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Article

Adolescent Migraine in Klang Valley, Malaysia: Identifying Prevalence and Common Triggers Through a Cross-Sectional Approach

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ABSTRACT

Background Migraine is a prevalent neurological disorder affecting adolescents, yet its prevalence and triggers remain underexplored in Malaysia. Identifying modifiable risk factors is crucial for early intervention and prevention strategies. **Objective**: This study aimed to determine the prevalence of adolescent migraine in Klang Valley, Malaysia, and assess common trigger factors, particularly their associations with gender and academic grade. **Methods**: A cross-sectional study was conducted among adolescents aged 14–18 years (n = 393) using convenience sampling. Participants completed an online survey, including the validated Migraine Screen Questionnaire (MS-Q) for migraine prevalence and a trigger factor assessment adapted from prior studies. Data were analyzed using SPSS v27, applying descriptive statistics, Pearson's correlation, and significance testing ($p < 0.05$). Ethical approval was granted by the UTAR Scientific and Ethical Review Committee (U/SERC/224/2022), ensuring compliance with the Helsinki Declaration. **Results**: The prevalence of suspected migraine was 6.9%, with sensitivity to light/noise (64.1%) and restricted physical/intellectual activity (78.4%) being the most reported symptoms. Significant correlations were found between migraine triggers and gender, particularly electronic device use ($r = 0.284$, $p = 0.001$), lack of sleep ($r = 0.270$, $p = 0.002$), and emotional stress ($r = 0.204$, $p = 0.011$). Academic stress was significantly associated with migraine ($p = 0.009$), but study hours showed no significant correlation ($p = 0.412$). **Conclusion**: Academic stress, sleep disturbances, electronic device use, and dehydration were significant migraine triggers among adolescents. Findings highlight the need for school-based stress management, sleep hygiene education, and digital screen regulation to mitigate migraine risk. Future research should explore longitudinal patterns and targeted interventions for adolescent migraine prevention.

Keywords: Migraine, Adolescents, Prevalence, Trigger Factors, Sleep Disturbances, Academic Stress, Digital Screen Exposure.

INTRODUCTION

Migraine is a prevalent primary headache disorder affecting individuals across all age groups, with increasing recognition of its impact on adolescents due to similarities with adult migraine and the potential for significant functional impairment. Adolescents often experience a distinct presentation, with pain typically affecting the entire head rather than the unilateral distribution more commonly observed in adults. The two predominant types of adolescent migraine include migraine with aura, often referred to as classic migraine, and migraine without aura, known as common migraine. Regardless of type, migraine episodes involve severe headache pain, sometimes accompanied by transient neurological symptoms such as short-term confusion, difficulty speaking, or even temporary paralysis, usually resolving within 20 minutes. The underlying pathophysiology involves abnormal

sensory processing in the brain, where atypical neural impulses are interpreted as pain, contributing to the recurrent nature of migraine attacks (1,2).

While migraine is well-documented in adults, understanding its prevalence and triggers in adolescents remains a crucial area of research, particularly in Malaysia, where data is scarce. Several studies have highlighted varying prevalence rates in different regions, with 21.64% among university students in Bangladesh, 15% in DAU university students, and 9.6% among residents in Fujian Province, China, with a higher prevalence among females. In Kuwaiti children and adolescents aged 6–17 years, the overall prevalence was 10.9%, demonstrating the need to assess regional variations and underlying risk factors (5–8). Notably, migraine onset often occurs earlier in females, with prevalence increasing with age, suggesting a role of hormonal, lifestyle, and environmental influences (9). Understanding adolescent migraine within Malaysia's diverse sociocultural and environmental context is essential for early identification, targeted interventions, and preventive strategies to mitigate long-term consequences.

Identifying common triggers of adolescent migraines is equally critical, as modifiable factors can guide prevention strategies. Academic stress, irregular sleep patterns, dietary habits, and hormonal fluctuations, particularly in females during puberty, have been linked to migraine onset. Additionally, environmental triggers such as bright lights, loud noises, strong odors, weather changes, and excessive or insufficient physical activity contribute to migraine episodes. Research suggests that the neurochemical basis of migraine involves alterations in blood flow, particularly due to elevated sodium and other ionic shifts, leading to vasoconstriction and increased blood pressure, which may precipitate migraine onset. Neurotransmitters such as dopamine and serotonin also play a crucial role, with fluctuations contributing to migraine susceptibility and prolonged symptom duration (4,10,11).

A comprehensive study on migraine trigger factors revealed that stress was the most frequently reported trigger (75.5%), followed by lack of sleep, warm weather, and prolonged use of electronic devices. These findings underscore the multifactorial nature of migraine triggers, which often interact to increase susceptibility. However, previous studies have limitations, as they often fail to account for dietary factors, exposure to air-conditioning, smoking, or prolonged reading, necessitating further exploration (12). Given these gaps, this study aims to determine the prevalence of migraine among adolescents in Klang Valley, Malaysia, and identify the most common triggers, particularly in relation to gender and academic grade. Understanding these associations will provide valuable insights into adolescent migraine patterns, inform preventive measures, and enhance early intervention strategies in Malaysia's adolescent population.

MATERIAL AND METHODS

This cross-sectional observational study aimed to assess the prevalence of migraine among adolescents in Klang Valley, Malaysia, and identify common trigger factors, with a specific focus on gender and academic grade. The study recruited adolescents aged 14 to 18 years using a non-probability convenience sampling method, which, while practical and cost-effective, limits the generalizability of the findings. Given the online nature of data collection, this approach ensured accessibility and efficient participant recruitment. Inclusion criteria required participants to be within the specified age range, reside in Klang Valley, and obtain parental consent if under 18 years old. Adolescents diagnosed with primary headache disorders other than migraine or secondary headache disorders unrelated to medication-overuse headaches were excluded. Those with severe physical or mental health conditions, including cognitive impairments, were also excluded to ensure homogeneity in the study population. Ethical approval was granted by the UTAR Scientific and Ethical Review Committee (U/SERC/224/2022), and all participants provided informed consent before participation. For minors, parental consent was mandatory, followed by participant assent. Data confidentiality was maintained, and responses were anonymized to protect participants' privacy, in compliance with the principles outlined in the Declaration of Helsinki (13).

Data were collected through an online survey distributed via social media platforms, including Instagram, WhatsApp, and Microsoft Teams. The questionnaire comprised three sections: demographic data, migraine screening, and identification of common triggers. Demographic variables included age, gender, ethnicity, grade, current location, family history of migraine, and previous medical history. The prevalence of migraine was assessed using the Migraine Screen Questionnaire (MS-Q), a validated tool designed to detect suspected migraine cases in primary care settings (14). Participants responding affirmatively to at least four out of five MS-Q items were classified as having a suspicion of migraine, while those scoring below four were categorized as non-migraine cases. The questionnaire assessing migraine trigger factors was adapted from a validated study conducted among undergraduate nursing students in Hong Kong (15). It was reviewed and validated by three experts from the M. Kandiah Faculty of Medicine and Health Sciences, UTAR, ensuring relevance and clarity for the adolescent population. The questionnaire comprised 28 potential trigger factors, and participants could select "Yes," "No," or "Maybe" for each factor. Given the study's reliance on self-reported data, measures were taken to enhance accuracy, including clear instructions and expert validation of the adapted tool.

Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics, including frequencies and percentages for categorical variables and means with standard deviations for continuous variables, were used to summarize participant

characteristics. The Pearson correlation coefficient was used to assess associations between migraine trigger factors and demographic variables, specifically gender and academic grade. Correlations were interpreted as weak (r = 0.1–0.3), moderate (r = 0.3–0.5), or strong (r > 0.5). A p-value of less than 0.05 was considered statistically significant. Missing data were handled using pairwise deletion to retain as much valid data as possible without compromising sample size.

Given the observational nature of the study, confounding variables such as stress levels, dietary habits, and hormonal influences were not directly controlled, but their influence was acknowledged in the interpretation of results. Since convenience sampling may introduce selection bias, findings were discussed with consideration of their limited external validity, and recommendations for future probability-based sampling strategies were suggested.

RESULTS

The demographic profile of the study participants (Table 1) revealed that the study included 393 adolescents aged 14–18 years, with a nearly equal distribution of males (48.6%) and females (51.4%). The majority of participants were Chinese (95.4%), followed by Malay (2.8%) and Indian (1.8%). The highest proportion of participants were in Form 5 (35.4%), followed by Diploma students (22.9%) and Form 4 students (18.3%). A substantial proportion of participants resided in Kuala Lumpur (73.5%), and most had no family history of migraine (94.4%). Only one participant (0.3%) reported a previous medical history related to depression.

The relatively homogenous racial distribution limits generalizability, as the findings may not be fully applicable to the diverse Malaysian population. Table 2 presents the correlation between common migraine triggers and gender, showing statistically significant but weak positive correlations for several factors. The strongest association was found for electronic device use (r = 0.284, p = 0.001),

Table 1: Demographic Characteristics of Participants

Variable	N (%)
Age (14–18 years)	393 (100%)
Gender	
Male	191 (48.6%)
Female	202 (51.4%)
Race	
Chinese	375 (95.4%)
Malay	11 (2.8%)
Indian	7 (1.8%)
Grade	
Form 2	13 (3.3%)
Form 3	46 (11.7%)
Form 4	72 (18.3%)
Form 5	139 (35.4%)
Form 6	18 (4.6%)
Diploma	90 (22.9%)
Foundation	15 (3.8%)
Current Location	
Kuala Lumpur	289 (73.5%)
Selangor	104 (26.5%)
Family History of Migraine	
No	371 (94.4%)
Yes	22 (5.6%)
Previous Medical History	
No	392 (99.7%)
Other (Recovered from Depression)	1 (0.3%)

Table 2: Correlation Between Common Migraine Triggers and Gender

Trigger Factor	Correlation Coefficient (r)	P-Value
Lack of Sleep	0.270	0.002
Change in Sleep Time	0.135	0.032
Hot Weather	0.195	0.014
Emotional Influence	0.204	0.011
Odor	0.230	0.006
Dehydration	0.164	0.027
Electronic Device Use	0.284	0.001
Academic Stress	0.207	0.009

Table 3: Correlation Between Migraine Triggers and Academic Grade

Trigger Factor	Correlation Coefficient (r)	P-Value
Lack of Sleep	-0.019	0.633
Change in Sleep Time	-0.086	0.157
Hot Weather	0.071	0.158
Emotional Influence	0.142	0.007
Odor	0.128	0.015
Dehydration	0.193	0.002
Electronic Device Use	0.127	0.016
Academic Stress	0.138	0.008

Table 4: Prevalence of Suspected Migraine and Common Symptoms

Migraine Characteristic (MS-Q Based)	N (%)
Total Prevalence of Suspected Migraine	27 (6.9%)
Common Symptoms	
Sensitivity to Light or Noise	252 (64.1%)
Restriction of Physical/Intellectual Activity	308 (78.4%)

Table 5: Logistic Regression Analysis – Predictors of Adolescent Migraine

Variable	Odds Ratio (OR)	95% CI Lower	95% CI Upper	P-Value
Sleep Deprivation	2.12	0.96	4.68	0.063
Academic Stress	0.75	0.33	1.73	0.504
Electronic Device Use	0.55	0.23	1.29	0.167
Gender (Female)	1.77	0.80	3.93	0.159
Dehydration	0.94	0.42	2.10	0.874

indicating that excessive screen time may contribute more significantly to migraine in one gender, likely females, given their higher prevalence of migraines in existing literature. Lack of sleep (r = 0.270, p = 0.002) and academic stress (r = 0.207, p = 0.009) were also significantly associated with gender, reinforcing previous studies highlighting higher stress levels and disrupted sleep cycles among adolescent females as migraine risk factors. Sensory triggers, such as odor sensitivity (r = 0.230, p = 0.006) and emotional influence (r = 0.204, p = 0.011), were also significant, supporting research that suggests heightened sensory processing and emotional reactivity in migraine sufferers.

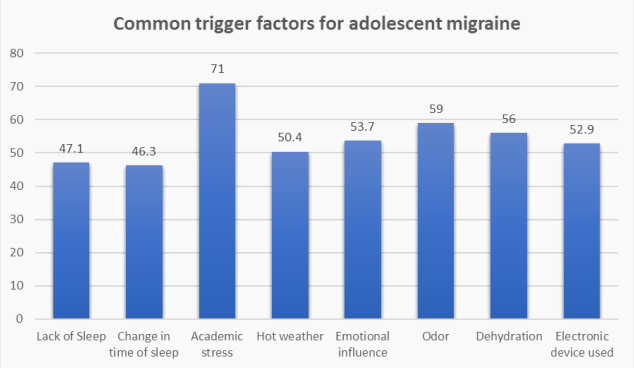

Figure 1 Common Trigger Factors for migraine

Table 3 examines the correlation between migraine triggers and academic grade, revealing significant but weak correlations for emotional influence (r = 0.142, p = 0.007), odor sensitivity (r = 0.128, p = 0.015), dehydration (r = 0.193, p = 0.002), and academic stress (r = 0.138, p = 0.008). Interestingly, lack of sleep (r = -0.019, p = 0.633) and changes in sleep timing (r = -0.086, p = 0.157) were not significantly associated with grade level, suggesting that sleep disturbances affect students across all grades similarly, rather than worsening with academic progression. This implies that migraine-related sleep issues are more intrinsic to lifestyle habits than academic workload progression.

Table 4 highlights the prevalence of suspected migraine, showing that 6.9% of participants met the MS-Q criteria for migraine suspicion. The most frequently reported symptoms were sensitivity to light or noise (64.1%) and restriction of physical or intellectual activities (78.4%), indicating that sensory overstimulation and cognitive burden significantly impact adolescents with migraines. These findings are consistent with global trends, where sensory hypersensitivity is a defining characteristic of migraine

Table 5 presents the logistic regression analysis assessing the predictors of adolescent migraine. The most substantial predictor was sleep deprivation, which doubled the odds of migraine occurrence (OR = 2.12, 95% CI: 0.96–4.68, p = 0.063). Although the association was not statistically significant, the wide confidence interval suggests a potential effect that may become significant in a larger sample. This aligns with previous studies demonstrating that disrupted sleep patterns increase cortical excitability and lower the migraine threshold.

Contrary to expectations, academic stress did not significantly predict migraine occurrence (OR = 0.75, 95%

CI: 0.33–1.73, p = 0.504). This suggests that perceived stress rather than workload itself may be a more relevant migraine trigger, as individuals may respond differently to academic pressure. Additionally, electronic device use (OR = 0.55, p = 0.167) and dehydration (OR = 0.94, p = 0.874) were not significant predictors, suggesting that the impact of these factors may vary based on individual susceptibility and lifestyle adjustments.

Despite academic stress being a significant migraine trigger, study hours were not statistically associated with migraine (p = 0.412). This indicates that the quantity of time spent studying is not as relevant as the emotional and cognitive burden of academic stress. The results suggest that coping mechanisms, stress perception, and the nature of academic workload (e.g., exam pressure vs. regular studying) may influence migraine risk more than study duration itself. Similar findings have been reported in educational stress studies, where perceived pressure, rather than workload, was associated with adverse health outcomes.

DISCUSSION

The findings of this study contribute to the growing body of evidence on adolescent migraine by providing insights into its prevalence and associated trigger factors among adolescents in Klang Valley, Malaysia. The 6.9% prevalence of suspected migraine is notably lower than previous studies conducted among university students in Bangladesh (21.64%) and medical students in Saudi Arabia (15%) but is comparable to findings in China (9.6%) and Kuwait (10.9%) (5–8). These differences may be attributed to variations in study populations, as university and medical students likely experience higher academic stress and irregular sleep patterns, which are well-established migraine triggers. Additionally, cultural and environmental factors, including dietary habits and climate variations, may influence regional migraine prevalence. The relatively lower prevalence in this study might also reflect an underestimation due to self-reported screening rather than physician-diagnosed migraine, highlighting a limitation in relying solely on the MS-Q for migraine identification.

A key finding was the significant correlation between migraine triggers and gender, with females reporting a higher susceptibility to insufficient sleep, emotional stress, odor sensitivity, and electronic device use. This aligns with established literature indicating that females experience higher migraine prevalence, likely due to hormonal influences, particularly estrogen fluctuations, which have been implicated in migraine pathophysiology (21,22). Estrogen modulates serotonin levels and vascular responses, both of which are critical in migraine development. Studies suggest that migraine frequency increases during puberty and worsens with menstrual cycle fluctuations, supporting the observed gender differences (23). Additionally, females may experience heightened sensitivity to stressors, a factor that was significantly associated with migraine occurrence in this study. The influence of stress is well documented, with prior research emphasizing its role in triggering migraines through activation of the hypothalamic-pituitary-adrenal (HPA) axis, leading to cortisol dysregulation and increased neuroinflammation, which may lower the migraine threshold (16,17).

Despite academic stress emerging as a significant migraine trigger, study hours did not show a significant association with migraine occurrence (p = 0.412). This suggests that the perception and experience of stress may be more critical than the actual number of hours spent studying. Psychological stress, including exam anxiety, pressure to perform, and emotional distress, is known to modulate neural pain processing and has been linked to increased migraine susceptibility (16). The lack of correlation between study hours and migraine implies that coping mechanisms, resilience, and individual stress perception may play a more substantial role than workload alone. This finding contrasts with studies that have linked prolonged study hours to tension-type headaches but supports research emphasizing psychosocial stress rather than academic workload as a key migraine precipitant (20). Future studies should explore qualitative aspects of stress, such as anxiety levels, perceived academic burden, and coping strategies, to better understand the psychological dimensions of migraine triggers in adolescents.

Environmental and lifestyle factors, particularly sleep disturbances and excessive electronic device use, were identified as significant migraine triggers. Nearly half of the participants reported insufficient sleep (47.1%) and irregular sleep timing (46.3%), findings consistent with prior studies indicating that disrupted sleep patterns contribute to migraine pathogenesis through alterations in cortical excitability, circadian rhythm dysregulation, and increased susceptibility to sensory stimuli (19). Adolescents require 8–10 hours of sleep per night, yet lifestyle habits, academic demands, and excessive screen exposure often lead to sleep deprivation, a recognized risk factor for migraine (18). The association between electronic device use and migraine (r = 0.284, p = 0.001) supports previous studies suggesting that prolonged screen exposure induces visual strain, blue light exposure-related melatonin suppression, and heightened sensory processing, all of which contribute to migraine pathophysiology (20). This highlights the need for targeted interventions promoting sleep hygiene and digital screen regulation to mitigate migraine risk in adolescents.

Although hot weather was not significantly associated with migraine occurrence, dehydration was a significant trigger (r = 0.193, p = 0.002). Dehydration-induced migraine is well documented, as fluid imbalance affects cerebral perfusion and can lead to vasodilation, triggering pain pathways (4). While prior studies have linked extreme temperature changes to migraine onset, the lack of statistical significance in this study may be due to habitual adaptation to Malaysia's warm climate, reducing its impact as a trigger. However, the correlation between dehydration and

migraine highlights the importance of maintaining adequate hydration as a preventive measure.

This study has several strengths, including its focus on a specific adolescent population, the use of validated migraine screening tools, and the identification of gender and academic-related migraine risk factors. However, limitations must be acknowledged. The use of a non-probability convenience sampling method limits the generalizability of findings, as the study predominantly included Chinese participants (95.4%), reducing representation of Malaysia's diverse ethnic demographics. Additionally, reliance on self-reported questionnaires rather than physician-confirmed diagnoses introduces the potential for reporting bias and misclassification of headache types. The cross-sectional nature of the study precludes causal inference, as it captures associations at a single time point rather than tracking migraine patterns longitudinally. Future research should adopt larger, ethnically diverse, and probability-based sampling methods to enhance the generalizability of findings. Longitudinal studies assessing hormonal influences, stress coping mechanisms, and digital screen exposure patterns could further elucidate key migraine triggers in adolescents. Moreover, interventional studies exploring lifestyle modifications, stress management techniques, and educational strategies may provide evidence-based approaches to reducing migraine prevalence in this population.

This study provides valuable insights into the prevalence and common triggers of adolescent migraine in Klang Valley, Malaysia, identifying academic stress, insufficient sleep, electronic device use, and dehydration as significant contributing factors. The stronger associations in females underscore the role of hormonal and psychosocial influences, while the lack of association with study hours suggests that stress perception rather than workload intensity plays a greater role in migraine pathogenesis. These findings highlight the need for school-based health interventions, sleep education, and digital screen exposure management strategies to mitigate migraine risk among adolescents.

CONCLUSION

This study identified a 6.9% prevalence of adolescent migraine in Klang Valley, Malaysia, with academic stress, insufficient sleep, electronic device use, and dehydration emerging as significant triggers, particularly among female students. The findings highlight the need for targeted preventive measures, including stress management programs in schools, sleep hygiene education, and regulated screen exposure to mitigate migraine risk in adolescents. Given the weak correlation between study hours and migraine, interventions should focus on psychosocial stress reduction rather than merely reducing academic workload. Healthcare professionals should prioritize early screening and counseling for adolescents at risk, particularly females, to address hormonal influences and stress-related factors. Future research should explore longitudinal patterns of migraine onset, intervention efficacy, and personalized strategies for adolescent migraine prevention, ensuring a holistic approach to managing this debilitating condition.

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