical data. Associations between exercise and MWA frequency/severity were analyzed. A p-value of less than 0.05 was considered significant. Data were analyzed by SPSS 25.0.

RESULTS

The study included 384 participants: 288 (75%) females and 96 (25%) males. Among exercisers, there were 106 (74.1%) females and 37 (25.9%) males, while non-exercisers included 182 (75.5%) females and 59 (24.5%) males ($p = 0.812$), showing no significant difference in gender distribution. The details of demographic and clinical characteristics were demonstrated in table 1.

Table 1: Demographic and Clinical Characteristics				
Characteristic	**Total (n=384)**	**Exercisers (n=143)**	**Non-Exercisers (n=241)**	**p-value**
Age (Mean ± SD)	31.6 ± 8.7	31.2 ± 9.0	31.8 ± 8.5	0.524
Marital Status				
Married (%)	229 (59.6%)	87 (60.8%)	142 (58.9%)	0.726
Unmarried (%)	155 (40.4%)	56 (39.2%)	99 (41.1%)	0.726
Education Level				
Graduate (%)	138 (35.9%)	53 (37.1%)	85 (35.3%)	0.780
Secondary (%)	116 (30.2%)	44 (30.8%)	72 (29.9%)	0.831
Others (%)	130 (33.9%)	46 (32.1%)	84 (34.8%)	0.812
Stress as trigger	294 (76.6%)	107 (74.8%)	187 (77.6%)	0.616
Menstrual-related migraine (females)	169 (58.7%)	62 (58.5%)	107 (58.8%)	0.964

Stress was the most frequently reported migraine trigger, affecting 294 (76.6%) participants, with 107 (74.8%) exercisers and 187 (77.6%) non-exercisers (p = 0.616). Irregular sleep was reported by 121 (31.5%) and dietary triggers by 103 (26.8%). Menstrual cycle-related migraines were reported by 169 females (58.7%), with similar prevalence in exercisers (62, 58.5%) and non-exercisers (107, 58.8%) (p = 0.964). The details of frequency of MWA, it triggers and exercise habits are exhibited in table 2.

Table 2: Frequency of MWA Triggers and Exercise Habits				
Trigger / Exercise Habit	**Total (n=384)**	**Exercisers (n=143)**	**Non-Exercisers (n=241)**	**p-value**
Irregular sleep	121 (31.5%)	46 (32.1%)	75 (31.1%)	0.887
Dietary triggers (e.g., chocolate)	103 (26.8%)	42 (29.4%)	61 (25.3%)	0.520
Aerobic exercise	143 (37.2%)	143 (100%)	0 (0%)	—
Exercise frequency ≥3 times/week	92 (64.4%)	92 (64.4%)	0 (0%)	—
No regular physical exercise	241 (62.8%)	0 (0%)	241 (100%)	—

Regular physical exercise was reported by 143 (37.2%) participants, with walking being the most common activity (101, 70.6%). Most exercisers worked out three or more times per week 92 (64.4%), with 30–45 minute sessions 54 (37.8%) and over 45 minutes 37 (25.9%). Exercisers had significantly lower migraine frequency (3.1 ± 1.6 vs. 4.9 ± 2.3 attacks/month, p < 0.001) and lower pain severity (5.8 ± 1.7 vs. 7.3 ± 2.0, p < 0.001) compared with non-exercisers, while the overall duration of MWA history was similar between groups (p = 0.14). The duration of individual migraine attacks was reported by participants in hours, consistent with the ICHD-3 definition of 4–72 hours per attack.

Exercisers experienced significantly lower migraine frequency, 3.1 ± 1.6 attacks per month vs. 4.9 ± 2.3 attacks per month in non-exercisers (p < 0.001), and lower pain severity, VAS 5.8 ± 1.7 vs. 7.3 ± 2.0 (p < 0.001). Duration of migraine history was similar between groups, 6.0 ± 3.7 vs. 6.3 ± 4.1 years (p = 0.14). The details of characteristics of physical exercise among exercisers were reported in Table 3.

Table 3: Characteristics of Physical Exercise Among Exercisers (n = 143)	
Variable	**n (%)**
Type of exercise	
Walking	101 (70.6)
Jogging	23 (16.1)
Cycling	19 (13.3)
Gym-based workouts	28 (19.6)
Yoga	11 (7.7)
Exercise frequency	
1–2 days/week	51 (35.7)
≥3 days/week	92 (64.4)
Duration per session	
<30 minutes	52 (36.4)
≥30 minutes	91 (63.6)
Perceived impact on migraine	
Improved	82 (57.3)
No change	29 (20.3)
Worsened	11 (7.7)
Not sure	21 (14.7)

DISCUSSION

This study shows significant role of regular physical exercise in reducing both the frequency and severity of MWA. The findings reinforce and expand upon existing research, demonstrating that consistent aerobic exercise may positively influence MWA pathophysiology.9 Importantly, our results offer novel insights specific to the Pakistani population, where MWA management remains predominantly reliant on pharmacological interventions, with limited emphasis on lifestyle modifications. Similar findings have been reported in other regional studies, emphasizing the need for lifestyle-focused interventions in migraine management.[10,11]

The substantial reduction in migraine frequency observed among exercisers compared to non-exercisers strongly supports the hypothesis that exercise exerts neuroprotective and vasoregulatory effects.[12] This finding is consistent with randomized controlled trials showing that moderate-intensity aerobic exercise can reduce the frequency of migraine attacks by 20–30% over 8–12 weeks.[13] These findings align with previous studies conducted in Western populations, though the magnitude of benefit in our cohort was notably higher.[14] Such differences may also reflect variations in adherence, lifestyle factors, or genetic predispositions influencing migraine severity.[15] This discrepancy may stem from differences in baseline physical activity levels, cultural attitudes toward exercise, or variations in stress exposure. Additionally, the significant decrease in pain severity further underscores the therapeutic potential of exercise in migraine management. Moreover, meta-analyses have reported similar reductions in pain intensity, suggesting that even low-to-moderate intensity activities like walking can meaningfully alleviate migraine-related discomfort.[16,17]

Despite these benefits, only 37.2% of participants reported engaging in regular physical activity, highlighting a critical gap in patient education and awareness. This low participation rate mirrors findings from other low- and middle-income countries, where knowledge about non-pharmacological migraine interventions remains limited.[18,19] Unlike structured exercise programs

commonly prescribed in high-income countries, most active participants in our study relied on walking (70.6%), suggesting that even low-to-moderate-intensity exercise can yield meaningful improvements.[20] Previous studies have similarly shown that simple, accessible activities like walking or cycling can significantly reduce migraine frequency and improve quality of life.[21] This is particularly relevant in resource-limited settings, where access to specialized fitness facilities may be restricted. The high proportion of participants exercising at least three times per week (64.4%) further reinforces the feasibility of integrating physical activity into routine migraine care.[22] These findings suggest that culturally adapted, low-cost exercise interventions could be a practical strategy for migraine management in Pakistan and similar contexts.

Interestingly, while exercise significantly reduced migraine frequency and severity, it did not influence attack duration in our study. This aligns with some prior research, indicating that while exercise may modulate attack onset and intensity, it may not alter the underlying mechanisms that prolong migraine episodes.[23,24] A study by Busch et al. reported similar findings, where aerobic exercise reduced attack frequency but did not significantly change attack duration, suggesting that exercise primarily affects triggering mechanisms rather than intrinsic migraine pathology.[25] Future investigations should explore whether different exercise modalities such as yoga, resistance training, or high-intensity interval training have varying effects on migraine duration.[26] Emerging evidence suggests that mind-body exercises like yoga may additionally reduce attack duration through autonomic regulation and stress reduction.[27] Additionally, the lack of gender-based differences in exercise benefits suggests that physical activity may be equally effective for both male and female migraine sufferers, although the potential influence of hormonal factors requires further investigation.[28] Previous studies have noted that while overall benefit is similar, menstrual cycle phases may modulate migraine response to exercise in females.[29]

Stress emerged as the predominant migraine trigger (76.6%), consistent with global epidemiological data. Although exercisers reported marginally fewer stress-induced migraines (74.8% vs. 77.6%), the difference was not statistically significant. Nevertheless, this trend aligns with well-established evidence that exercise mitigates stress through endorphin release and hypothalamic-pituitary-adrenal (HPA) axis modulation. A randomized trial demonstrated that regular aerobic exercise significantly lowered perceived stress scores and reduced migraine frequency, supporting the notion that stress reduction is a key mediator of exercise benefits.30 Future studies incorporating biochemical markers, such as cortisol levels, could provide deeper insights into the stress-exercise-migraine interplay. Additionally, recent research suggests that heart rate variability, a marker of autonomic regulation, may improve with exercise and correlate with fewer stress-induced migraine attacks.[31]

A key limitation of this study is its cross-sectional design, which precludes definitive causal inferences. Recall bias may also affect the accuracy of self-reported exercise habits and migraine characteristics. Furthermore, the study did not assess exercise intensity or long-term adherence, both of which could influence outcomes. Additionally, the reliance on self-reported migraine frequency and severity without objective verification may underestimate or overestimate the true effects of exercise.[32] Prospective, randomized controlled trials are needed to establish causality and determine optimal exercise prescriptions for migraine prevention.

CONCLUSION

Regular physical exercise was found to be associated with a significant reduction in both the frequency and severity of migraine without aura attacks in this study population. The findings support exercise as a simple, low-cost migraine treatment. Promoting physical activity could help migraine patients.

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Amir Hamza: Concept, Design, Data collection, manuscript writing
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Mohammad Azam; data collection, data analysis, manuscript writing
Riaz Ahmed; data analysis, manuscript writing
Ikramullah; data interpretation, manuscript revision

All the authors have approved the final version to be published and agree to be accountable for all aspects of the work.