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Original Article

Modifiable gaps in preventive medication use and exercise among patients with chronic migraine: A descriptive study from Eastern Taiwan

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Abstract

Objectives: This study investigated the clinical characteristics, lifestyle, and psychological factors of patients with chronic migraine in Eastern Taiwan, a region with limited healthcare accessibility and a distinct demographic profile. Preventive medication use and exercise participation were treated as modifiable factors for improving migraine management. **Materials and Methods:** This retrospective observational study was conducted at a tertiary medical center in Eastern Taiwan. The medical records of patients aged ≥18 years diagnosed with chronic migraine according to the International Classification of Headache Disorders, 3rd edition, between July 2023 and August 2024 were reviewed. Data on demographic characteristics, migraine features, preventive medication use, and regular exercise were collected. Disability, sleep quality, anxiety, depression, and cognitive function were assessed using the Migraine Disability Assessment (MIDAS), Pittsburgh Sleep Quality Index, Beck Anxiety Inventory, Beck Depression Inventory, and Mini-Mental State Examination. **Results:** This study included 50 patients (86% women; mean age, 43.60 ± 13.77 years), of which, only 24% received preventive medications. No significant sex differences in migraine severity, weekly exercise duration, psychological measures, or preventive medication use were observed. Overall, 66% of the patients did not engage in regular exercise. Additionally, 66% reported severe migraine-related disability (MIDAS ≥ 21), with high rates of comorbid anxiety and depression. **Conclusion:** Chronic migraine is associated with substantial physical and psychological burdens. The underutilization of preventive medications and low exercise participation are key modifiable gaps in care. Therefore, interdisciplinary collaboration that addresses optimizing preventive medication utilization, promoting regular exercise, and supporting mental health may help identify comprehensive strategies to improve patient care.

Keywords: *Chronic migraine, Epidemiological study, Exercise, Preventive medication*

Introduction

Migraine is a prevalent neurological disorder associated with a significant global health burden. According to the 2019 Global Burden of Disease study, migraine is the second-leading cause of disability worldwide, followed by low back pain [1]. Among women aged <50 years, migraine is the leading cause of disability [1]. Chronic migraine, the most debilitating form of migraine, affects approximately 2% of the global population, with a higher prevalence in women [2]. It is characterized by headaches occurring on ≥15 days per month for ≥3 months, with the presence of migraine features on ≥8 days monthly [3]. This condition significantly compromises an individual's quality of life while placing considerable strain on healthcare systems and broader societal resources [4]. Epidemiological studies have indicated an increasing prevalence of chronic migraine, particularly among younger adults and urban populations [5], highlighting its growing significance in public health contexts.

In Taiwan, studies by Tu *et al*. [6] and Yin *et al.* [7] have substantially contributed to the understanding of the epidemiology and comorbidities of chronic migraine, primarily focusing on Northern Taiwan. However, region-specific research from other parts of the country remains scarce, particularly in Eastern Taiwan, where demographic characteristics and healthcare accessibility differ markedly

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from those in the north. Eastern Taiwan is characterized by a predominantly mountainous terrain and a relatively high proportion of Aboriginal populations, predominantly residing in remote, mountainous areas [8]. Geographic isolation and challenging transportation conditions in these regions often hinder healthcare access [8,9]. Moreover, healthcare resources in Eastern Taiwan are relatively limited. The region is served by only one tertiary medical center, in comparison with 10 medical centers available in Northern Taiwan. Rural townships in Eastern Taiwan have an average of 6.89 physicians per 10,000 residents, which is substantially lower than the national average of 19.03 physicians per 10,000 residents [10]. Such disparities in healthcare availability may elevate mortality rates [9] and limit the diagnosis and management of chronic conditions, including chronic migraine. To address this gap, further investigation is necessary to better understand the clinical profile of patients with chronic migraine in this underserved area.

Regular exercise is beneficial for individuals with migraine. In particular, aerobic exercise remarkably improves migraine symptoms, often achieving superior outcomes compared with those of pharmacological treatments alone [11]. Moreover, exercise modulates neurobiological pathways, including the release of endogenous cannabinoids and brain-derived neurotrophic factor, contributing to pain reduction and inflammation control [12,13]. Furthermore, various exercise modalities, such as moderate to high-intensity aerobic exercise and yoga, are notably efficient in reducing migraine symptoms [14]. Despite the well-established benefits of exercise for migraine management, the actual participation of individuals with chronic migraine in exercise remains inadequately understood. Accordingly, this study examined the clinical characteristics, lifestyle, and psychological factors associated with chronic migraine in Eastern Taiwan. The study placed particular emphasis on preventive medication use and exercise participation because these factors represent potentially modifiable targets for improving chronic migraine care.

Materials and methods

Study design and ethical considerations

This retrospective observational study aimed to identify the clinical characteristics, lifestyle, and psychological factors of patients with chronic migraine. The study adhered to the ethical principles of the Declaration of Helsinki and was approved by the Research Ethics Committee of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (REC No.: IRB113-201-B). The requirement for informed consent was waived by the Institutional Review Board due to the retrospective nature of the study.

Study setting and population

The study was conducted at the headache clinic of Hualien Tzu Chi Hospital, a leading tertiary medical center in Eastern Taiwan. This headache clinic is a specialized outpatient service under the Department of Neurology dedicated to the diagnosis and management of headache disorders. It accepts patient referrals from other physicians and direct appointments from community residents. The clinic serves approximately 200 patients per month, providing comprehensive headache care by a team of experienced healthcare professionals. The study involved a detailed examination of electronic medical records spanning from July 1, 2023, to August 31, 2024. The eligibility criteria were as follows: chronic migraine diagnosis according to the International Classification of Headache Disorders, 3rd edition (ICHD-3) [3], confirmed by a board-certified headache specialist, and an age of ≥18 years. The exclusion criteria were as follows: incomplete medical records, recent trauma or surgery within the last 3 months, severe neurological or psychiatric disorders diagnosed by a healthcare provider, and pregnancy or breastfeeding. The initial sample of 65 patients was reduced to 56 after excluding nine patients with incomplete medical records. Of the remaining 56 eligible participants who met all predefined inclusion criteria, only the first 50 patients (based on the order of data extraction) were included in the final analysis, in accordance with the IRB-approved sample size.

Clinical assessment and data collection

The demographic variables collected included age, sex, regular exercise, weekly exercise duration, and use of preventive medications. Clinical data comprised migraine type (without/with aura), monthly headache days (MHD), and pain severity, measured using a numerical rating scale (NRS) [15]. A neurologist with subspecialty training in headache medicine then performed a clinical evaluation and established a migraine diagnosis based on the International Classification of Headache Disorders, 3rd edition (ICHD-3).

For patients diagnosed with chronic migraine, additional standardized questionnaires were administered, including evaluations of migraine-related disability levels, psychological symptoms, sleep quality, and cognitive function. These assessments were performed by a licensed clinical psychologist.

All clinical data, including migraine history, medication records, and lifestyle factors, were systematically documented by the neurologist with subspecialty training in headache medicine, ensuring consistency and reliability in data collection.

Assessment tools and measurements

The Migraine Disability Assessment (MIDAS) questionnaire was used to measure migraine-related disability over the past 3 months [16]. This validated five-question tool is used to assess the impact on daily functioning, with scores categorized as follows: 0–5 = minimal to no disability; 6–10 = mild disability; 11–20 = moderate disability; and ≥21 = severe disability.

Regular exercise, including type and weekly exercise duration, was recorded using medical records. Herein, regular exercise was defined as engaging in any form of planned, structured physical activity (e.g., walking, jogging, swimming, yoga, or resistance training) at least three times per week, regardless of duration or intensity. This definition is consistent with broad public health guidelines, thereby including various forms of exercise suited to individual capabilities [17]. When

diagnosing chronic migraine during the initial consultation, physicians routinely inquired about the patient's exercise habits, including whether they engage in regular exercise, the types of exercises performed, the frequency of exercise per week, and the duration of each session. Based on the type of primary exercise performed by the patient, the exercise classification included aerobic, resistance, flexibility, and neuromotor exercises [17].

Sleep quality was measured using the Chinese version of the Pittsburgh Sleep Quality Index (PSQI) [18]. This validated tool is used to assess seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each domain is scored from 0 to 3, with the total PSQI score ranging from 0 to 21, with higher scores indicating poorer sleep quality.

Psychological assessments were performed using two validated tools. The Beck Anxiety Inventory (BAI), a 21-item self-report questionnaire, is used to measure anxiety severity with scores ranging from 0 to 63, categorized as follows: 0–7 = minimal; 8–15 = mild; 16–25 = moderate; and ≥26 = severe [19]. Clinically significant anxiety symptoms are indicated by a BAI score of ≥16. The Beck Depression Inventory (BDI), also a 21-item instrument, evaluates depressive symptoms, with score ranges defined as follows: 0–13 = minimal; 14–19 = mild; 20–28 = moderate; and ≥29 = severe [20]. BDI scores ≥20 indicate clinically relevant depressive symptoms.

Cognitive function was evaluated using the Mini-Mental State Examination (MMSE) [21], a widely validated tool that is used to measure five cognitive domains: orientation, registration, attention and calculation, recall, and language. The total score ranges from 0 to 30, with higher scores indicating better cognitive performance. Although scores ≤23 often indicate cognitive impairment, this study used age- and education-adjusted cutoff values to identify objective cognitive impairment.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (version 25; IBM Corp., Armonk, NY, USA). P <0.05 was used to indicate statistical significance for all tests. Data normality was assessed using the Kolmogorov–Smirnov test, in which $P > 0.05$ indicated a normal distribution [22]. Variables in this study were classified as follows: continuous variables included age, MHD, pain severity (NRS), migraine disability (MIDAS score), weekly exercise duration, anxiety symptoms (BAI score), depression symptoms (BDI score), and sleep quality (PSQI score). Furthermore, dichotomous variables included sex (female/male), migraine type (without aura/with aura), preventive medication use (yes/no), and regular exercise (yes/no). Continuous data were expressed as means ± standard deviations, whereas categorical data were reported as frequencies and percentages. The independent t-test or Wilcoxon rank-sum test was performed to compare the outcome variables between the female and male groups. The Chi-square or Fisher's exact test was used to evaluate the association between the two categorical variables.

Use of artificial intelligence-assisted tools

A generative artificial intelligence (AI) tool (ChatGPT-4, OpenAI) was used to improve the fluency and clarity of the manuscript, focusing on grammar, spelling, and sentence structure. All AI-assisted contents were critically reviewed, edited, and approved, and we take full responsibility for the accuracy, originality, and integrity of the manuscript.

Results

Baseline clinical characteristics, lifestyle, and psychological factors

This study included 50 patients diagnosed with chronic migraine, comprising 43 women (86%) and 7 men (14%). Table 1 presents the baseline characteristics of the patients. Most patients (94.0%) experienced migraine without aura, whereas only a small proportion (6%) had migraine with aura. All male participants experienced migraine without aura. Of 50 patients, 26 (52%) had sought medical help for migraine before visiting our clinic. Among them, 12 (24%) were currently using preventive medication during their first visit. Of 50 patients, 17 (34%) experienced medication overuse.

No significant sex differences were found across clinical variables, including age (42.48 ± 13.47), MHD (23.08 ± 6.77), MIDAS (56.76 ± 57.74), pain intensity (NRS: 6.16 ± 1.95), use of preventive medications (24%), anxiety symptoms (BAI: 17.82 ± 12.85), depressive symptoms (BDI: 19.22 ± 13.75), sleep quality (PSQI: 11.86 ± 5.50), cognitive performance (MMSE: 27.56 ± 2.82), and objective cognitive impairment (12%).

The median weekly exercise duration was 0.0 min (interquartile range: 0.0–60.0) and 120.0 min (0.0–480.0) for women and men, respectively (P = 0.074); no statistically significant difference was observed between the sexes. Concerning regular exercise participation, 30.2% of women and 57.1% of men engaged in regular exercise; however, this difference did not reach statistical significance (P = 0.210).

Types of exercise in patients with chronic migraine

Most patients (66.0%, n = 33) did not engage in regular exercise [Figure 1]. The prevalence of no regular exercise was slightly higher among women (69.8%, n = 30) than among men (42.9%, n = 3). Among those who reported engaging in regular exercise, aerobic exercise was the most common type, practiced by 22.0% of the cohort (n = 11). Participation in neuromotor exercise was reported by only 8% of the patients (n = 4). Resistance training and flexibility exercises were the least reported. Only one male patient (2%) participated in resistance training, and one female patient (2%) participated in flexibility exercises.

Proportional distribution of key variables

The distribution of migraine-related disability, as measured using the MIDAS scale, exhibited a clear skew toward higher severity levels [Figure 2]. Most patients (66%) experienced severe disability (MIDAS ≥21), whereas only 16% reported moderate disability. Mild (MIDAS 6–10) and minimal or no

Table 1: Demographic and clinical characteristics of patients with chronic migraine (*n*=50)

Item	Female	Male	Total	*P*
n	43	7	50	
Age (years)	43.60±13.77	35.57±9.43	42.48±13.47	0.145
Migraine type				
Without aura	40 (93.0)	7 (100.0)	47 (94.0)	1.000
With aura	3 (7.0)	0	3 (6.0)	
MHD	23.09±6.84	23.00±6.81	23.08±6.77	0.974
NRS	6.33±1.91	5.14±2.04	6.16±1.95	0.139
MIDAS	55.81±57.46	62.57±63.84	56.76±57.74	0.777
MIDAS group (%)				
Minimal to no disability (0~5)	6 (14.0)	1 (14.3)	7 (14.0)	1.000
Mild disability (6~10)	2 (4.7)	0	2 (4.0)	
Moderate disability (11~20)	7 (16.3)	1 (14.3)	8 (16.0)	
Severe disability (≥21)	28 (65.1)	5 (71.4)	33 (66.0)	
Preventive medication use (%)	10 (23.3)	2 (28.6)	12 (24.0)	1.000
Type of exercise				
No regular exercise	30 (69.8)	3 (42.9)	33 (66.0)	0.151
Aerobic exercise	9 (20.9)	2 (28.6)	11 (22.0)	
Resistance exercise	0	1 (14.3)	1 (2.0)	
Flexibility exercise	1 (2.3)	0	1 (2.0)	
Neuromotor exercise	3 (7.0)	1 (14.3)	4 (8.0)	
Regular exercise (%)	13 (30.2)	4 (57.1)	17 (34.0)	0.210
Weekly exercise duration (min)	0.0 (0.0–60.0)	120.0 (0.0–480.0)	0.0 (0.0–97.5)	0.074
PSQI	11.40±5.24	14.71±6.60	11.86±5.50	0.140
BAI	17.91±13.20	17.29±11.35	17.82±12.85	0.907
BAI group (%)				
0–7 (minimal)	12 (27.9)	2 (28.6)	14 (28.0)	0.945
8–15 (mild)	11 (25.6)	1 (14.3)	12 (24.0)	
16–25 (moderate)	8 (18.6)	2 (28.6)	10 (20.0)	
≥26 (severe)	12 (27.9)	2 (28.6)	14 (28.0)	
BDI	19.44±14.3	17.86±10.53	19.22±13.75	0.781
BDI group (%)				
0–13 (minimal)	18 (41.9)	3 (42.9)	21 (42.0)	1.000
14–19 (mild)	9 (20.9)	1 (14.3)	10 (20.0)	
20–28 (moderate)	5 (11.6)	1 (14.3)	6 (12.0)	
≥29 (severe)	11 (25.6)	2 (28.6)	13 (26.0)	
MMSE	27.42±2.99	28.43±1.13	27.56±2.82	0.385
Objective cognitive impairment (MMSE<cut-off)	6 (14.0)	0	6 (12.0)	0.576

P<0.05 was considered statistically significant after test. Data are presented as n and percentage or mean±SD or median (Q1–Q3). MHD: Monthly Headache Day, NRS: Numerical Rating Scale, MIDAS: Migraine Disability Assessment Scale, PSQI: Beck Pittsburgh Sleep Quality Index, BAI: Beck Anxiety Inventory, BDI: Beck Depression Inventory, MMSE: Mini-Mental State Examination, SD: Standard Deviation

disability (MIDAS 0–5) were comparatively rare, observed in 4% and 14% of the patients, respectively.

Anxiety symptoms, assessed using the BAI, were broadly distributed across the severity levels among the patients [Figure 3]. Severe anxiety (BAI ≥26) and minimal anxiety (BAI 0–7) were the most prevalent, each affecting 28% of the patients. Mild anxiety (BAI 8–15) accounted for 24%, whereas moderate anxiety (BAI 16–25) was the least frequent, reported by 20% of the patients.

The depressive symptoms, evaluated using the BDI, also exhibited considerable variation among the patients [Figure 4]. Minimal depression (BDI 0–13) was observed in 42% of the patients, whereas severe depression (BDI ≥29) was observed in 26%. Mild depressive symptoms (BDI 14-19) were reported by 20% of the patients, and moderate depression (BDI 20–28) was the least common, observed in 12% of the patients.

Discussion

This study investigated the clinical characteristics, lifestyle, and psychological factors of patients with chronic migraine in Eastern Taiwan, offering valuable insights into the management of this condition.

The demographic characteristics of the cohort provided meaningful insights into sex-specific patterns of chronic migraine. The predominance of female patients is consistent with well-established epidemiological trends [2], potentially reflecting the influence of hormonal fluctuations and sex-based differences in nociceptive processing [23]. The mean age of the participants mirrored the typical age distribution reported in previous studies on migraine. The average MIDAS score (56.76 ± 57.74) indicated a substantial degree of migraine-related disability, with no significant sex-based differences observed. In contrast, the rate of preventive

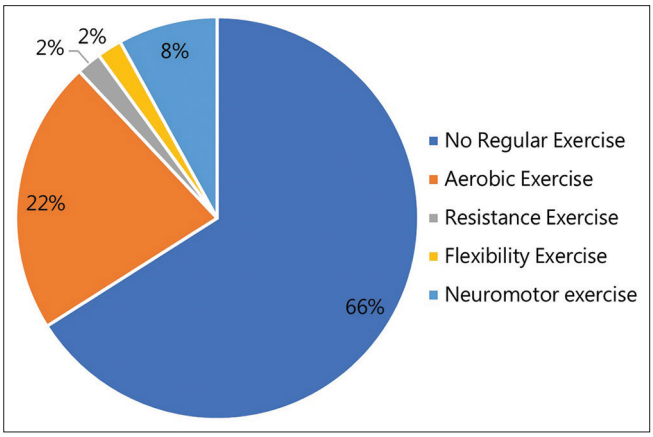

Figure 1: Distribution of exercise types among patients with chronic migraine. Most patients (66%) reported no regular exercise. Among those who exercised, aerobic exercise was the most common (22%), followed by neuromotor (8%), resistance (2%), and flexibility (2%) exercises. Data were obtained from retrospective medical records (n = 50)

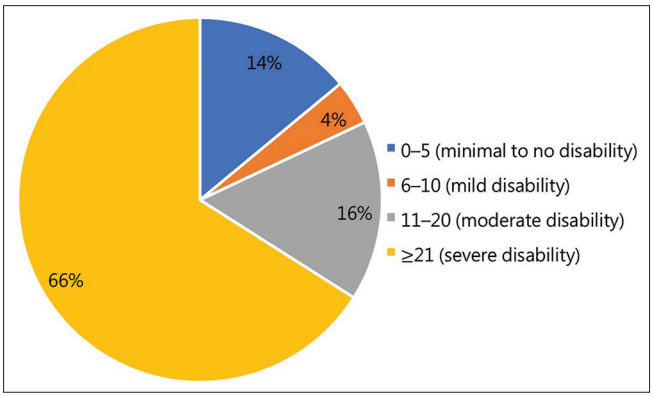

Figure 2: Distribution of Migraine Disability Assessment (MIDAS) scores among patients with chronic migraine. Most patients (66%) had a MIDAS score of ≥21, indicating severe disability. Moderate disability (scores 11–20) was observed in 16% of the patients, minimal to no disability (score 0–5) in 14% of the patients, and mild disability (score 6–10) in 4% of the patients. Data were obtained from retrospective medical records (n = 50)

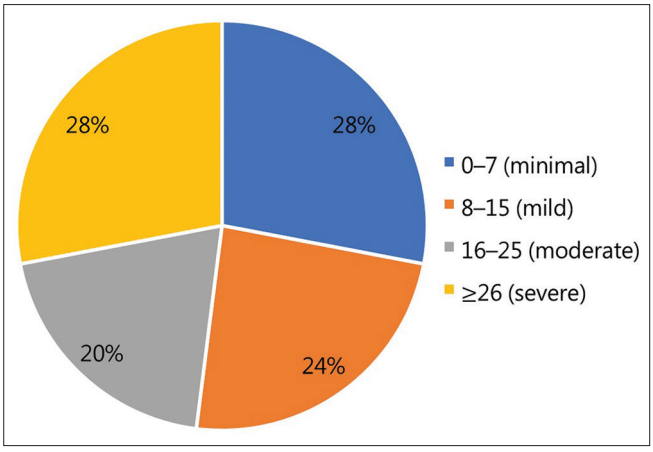

Figure 3: Distribution of Beck Anxiety Inventory (BAI) scores among patients with chronic migraine. BAI scores indicated minimal anxiety (scores 0–7) in 28% of the patients, mild anxiety (scores 8–15) in 24% of the patients, moderate anxiety (score 16–25) in 20% of the patients, and severe anxiety (score ≥26) in 28% of the patients. Data were obtained from retrospective medical records (n = 50)

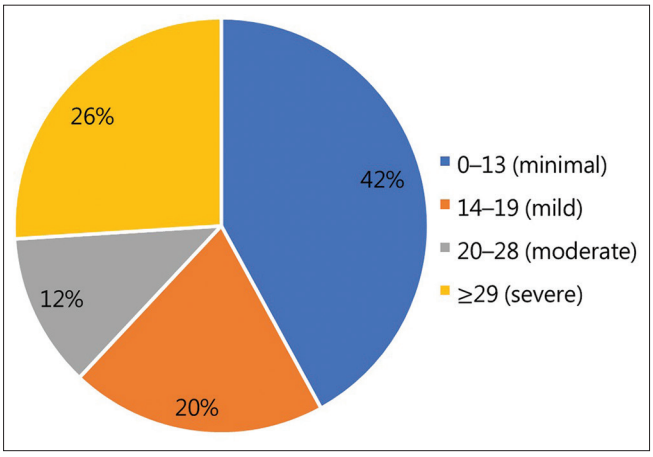

Figure 4: Distribution of Beck Depression Inventory (BDI) scores among patients with chronic migraine. Among the patients, 42% had minimal depressive symptoms (scores 0–13), 20% had mild symptoms (scores 14–19), 12% had moderate symptoms (scores 20–28), and 26% had severe depressive symptoms (scores ≥29). Data were obtained from retrospective medical records (n = 50)

medication use at diagnosis (24%) was significantly lower than international benchmarks [24,25], raising concerns regarding potential underutilization in clinical practice. The comparable severity of psychological symptoms between sexes contradicts that observed in previous studies that suggested higher rates of anxiety and depression in female patients with migraine [7]. This discrepancy may reflect our focus on patients with chronic migraine or cultural factors unique to the Asian population.

Sleep disturbances were highly prevalent in the cohort, consistent with previous studies highlighting the strong association between poor sleep quality and chronic migraine [26]. Similarly, elevated levels of anxiety and depression were observed, highlighting the need for a multidisciplinary approach that concurrently addresses the neurological and psychological components of migraine. Although subjective cognitive complaints are frequently reported in patients with migraine [27], no significant objective cognitive impairment was identified in this study. Nonetheless, considering the limited sensitivity of the MMSE, subtle or domain-specific cognitive deficits may have been undetected, supporting the need for further evaluation using more sensitive neuropsychological instruments.

Underutilization of preventive medications

Although preventive medications are essential for avoiding migraine chronification [28], our study found a surprisingly low rate of preventive medication use among patients with chronic migraine at a tertiary medical center. Therefore, many patients may have undergone multiple consultations at primary care clinics and regional hospitals without receiving or adhering to preventive medications. This phenomenon highlights the significant underutilization of preventive medications in Eastern Taiwan, which is consistent with that observed in previous studies conducted in other countries [29]. Reportedly, only 24% of patients with chronic migraine in our study were using preventive medications. This proportion is slightly lower than the 28.6% reported in a recent

population-based study in Taiwan [30]. This discrepancy may be attributable to differences in study settings and patient populations. Our study was conducted at a tertiary headache clinic in Eastern Taiwan, where patients may have different healthcare-seeking behaviors, lower awareness of preventive treatments, or limited access to healthcare services than the general population. Common barriers included limited migraine awareness, a preventive treatment gap among both physicians and patients [31,32], and concerns regarding the side effects of preventive medications [33].

Considering the strong evidence supporting the efficacy of preventive medications in reducing migraine frequency and severity [34], the use of these medications should be promoted at both the physician and patient levels. Physician education programs should emphasize guideline-based prescription practices, and patient education campaigns should address misconceptions and improve adherence strategies.

Low exercise participation

Our findings suggest limited engagement in exercise among individuals with migraine [Figure 1], highlighting a potential area for targeted intervention or patient education. The proportion of patients with chronic migraine engaging in regular exercise was lower than previously reported rates in the general Taiwanese population within the same age group [35]; however, this difference was based on separate studies and did not involve a direct statistical comparison. The low exercise participation observed among patients with chronic migraine in this study may be attributed to several factors. First, fear of exercise-induced migraine is common. Notably, exercise can trigger migraine attacks in susceptible individuals [13], leading many patients to avoid exercise as a preventive strategy. Second, a lack of awareness of the benefits of exercise for migraine management may also contribute to the observed phenomenon. This finding is concerning because accumulating evidence supports the efficacy of aerobic exercise in reducing migraine frequency, attack duration, and pain intensity by modulating both central and peripheral pain pathways and mitigating stress-related triggers [36].

Considering the well-established benefits of exercise, encouraging regular exercise among individuals with chronic migraine is imperative. Future research should investigate the specific barriers to exercise participation in this population, ideally employing validated instruments, such as the Exercise Benefits/Barriers Scale and Self-Efficacy for Exercise Scale, to guide targeted interventions.

Our findings have several implications for clinical practice. First, improving the use of preventive medications is crucial for managing chronic migraine. Enhancing physician adherence to guideline-based prescribing and implementing patient support programs may help optimize treatment outcomes. Second, promoting exercise among patients with chronic migraine necessitates identifying and addressing participation barriers and integrating personalized exercise recommendations into routine care. Finally, comprehensive migraine management should include sleep and mental health assessments. Considering the high prevalence of poor sleep quality and psychiatric comorbidities in this population, incorporating behavioral therapies and sleep hygiene education may enhance overall patient well-being. In conclusion, these findings support a multidisciplinary care model that emphasizes individualized integrative strategies across physical, psychological, and lifestyle domains.

This study has several strengths, including the use of validated assessment tools and comprehensive analyses of clinical, lifestyle, and psychological factors. Our study adds to the scarce literature on chronic migraine among Asian populations, particularly focusing on Eastern Taiwan. Despite these strengths, this study also has limitations that should be considered. This retrospective study relied on preexisting medical records, which may not have captured all relevant lifestyle factors. Furthermore, considering that this was a single-center study in a tertiary care setting, the findings may not be generalizable to broader populations. In the future, prospective multicenter studies with detailed evaluations of lifestyle, psychological, and demographic factors influencing migraine outcomes are warranted.

Conclusion

Chronic migraine is a highly disabling condition that significantly impairs patients' quality of life and reduces societal productivity. The high prevalence of comorbidities highlights the need for a comprehensive management strategy that incorporates lifestyle modifications, psychological assessments, and personalized treatment plans. Our findings highlight two key areas of unmet need in chronic migraine care, including the underutilization of migraine preventive medications and insufficient engagement in regular exercise. Addressing these gaps through targeted interventions, such as optimizing the use of preventive medications, promoting regular exercise, and managing sleep and mental health comorbidities, may help develop comprehensive strategies to improve patient care for individuals with chronic migraine.

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Data availability statement

The datasets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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