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Evaluating the effectiveness of pharmacological interventions versus cognitive behavioral therapy in the treatment of chronic migraine headaches among young adults: a quasi-experimental study

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ABSTRACT

Background:
Chronic migraine is a disabling neurological condition that affects young adults and disrupts daily functioning, academic performance, productivity, social interactions, and quality of life. Pharmacological therapies are used for prevention and management, while cognitive behavioral therapy offers a structured nonpharmacological approach. Comparative evidence evaluating these interventions in adults remains limited.

Objective:
This study aimed to compare the effectiveness of pharmacological therapy and cognitive behavioral therapy in reducing migraine frequency, pain intensity, and migraine related disability among adults with chronic migraine.

Methodology:
A quasi experimental study was conducted among fifty adults diagnosed with chronic migraine who were assigned to either pharmacological treatment or a structured cognitive behavioral therapy program. Outcomes included migraine frequency, pain intensity measured using the Visual Analog Scale, and disability assessed through the Migraine Disability Assessment questionnaire at baseline, eight weeks, and three months follow up. Both groups improved after eight weeks; however, the cognitive behavioral therapy group demonstrated greater reductions in migraine days, pain severity, and disability scores, with sustained benefits over time.

Results:
Both groups showed improvement after intervention, but cognitive behavioral therapy resulted in significantly greater reductions in migraine frequency, pain intensity, and disability scores ($p \leq 0.003$). At three months, the pharmacological group showed partial relapse, whereas improvements in the cognitive behavioral therapy group were maintained or further enhanced ($p < 0.001$).

Conclusion:
Cognitive behavioral therapy provides more durable benefits than pharmacological therapy and may be considered an effective alternative or adjunct, highlighting the importance of non-pharmacological strategies in chronic migraine management**.**

Keywords: Chronic Migraine, Cognitive Behavioral Therapy, Pharmacological Treatment, Young Adult, Treatment Effectiveness

Introduction:
Migraine is a highly common neurological condition worldwide and can be particularly debilitating for adolescents and young adults, as it affects them during key periods of academic growth, career development, and social engagement. The disorder is characterized by recurrent headache episodes, often accompanied by nausea, photophobia, and phonophobia, which can severely impact daily functioning, academic performance, work productivity, and overall quality of life. Chronic migraine, generally defined as experiencing headaches on 15 or more days per month, imposes an even greater burden, disrupting daily routines, increasing healthcare utilization, and contributing to psychological distress (1,2).Recent evidence from South Asia indicates that migraine is highly prevalent among medical students, early-career healthcare professionals, and young adults facing academic and professional pressures (1,2). Research from Pakistan indicates that many young individuals with migraine also face depression and other emotional challenges, highlighting a close connection between neurological conditions and psychological well-being (3). Emotional strain and stress can exacerbate migraine attacks and influence adherence to pharmacological treatment, highlighting the need for interventions that address both physiological and psychological dimensions of the disorder.

Pharmacologic therapies remain the cornerstone of chronic migraine management. Antiepileptic drugs such as topiramate have been widely used for prophylaxis, demonstrating efficacy in reducing headache frequency and severity across diverse populations, including

Pakistani cohorts (4,5). Novel agents, including lacosamide, have also been explored as alternatives to conventional prophylactic medications. While pharmacological therapies can provide meaningful reductions in headache burden, individual response and tolerability vary, and sustained long-term benefits are not consistently observed for all patients (5,6).

Non-drug treatments, especially cognitive behavioral therapy (CBT), are gaining growing recognition as valuable options in the management of migraine's targets maladaptive emotional, cognitive, and behavioral patterns that can intensify pain and perpetuate chronicity. Neuroimaging studies suggest that CBT may modify brain connectivity and activity in regions involved in pain perception and emotional regulation (7). Systematic reviews and clinical trials indicate that CBT not only reduces headache frequency and migraine-related disability but also improves coping strategies, psychological well-being, and functional outcomes in young adults (8–10).

Although both pharmacological therapy and cognitive behavioral therapy (CBT) are recognized as effective approaches for managing chronic migraine, direct comparisons between these treatments in young adults remain limited. This age group faces distinct challenges, including demanding academic schedules, evolving professional responsibilities, irregular routines, and heightened emotional stress, all of which can influence migraine patterns and treatment response. As a result, findings from broader adult populations may not fully apply to younger individuals. There is a clear need to investigate how these interventions perform specifically within this group to better understand their relative effectiveness under real-life conditions.

The rationale for this research lies in identifying the most appropriate and sustainable treatment strategy for young adults with chronic migraine. Comparing pharmacological and CBT-based approaches can provide valuable insights into their short-term benefits and long-term outcomes, helping clinicians make informed, patient-centered decisions. Furthermore, exploring whether a combination or sequence of these therapies yields improved results may guide more comprehensive management plans. Generating such evidence is essential for optimizing care, reducing disease burden, and enhancing overall quality of life in this population.

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Objectives:

The main aim of this study is to evaluate and compare the lasting effects of Cognitive Behavioral Therapy (CBT) versus medication-based treatment in young adults with chronic migraine, aiming to determine whether CBT offers more enduring relief and a longer-term decrease in headache frequency and intensity than pharmacological interventions.

Study design and methodology:

Following approval from the Institutional Review Board, a quasi-experimental study was conducted at a private hospital in Karachi over a six-month period, from January 2025 to June 2025. The study was designed to assess and compare the effectiveness of pharmacological treatment and cognitive behavioral therapy (CBT) in managing chronic migraines in young adults. A total of 50 participants between 18 and 40 years of age were included, all of whom met the International Classification of Headache Disorders (ICHD) criteria for chronic migraine and had been experiencing symptoms for a minimum of six months. There were no restrictions based on gender. Participants were recruited using consecutive purposive sampling and then randomly allocated into two equal groups of 25 through a lottery method to ensure unbiased distribution.

Group 1 (Pharmacological Therapy) received standard preventive migraine medications as prescribed by the treating clinician, including topiramate or other approved prophylactic agents. Group 2 (CBT Group) participated in structured CBT sessions targeting migraine-related pain, stress, and maladaptive behaviors that could aggravate headache frequency or intensity. The CBT program included relaxation training, stress management strategies, cognitive restructuring, and coping skill development, delivered over multiple sessions by trained therapists.

Inclusion criteria comprised young adults aged 18–40 years with chronic migraine, willingness to participate in either pharmacological treatment or CBT, and the ability to provide informed consent. Participants were excluded if they had other primary headache disorders (e.g., cluster headache), active major psychiatric conditions or cognitive impairments, were unwilling to comply with treatment and follow-up schedules, or were pregnant or lactating.

This design allowed a controlled comparison of pharmacological and behavioral interventions in a real-world clinical setting while minimizing allocation bias and ensuring safety and ethical compliance.

Data collection and outcomes:

Written informed consent was obtained from all participants prior to data collection. Baseline information included demographic details, frequency of migraine episodes, and headache intensity assessed on a 0–10 Visual Analog Scale (VAS). Functional impairment was evaluated using the Migraine Disability Assessment (MIDAS) questionnaire. Participants were then randomly assigned to either the pharmacological therapy group or the CBT group using a lottery method, ensuring unbiased allocation. While the nature of the interventions prevented participant blinding, outcome assessors were blinded to group assignments to reduce measurement bias.

Follow-up assessments were conducted at the end of the 8-week intervention and again at three months post-intervention to evaluate both immediate and sustained treatment effects. The primary outcome measures included reduction in migraine frequency and headache intensity, while secondary outcomes comprised improvements in functional ability, disability scores, and overall quality of life.
This structured design allowed a rigorous comparison of pharmacological and CBT interventions, capturing both short-term and longer-term outcomes. By incorporating random allocation, blinded outcome assessment, and informed consent, the study ensured methodological rigor, ethical compliance, and practical relevance in a real-world clinical setting.

Statistical evaluation:
Data will be analyzed using SPSS version 26, with continuous variables presented as mean ± standard deviation and categorical variables as frequencies and percentages. Paired t-tests were applied to assess changes within each group in migraine frequency, pain intensity, and disability scores between baseline, post-intervention, and the three-month follow-up.
Independent t-tests will compare outcomes between the CBT and pharmacological groups, assessing which intervention provides greater improvements. Additionally, repeated measures ANOVA will examine interaction effects between treatment type and time to determine sustained differences in outcomes. A p-value < 0.05 will be considered statistically significant. This approach allows a clear assessment of both short-term and long-term effectiveness of CBT compared to medication in young adults with chronic migraines.

Results:
A total of 50 young adults with chronic tension-type headaches were included, with 25 participants in the pharmacological therapy group and 25 in the CBT group. Baseline comparisons showed no statistically significant differences between the groups in terms of age, gender distribution, migraine duration, headache frequency, pain intensity, or disability levels (all p > 0.05). This indicates that both groups were comparable prior to intervention. Table 1 shows the Basic demographics of the participants (n=50)

At the 8-week follow-up, both groups demonstrated improvement across all clinical measures; however, the CBT group showed significantly greater reductions. Mean migraine frequency decreased from 19.1 ± 3.1 to 9.8 ± 2.6 days/month in the CBT group, compared with a reduction from 18.7 ± 2.9 to 12.4 ± 3.2 days/month in the pharmacological group (p = 0.003). Similarly, headache intensity (VAS) decreased more markedly in the CBT group (7.5 ± 1.2 to 3.8 ± 1.2) compared with the pharmacological group (7.6 ± 1.1 to 5.1 ± 1.4) (p = 0.001). Functional disability measured by the MIDAS score also showed superior improvement with CBT. Participants in the CBT group demonstrated a reduction of 21.0 points, compared with 13.3 points in the pharmacological group (p = 0.002). Table 2 shows the Clinical outcomes of the participants at 8 week and 3 months follow up.

The differences between the two interventions widened at the 3-month follow-up. Although the pharmacological group exhibited partial relapses across all outcomes, the CBT group showed either continued improvement or maintenance of 8-week gains. Migraine frequency increased again in the pharmacological group (12.4 ± 3.2 to 14.6 ± 3.5), while the CBT group showed a further reduction (9.8 ± 2.6 to 8.7 ± 2.3) (p < 0.001). Headache intensity demonstrated a similar trend, with a slight relapse in the pharmacological arm but continued improvement in the CBT group (p < 0.001). MIDAS scores also increased in the pharmacological group but continued to decline in the CBT group (p < 0.001).

Repeated measures ANOVA confirmed significant main effects of time (p < 0.001) and treatment group (p = 0.001–0.004) for all outcomes. Moreover, a significant time × group interaction was observed for migraine frequency, headache intensity, and MIDAS disability scores (all p < 0.001), indicating that the CBT group not only improved more rapidly but also maintained or enhanced improvements over time.

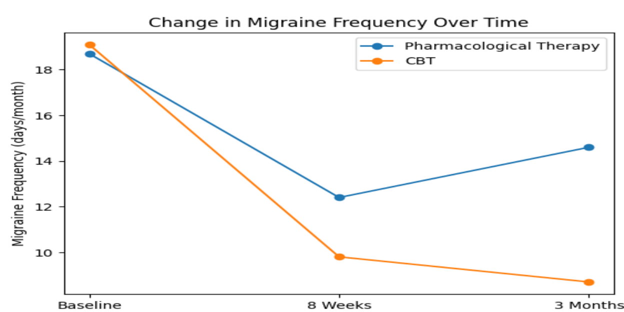
Table 1. Baseline Demographics of Participants (n = 50)

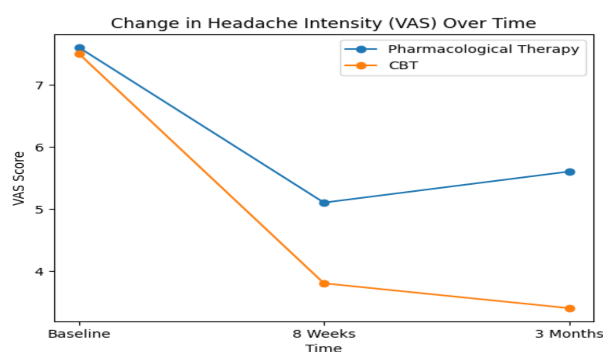
Variable/ Outcome	Pharmacological therapy (n=25)	Cognitive behavioral therapy (n=25)	p-value (between groups
Baseline Demographics			
Age (years), mean ± SD	27.8 ± 4.5	28.1 ± 4.2	0.72
Gender (M/F), n	13 / 12	12 / 13	0.78
Migraine duration (months), mean ± SD	18.3 ± 6.2	18.3 ± 6.2	0.81

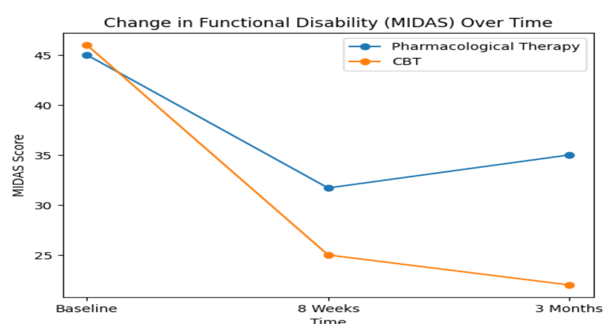
Table 2. Clinical Outcomes of the Participants

Variable/ Outcome	Pharmacological therapy (n=25)	Cognitive behavioral therapy (n=25)	p-value (between groups
Clinical Baseline Measures			
Migraine frequency (days/month), mean ± SD	18.7 ± 2.9	19.1 ± 3.1	0.64
Pain intensity (VAS 0–10), mean ± SD	7.6 ± 1.1	7.5 ± 1.2	0.81
MIDAS score, mean ± SD	45.0 ± 8.2	46.0 ± 7.8	0.73
8 Week Follow Up			

Migraine frequency (days/month), mean ± SD	12.4 ± 3.2	9.8 ± 2.6	0.003
Pain intensity (VAS 0–10), mean ± SD	5.1 ± 1.4	3.8 ± 1.2	0.001
MIDAS score, mean ± SD	31.7 ± 7.9	25.0 ± 6.9	0.002
3 Month Follow Up			
Migraine frequency (days/month), mean ± SD	14.6 ± 3.5	8.7 ± 2.3	<0.001
Pain intensity (VAS 0–10), mean ± SD	5.6 ± 1.3	3.4 ± 1.1	<0.001
MIDAS score, mean ± SD	35.0 ± 8.5	22.0 ± 6.4	<0.001







The results of this study indicate that both pharmacological treatment and cognitive behavioral therapy (CBT) help reduce headache frequency, lessen pain severity, and improve migraine-related disability in young adults with chronic migraine. Pharmacological treatment showed noticeable improvement during the early phase of intervention, highlighting its role in short-term symptom relief. However, these improvements were not consistently sustained, as some participants experienced a degree of relapse at follow-up, suggesting limitations in long-term effectiveness when used alone.

In comparison, the CBT group exhibited more substantial and sustained improvements across all measured outcomes. Participants receiving CBT not only showed greater reductions in migraine frequency and pain severity at the end of the intervention period but also maintained or further improved these outcomes at the three-month follow-up. This pattern indicates that CBT may provide longer-lasting benefits by equipping individuals with practical skills such as stress management, cognitive restructuring, and adaptive coping strategies, which continue to be utilized beyond the treatment phase.

These results highlight the importance of addressing psychological and behavioral contributors to migraine. Factors such as stress, emotional dysregulation, and maladaptive coping can exacerbate migraine symptoms, and CBT directly targets these underlying mechanisms. Therefore, CBT appears to offer a durable therapeutic advantage and can be considered either as a standalone treatment or as a complementary approach alongside pharmacological therapy, supporting a more comprehensive and individualized strategy for managing chronic migraines in young adults.

Discussion:

Chronic migraine in young adults presents a complex clinical challenge, as effective management requires addressing both physical symptoms and psychological factors. Drugs like topiramate, lacosamide, and other preventive medications are frequently used to decrease how often migraine attacks occur and to reduce their severity. Research by Ahmed et al. indicates that topiramate effectively lowers the number of migraine days and improves patients' daily functioning (1). Similarly, Butt et al. reported that both lacosamide and topiramate are effective in decreasing headache frequency, although treatment-related side effects can affect patient adherence over time (2). Additional studies from Pakistan have confirmed the benefits of pharmacological therapy while highlighting that individual response may vary due to demographic differences and coexisting psychological conditions (3–6).

Despite their effectiveness in symptom reduction, medications alone often fail to fully address the cognitive and emotional aspects of chronic migraine. Cognitive Behavioral Therapy (CBT) has become an important nonpharmacological method that addresses these aspects. Nahman-Averbuch et al. demonstrated that CBT can alter brain function in adolescents, suggesting improvements in both clinical symptoms and underlying neurophysiological mechanisms (7). Systematic reviews and randomized trials consistently show that CBT reduces headache frequency, intensity, and associated disability [8–10]. Transdiagnostic CBT interventions, which address a range of psychological stressors, have been

shown to enhance coping strategies and mitigate migraine-related distress, supporting its role as a comprehensive treatment option (10).

Psychological comorbidities, including depression and anxiety, significantly influence migraine severity and chronicity. Studies conducted by Azhar et al. and Ahmed et al. report high rates of depressive symptoms among individuals with migraine, which can limit the effectiveness of pharmacological therapy if not simultaneously addressed (11,12). CBT directly targets these psychological factors through cognitive restructuring, stress management, and relaxation techniques, resulting in improved functional outcomes and quality of life (13,14). Powers et al. found that behavioral interventions in pediatric populations led to lasting reductions in headache frequency and disability, suggesting similar benefits can be expected in young adult populations (15).

Combining pharmacological treatment with CBT may provide synergistic advantages. Evidence from

Jamali et al. and Mínguez-Olaondo et al. indicates that addressing both the neurochemical and behavioral aspects of migraine produces superior control of symptoms, reduces disability, and enhances overall patient well-being (16,17). Additionally, CBT may help decrease reliance on medications and reduce the likelihood of adverse effects, supporting better long-term adherence and patient satisfaction compared with pharmacological therapy alone.

While medications can offer rapid relief, CBT tends to provide more sustained benefits by targeting the multidimensional nature of chronic migraine. Behavioral therapy not only decreases headache frequency and severity but also improves emotional regulation, coping strategies, and functional outcomes (7–10,17). Regional studies from Pakistan and India reinforce the value of individualized, patient-centered approaches that integrate CBT with conventional drug therapy (11,16,18–22).

Emerging evidence suggests that pharmacological therapy alone may be insufficient for achieving long-term improvements in psychosocial functioning, which is particularly important for young adults who face academic, occupational, and social stressors (7–10,17). Overall, CBT either as a stand-alone treatment or combined with medication appears to provide slightly superior and longer-lasting outcomes. These findings support its integration into standard treatment protocols for chronic migraine, offering a holistic strategy that addresses both the physiological and psychological dimensions of the disorder (23–25).

Conclusion:

Both pharmacological treatment and cognitive behavioral therapy (CBT) are effective in managing chronic migraine in young adults; however, CBT tends to provide better long-term outcomes by addressing psychological and behavioral contributors to the condition. A combined approach using both medication and CBT may be more beneficial, as it can improve symptom control, reduce disability, and enhance overall quality of life. These results highlight the importance of incorporating behavioral strategies into standard migraine treatment plans.

Limitation:

The quasi-experimental nature of the study restricts the ability to draw firm causal inferences, and the relatively small sample size may limit the generalizability of the findings to all young adults experiencing chronic migraine. Self-reported data and unmeasured factors such as lifestyle, sleep, and co morbidities could affect results. The follow-up period was short, restricting evaluation of long-term efficacy and adherence. Future studies should use larger, randomized samples with extended follow-up and objective measures.

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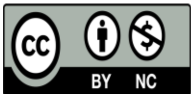
Dr. Mahmood Zahid: Conception and designing of the work; drafting of the manuscript
Dr. Zahid Akhtar: Data collection



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