



ORIGINAL ARTICLE

Prevalence and Characteristics of Primary Headache Disorders: Insights from a Large Cohort Study

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Abstract

Background: Headache disorders, particularly migraine and tension-type headaches (TTH), are major global health concerns. The burden of migraine and TTH in the Middle East exceeds the global average. The present study aimed to evaluate the prevalence, clinical features, and radiological findings of primary headache disorders comparing regional clinical and epidemiological characteristics with national and international studies to improve the treatment strategies in the Middle East.

Methods: A single-centre retrospective cohort study analyzed headache patients over 34 months. Clinical presentations, radiological features, and patient parameters were recorded and evaluated.

Results: Among 1,500 patients, 73.6% had migraines, 20.6% had TTH, and 5.5% had trigeminal autonomic cephalalgia (TAC). Migraine prevalence peaked between ages 20 and 25 (28.1%), while TTH (29.19%) and TAC (28.2%) were most common between ages 36 and 40. Migraine (59.8%) and TTH (57.9%) were more prevalent in females, while TAC (51%) and other primary headaches (83.3%) were more common in males. Positive family history was noted in migraine (63.8%) and TAC (22.2%). Migraine was often aggravated by head bathing and lack of sleep (23.3%), while TTH and TAC were triggered by physical stress (43.7%), and sunlight exposure (37%). MRI findings were normal in 85.6% of all headache types and 99.6% of migraines without aura. In contrast, migraines with aura showed white matter hyperintensities (WMH) in 95.96% of cases.

Conclusion: The study highlights a high prevalence of migraines, though lower than global estimates. Clinically significant MRI findings were observed in migraines with aura, aligning with international data. Multi-centre studies are required to further refine treatment strategies.

Keywords: Global health, Headache disorders, Migraine disorders, Prevalence, Tension-type headache, Trigeminal autonomic cephalalgias

Introduction

According to the Global Burden of Disease (GBD) study, headache disorders are among the most prevalent causes of disability worldwide.¹ In 2021, approximately 40% of the global population is estimated to be affected by headaches.² Over 90% of the individuals who seek headache evaluation are diagnosed with primary headache disorders.³ According to the International Classification of Headache Disorders (ICHD), primary headache disorders include migraine, tension-type headache (TTH), trigeminal autonomic cephalalgia (TAC), and other primary headache types.^{3,4}

Globally, 14% of the population experiences migraine, and 26% experience TTH.^{1,5} GBD has ranked migraine and TTH as the second and ninth leading causes of global neurological disability-adjusted life years, respectively.⁶ Other clinically heterogeneous primary headache disorders are relatively uncommon.^{4,7}

Migraine is considered a long-term condition, characterized by recurrent, moderate-to-severe headaches associated with nausea, vomiting, photophobia, and phonophobia.^{8,9} A migraine attack typically lasts 4-72 hours, and chronic migraine persists for more than 15 headache days per month for at least three months.^{4,5} Triggers include alcohol consumption, caffeine intake, smoking, stress, sleep deprivation, noises, sunlight, smells, and medication overuse.^{6,9} Migraine is associated with various comorbidities including neurological, cardiovascular, and psychiatric conditions.^{5,10} Migraine with aura increases the risk of ischemic stroke, while migraine without aura is linked to haemorrhagic stroke.¹¹ TTH is the most common neurological disorder. Its clinical manifestations include mild-to-moderate, bilateral, and hatband-like distributed headaches with relatively less pronounced neurological symptoms.⁹ Common triggers of TTH include sleep disturbance, alcohol consumption, sunlight, and weather changes.⁶ TACs are a group of rare primary headache disorders characterized by unilateral headaches with ipsilateral cranial autonomic symptoms.^{3,12} TACs include cluster headache, short-lasting unilateral neuralgiform, paroxysmal hemicrania, and

hemicrania continua.¹² Common triggers include lack of sleep, mood changes, specific smells, chocolate, coffee, and alcohol consumption.⁶

The remaining primary headache disorders are heterogeneous and relatively uncommon. They include (i) headaches associated with physical exertion, such as coughing, exercise, or sexual activity, as well as thunderclap headache, which is linked to conditions like subarachnoid hemorrhage;^{4,7} (ii) headaches caused by direct physical stimuli, including cold-stimulus and external-pressure headaches;⁴ (iii) epicranial headaches, such as primary stabbing (localized, single or series of stabs) and nummular headaches (mild to moderate continuous pain, occasionally severe);^{4,7} (iv) other miscellaneous primary headache disorders, such as hypnic headaches and new daily persistent headaches, which are generally considered benign.^{4,7}

Previous evidence indicates that in the Middle East and North Africa (MENA) region, primary headache disorders, particularly tension-type headaches (TTH), had an age-standardized point prevalence of 24,504.5 per 100,000 people in 2019.¹³ The prevalence of headache problems differs markedly across countries, with Saudi Arabia reporting rates between 8% and 12%.¹⁴ Notwithstanding these statistics, there exists a significant deficiency of thorough research on headache problems in most MENA nations, which obstructs the formulation of focused healthcare policies.¹⁵ Recent studies underscore the necessity for comprehensive research to address gaps in understanding the epidemiology of headache problems in this region.^{13,15} The variation in prevalence rates among countries further highlights the importance of region-specific studies to guide public health policies.

Accurate diagnosis and treatment play a crucial role in mitigating the adverse effects of headache disorders. However, misdiagnosis and inadequate treatment remain significant challenges.^{5,6,16} Early detection and treatment are crucial; yet the complex etiology and variability of symptoms make early diagnosis elusive.^{5,6} Identifying risk factors, including demographics and triggers, can help predict the high-risk patients and enable early intervention. Prognostic prediction further supports

the optimization of therapy plans. A predictive approach, applicable at every stage of headache management, is essential for delivering tailored care.⁶

Materials and Methods

This single-centre retrospective study included 1,500 patients registered in the Internal Medicine and Neurology departments of a tertiary healthcare centre located in Doha, Qatar, between August 2017 and August 2023 for headaches. Patients aged 18 years and older of both sexes were included in the study. The hospital caters to a broad demographic, reflecting the multicultural nature of Doha. Patients include local Qataris as well as expatriates from South Asia, the Middle East, and other regions. Across its facilities, Aster DM Healthcare in Qatar treats between 2,000 and 2,200 patients daily, reflecting a high volume and diverse case mix. The hospital offers specialized outpatient services, including neurology and headache clinics, which are integral to studies on primary headache disorders.

Key exclusion criteria comprised patients with systemic, metabolic, or traumatic conditions, along with those presenting radiological findings, directly or indirectly associated with headache causation. Systemic and metabolic conditions were ruled out through a combination of detailed clinical evaluation and routine laboratory investigations, including complete blood count, fasting blood glucose, renal and liver function tests, thyroid function tests, and serum electrolytes. Headaches originating from or referred to the cranium due to conditions in the maxillofacial region, pharynx, paranasal sinuses, neck, or ear were excluded. Additionally, patients with incomplete clinical data, insufficient diagnostic or treatment information, or those who failed to complete the one-year follow-up were not included in the study. Clinical presentations and radiological data were collected and analyzed. This study compared, classified, and analyzed the characteristics of primary headache disorders with reference to both national and international studies.

This study utilized a retrospective cohort approach, examining data from patients with headache disorders, identified from pre-existing medical records during a specified timeframe. The single-

center methodology guaranteed uniformity in diagnostic standards, data acquisition, and imaging procedures. This strategy may add selection bias and restrict generalizability; however, stringent inclusion and exclusion criteria along with standardized diagnostic techniques were employed to alleviate these risks. Methodical data extraction further diminished information bias.

Procedure

Headache diagnoses were made according to the International Classification of Headache Disorders, 3rd edition (ICHD-3) criteria, which provide standardized and internationally accepted definitions for primary headache disorders including migraine, tension-type headache, and trigeminal autonomic cephalalgias. All patients underwent brain MRI using institutional protocols for headache evaluation, which included multiplanar T1-weighted, T2-weighted, and FLAIR sequences to assess for structural abnormalities and exclude secondary causes. Additional sequences, such as MR venography or contrast-enhanced imaging, were performed when clinically indicated, following published neuroimaging guidelines for headache. All imaging studies were reviewed by experienced neuroradiologists to ensure diagnostic accuracy.

Statistical Analysis

All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize demographic and clinical characteristics, with categorical variables presented as frequencies and percentages, and continuous variables as means \pm standard deviations. Comparisons between groups (e.g., migraine, TTH, TAC, and other primary headaches) were conducted using Chi-square tests for categorical variables and independent t-tests or ANOVA for continuous variables, as appropriate. To adjust for potential confounders such as age and sex, multivariate logistic regression analyses were performed to assess the association between headache types and relevant clinical features, aggravating/relieving factors, and MRI findings. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Age and sex were included as covariates in all regression models to control for

their confounding effects. Statistical significance was set at $P < 0.05$.

Results

Prevalence and Sex Distribution of Primary Headache Disorders

Of the 1500 patients, 1,104 (male, $n = 444$; female, $n = 660$) were diagnosed with migraine, 309 (male, $n = 130$; female, $n = 179$) with TTH, 81 with TAC (male, $n = 41$; female, $n = 40$), and 6 with other types of primary headaches (male, $n = 5$; female, $n = 1$) (Table 1, Figure 1).

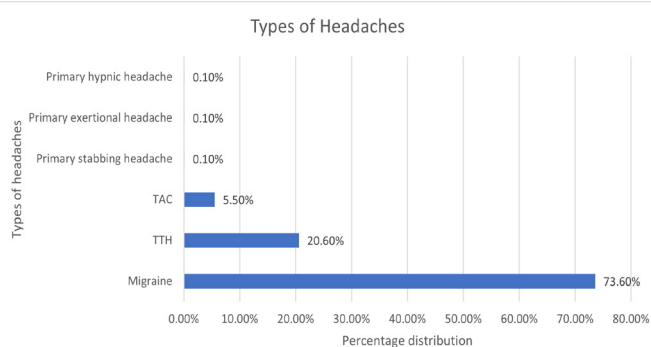


Figure 1: Distribution of different types of headaches

Characteristics of Migraine, TTH, and TAC

Migraine was most prevalent among individuals aged 20–25 years, with a prevalence of 28.1%. TTH and TAC were most common in the 36–40 age group, with prevalence rates of 29.1% and 28.2%, respectively. Of TAC patients, 87.6% had cluster

headaches and 12.4% had paroxysmal hemicrania. Overall, only a small proportion of patients experienced headaches after the age of 40 across all three types of headaches. Migraine and TTH were more common in females than males, while TAC was slightly more prevalent in males. A positive family history of migraine was significantly more common in migraine (63.8%) compared to TTH (1%) or TAC (22.2%) (Table 1).

Of the 220 patients with migraine with aura, 75.5% ($n = 166$) experienced visual aura and 24.5% ($n = 54$) experienced sensory aura. The temporal region was the most common site of migraine pain, affecting 64.3% of patients. Frontal, parietal, and occipital regions were affected in 21.2%, 10.1%, and 4.4% of patients, respectively (Table 2).

Throbbing headaches were more common in patients with migraine (81.8%), while aching headaches were more prevalent in TTH and TAC patients (53.7% and 51.8%, respectively). Band-like compressive sensations were less common in patients with migraine (0.5%) and TTH (11.7%). Pricking sensation was less common in patients with TAC (12.3%). Migraine episodes most commonly lasted 1–4 hours (31%) or 5–8 hours (30.8%). TTH and TAC episodes were more often 5–8 hours in duration (32.7% and 39.5%, respectively), followed by 1–4 hours (31.4% and 23.4%). Prolonged episodes lasting more than 12 hours were less common across all three headache types (Table 3).

Table 1: Age, sex distribution, and family history of migraine, TTH, and TAC

Characteristics	Migraine N = 1,104 n (%)	TTH N = 309 n (%)	TAC N = 81 n (%)
Age distribution (years)			
20-25	310 (28.1%)	50 (16.2%)	18 (22.2%)
26-30	281 (25.5%)	70 (22.7%)	21 (25.9%)
31-35	202 (18.3%)	59 (19.1%)	18 (22.2%)
36-40	293 (26.5%)	90 (29.1%)	23 (28.2%)
>40	18 (1.6%)	40 (12.9%)	1 (1.5%)
Sex distribution			
Male	444 (40.2%)	130 (42.1%)	41 (50.6%)
Female	660 (59.8%)	179 (57.9%)	40 (49.4%)
Family history of headache	704 (63.8%)	3 (1%)	18 (22.2%)

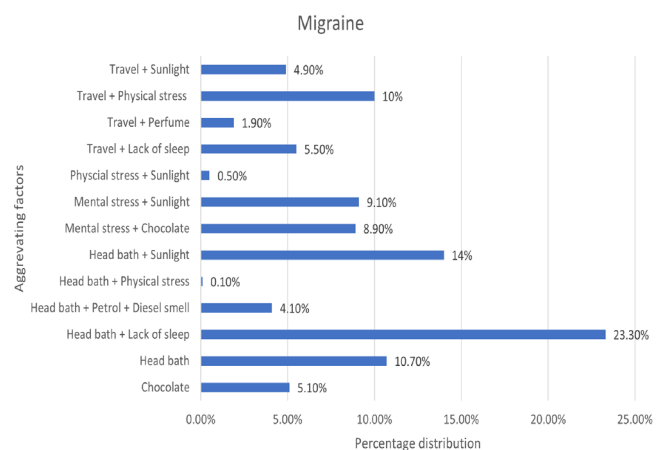
Table 2: Clinical presentations of migraine

Characteristics	Number of patients N = 1,104 n (%)
Presented with aura	
Migraine with aura	220 (19.9%)
Migraine without aura	884 (80.1%)
Migraine pain location	
Temporal	709 (64.3%)
Frontal	234 (21.2%)
Occipital	49 (4.4%)
Parietal	112 (10.1%)

Table 3: Clinical features of migraine, TTH, and TAC

Characteristics	Migraine N = 1,104 n (%)	TTH N = 309 (%)	TAC N = 81 n (%)
Duration of episode (hours)			
1-4 h	342 (31%)	97 (31.4%)	19 (23.4%)
5-8 h	339 (30.8%)	101 (32.7%)	32 (39.5%)
9-12 h	268 (24.2%)	82 (26.5%)	23 (28.3%)
>12 h	155 (14%)	29 (9.4%)	7 (8.6%)
Character of headache			
Throbbing	902 (81.8%)	53 (17.1%)	15 (18.6%)
Pricking	135 (12.2%)	54 (17.5%)	10 (12.3%)
Aching headache	61 (5.5%)	166 (53.7%)	42 (51.8%)
Band-like compressive sensation	6 (0.5%)	36 (11.7%)	14 (17.3%)

Various factors, such as a head bath, lack of sleep, mental or physical stress, sunlight, travel, perfume, petrol/diesel smell, chocolate, and alcohol, have been reported as aggravating factors for headaches (Figure 2). Head bath with lack of sleep was observed to be the most frequent aggravating factor of migraine (23.3%), while physical stress and sunlight exposure were identified as the key aggravating factors of TTH and TAC, with 43.7% and 37% of patients, respectively. No known factors have been identified for 1.9%, 0.6%, and 6.2% of patients with migraine, TTH, and TAC, respectively.

**(A)**

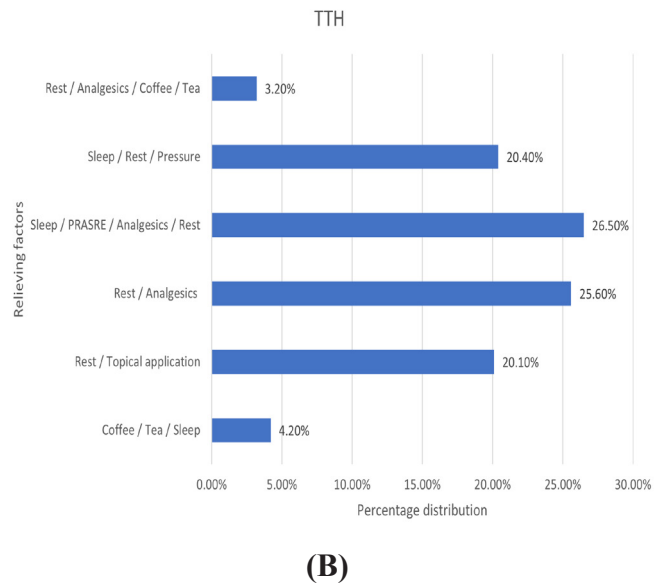
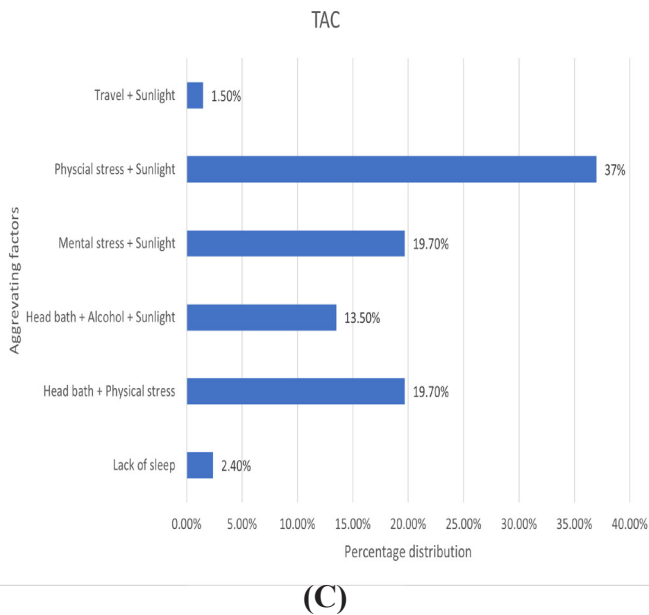
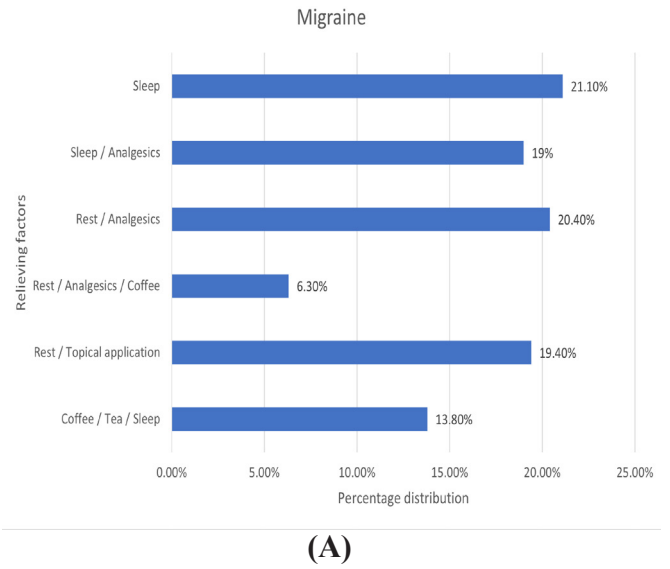
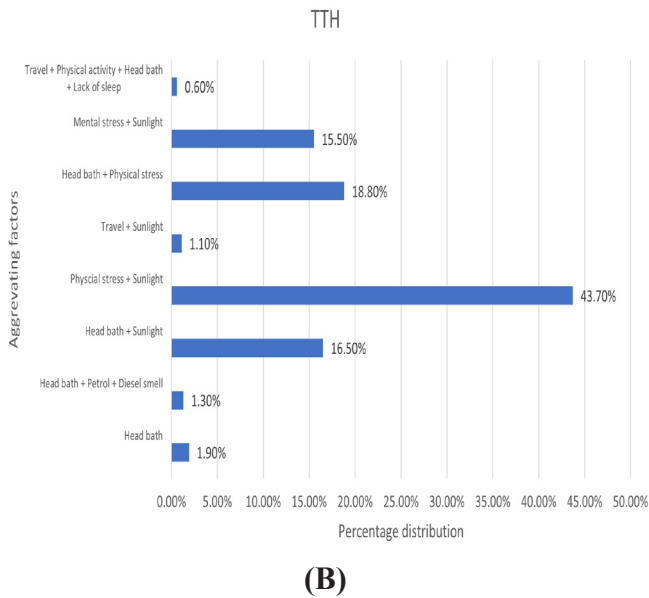


Figure 2: Aggravating factors of migraine (A), TTH (B), and TAC (C)

The medical and non-medical relieving factors include sleep, rest, analgesics, coffee, tea, and topical application (Figure 3). The most common relieving factor for migraine was sleep (21.1%), followed by a combination of rest and analgesics (20.4%). The most common relieving factors for TTH were a combination of rest, analgesics, Preventive And Symptomatic Relief (PRASRE), and sleep (26.5%), followed by rest and analgesics (25.6%). For TAC, the most common relieving factor was the combination of rest, analgesics, and sleep (33.3%), followed by rest and sleep (30.8%).

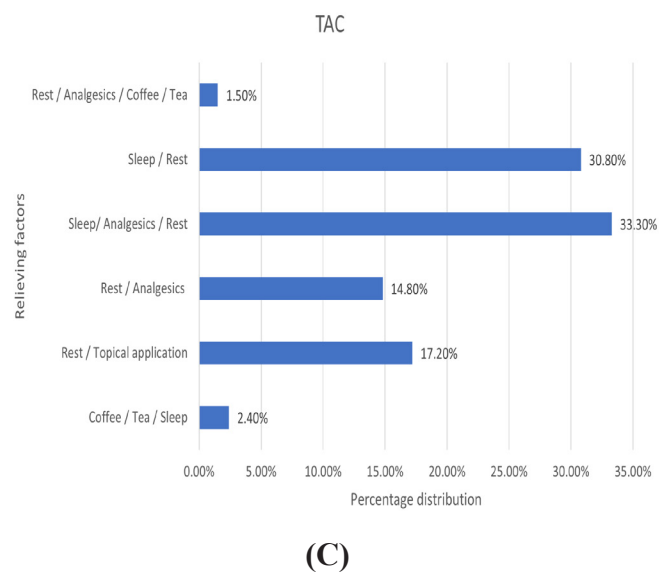


Figure 3: Relieving factors of migraine (A), TTH (B), and TAC (C)

Other Types of Primary Headaches

Table 4 presents data on patients with various primary headache types, including primary stabbing headache, primary exertional headache, and primary hypnic headache, with two patients reported for each

type. The table details age distribution, headache duration, headache characteristics, family history, and both aggravating and relieving factors for these patients.

Table 4: Characteristics of other types of primary headaches

		Primary stabbing headache n	Primary exertion headache n	Primary hypnic headache n
Sex	Male	1	2	2
	Female	1	0	0
Age distribution, (years)	26-30	1	-	1
	31-35	1	1	1
	36-40	-	1	-
Duration of headache (hours)	1-4 h	1	-	1
	5-8 h	1	-	1
	9-12 h	-	2	-
Headache character	Pricking	1	-	-
	Throbbing	1	2	2
Family history	Present	2	2	1
	Absent	-	-	1
Aggravating factors	Headache	-	1	-
	Headache + sunlight	2	-	1
	Headache + lack of sleep	-	1	-
	Mental stress + sunlight	-	-	1
Relieving factors	Rest + sleep	1	-	-
	Rest + analgesics	-	2	-
	Rest + analgesics + sleep	-	-	1
	Rest + analgesics + coffee/tea	-	-	1

MRI Findings

MRI findings were normal in 85.6% of patients with headaches, while abnormal white matter hyperintensities (WMHs) were observed in the temporal (9.5%), frontal (3.3%), and periventricular (1.6%) regions. MRI findings of migraine with aura showed normal results in 4.1% of patients. The remaining patients exhibited WMH in temporal (63.6%), frontal (22.7%), and periventricular (9.5%) regions. MRI findings of migraine without aura were predominantly normal (99.6%), with only 0.2% of patients showing WMH in frontal and periventricular regions (Table 5).

Discussion

In our investigation, migraine had the highest prevalence, succeeded by tension-type headache (TTH) and trigeminal autonomic cephalalgias (TAC), among 1,500 individuals with primary headaches. The GBD 2019 data suggested a higher global prevalence of TTH; nevertheless, South Asia had the highest frequency of migraine, aligning with our findings.¹⁷ Conversely, data from the GBD 2016 revealed that the prevalence of tension-type headache (TTH) surpasses that of migraine across the Eastern Mediterranean region, including Saudi Arabia.¹⁸ A population-based, cross-sectional study in Saudi Arabia indicated that the 1-year prevalence of tension-type headache surpasses that of migraine.¹⁵ The majority of migraine cases (80.1%) were classified as migraine without aura, aligning with global trends. In general, approximately 15-33% of individuals with migraine experience aura.¹⁹ Corroborating our clinical findings, the hospital-based cross-sectional investigation conducted in the Middle East, Asia, and Africa revealed a comparable prevalence of TAC (3.5%) within the study population.²⁰ When compared to global

statistics, the incidence of migraine in the Middle East is typically lower or exhibits significant variability, with reported rates ranging between 2.6% and 32%, and certain research suggesting a reduced prevalence of migraine in Saudi Arabia relative to other nations.^{21,22} This regional difference may be influenced by cultural variables, including societal attitudes that dissuade men from seeking treatment for headaches, potentially resulting in underreporting and underdiagnosis.²² Furthermore, environmental stimuli such as noise, potent scents, and severe weather are frequently reported by patients in the location and may influence unique headache patterns relative to other areas globally.²³

The age distribution indicated that migraines are more prevalent among young adults, particularly those aged 20-40 years, aligning with international research findings. A telephone-based interview in the US revealed the highest occurrence of migraines in the 30-39 age demographic.²⁴ TTH and TACs were more common in the older age demographics. In accordance with our findings, the GBD 2016 report indicated a significant prevalence of TTH among individuals aged 35-44 in the Eastern Mediterranean region.¹⁸ The GBD 2019 survey indicated that the regional point prevalence of TTH in the MENA was highest among men aged 35-39 and women aged 70-74.¹³ Cluster headaches exhibited a comparable age distribution, predominantly affecting individuals aged 20-40, consistent with an Asian study indicating that the mean age of onset for cluster headaches varied from 26.7 to 37.9 years.²⁵

Women are primarily impacted by primary headache disorders, especially migraines, which exhibit the greatest gender gap. TTH demonstrates a marginally greater prevalence in women, whereas cluster

Table 5: MRI findings

	Normal n (%)	WMH-Frontal n (%)	WMH-Periventricular n (%)	WMH-Temporal n (%)
Primary headache	1284 (85.6%)	50 (3.3%)	24 (1.6%)	142 (9.5%)
Migraine with aura	9 (4.1%)	50 (22.7%)	21 (9.5%)	140 (63.6%)
Migraine without aura	880 (99.6%)	2 (0.2%)	2 (0.2%)	-

headaches are somewhat more common in men. Our results correspond with the GBD 2019 data, which indicated a greater prevalence of migraine and TTH among females.¹ A study examining sex hormones in primary headaches indicates that women exhibit greater susceptibility to migraines and tension-type headaches, primarily attributable to hormonal fluctuations throughout their lives, notably during pregnancy and menstrual cycle.^{9,26} Narrative literature regarding cluster headaches in Asian countries exhibited a pronounced male predominance, aligning with our findings.²⁵

A favourable familial history is a prevalent risk factor for migraines, signifying a genetic susceptibility. Genome-wide investigations revealed 178 linkage disequilibrium-independent single nucleotide polymorphisms (SNPs) correlated with migraine. A total of 181 independent SNPs were linked to migraine, with three specifically connected with females.²⁷ Research demonstrates that hereditary variables substantially influence the risk of cluster headaches. First-degree relatives of individuals with cluster headaches demonstrate a 5–18-fold elevated risk, and second-degree relatives show a 1–3-fold increased risk, relative to the general population.⁶

Head showers, sleep deprivation, physical strain, and exposure to sunlight were the predominant triggers for all three headache categories. A previously published Indian study revealed hair washing and bathing as a prevalent trigger for migraines.²⁸ A thorough assessment of migraines in Arab nations revealed stress, exhaustion, sleep difficulties, extended exposure to intense sunlight or heat, and hunger as the predominant factors.²⁹ A meta-analysis of primary headache disorders indicates that stress and sleep are the most often identified triggers of primary headaches.³⁰ The most prevalent technique for alleviating all three types of headaches was the combination of rest, sleep, and analgesics. The systematic analysis in Arab countries also indicated drugs, pigmentation, massage, rest, and adequate sleep as alleviating variables for migraines, corroborating our findings.²⁹

The MRI results were predominantly normal in individuals with headaches and those with migraine without aura. Migraine with aura is

mostly linked to WMH in the temporal, frontal, and periventricular areas, especially inside the temporal lobe. In individuals suffering with migraine, lesions typically present as silent infarct-like abnormalities, characterized by T2 hyperintensities in the white matter on MRI.³¹ White matter lesions (WMLs) are more prominent in individuals with aura and can adversely affect physical and cognitive abilities.³² Cerebral blood flow patterns during migraine attacks may differ between individuals with and without aura.³³ A study reported that white matter hyperintensities (WMHs) are most frequently located in the frontal lobes, followed by the parietal lobes. Migraine patients exhibiting WMHs are considerably older and possess greater WMHs in the lobar (frontal, temporal, parietal, and occipital) and periventricular regions in comparison to their younger counterparts.³⁴ A retrospective cross-sectional study in Saudi Arabia found that patients over 40 with migraines were more likely to exhibit aberrant imaging findings.³⁵

The American Headache Society systematic review and evidence-based guideline advocates for neuroimaging in migraine patients exhibiting atypical or persistent aura symptoms, heightened frequency or intensity of migraines, alterations in clinical presentations, inaugural or exceptionally severe migraine episodes, migraine accompanied by brainstem aura, confusional or hemiplegic migraine, onset of migraine in later life, aura without accompanying headache, side-locked migraine, and posttraumatic migraine.³⁶

WMH are more frequently detected on MRI in individuals with migraine with aura than in those without aura. Their clinical significance is rooted in the documented correlation between migraine with aura and an elevated risk of ischemic stroke, especially among younger women and individuals with supplementary vascular risk factors like smoking or the use of oral contraceptives.³⁷⁻³⁹ The occurrence of WMH in migraine with aura is believed to indicate underlying small vessel alterations or temporary hypoperfusion associated with cortical spreading depression, the physiological mechanism of aura, which may lead to microvascular damage and heightened vulnerability to cerebrovascular incidents.^{37,38,40} In contrast, migraine without

aura rarely exhibits such MRI abnormalities. The disparity is probably because of the lack of cortical spreading depression and the related hemodynamic variations in migraine without aura, leading to reduced microvascular stress and fewer structural alterations identifiable by MRI.^{40,41} Moreover, migraine is primarily a dysfunction of aberrant brain activity rather than structural anomalies, resulting in most individuals, particularly those without aura, exhibiting normal MRI scans. Thus, WMH findings in migraine with aura may serve as a marker for elevated vascular risk, underlining the necessity of monitoring and controlling modifiable risk factors in this population.

One advantage of the present study is the enrolment of patients from both the Internal Medicine department at Aster Hospital and the neurology specialists in peripheral clinics, reflecting the real-world structure of the Aster Healthcare network in Doha. This approach ensured that both general and specialized headache cases were accurately captured and assessed using standardized diagnostic protocols. By involving neurologists from peripheral centers, we enhanced diagnostic accuracy and provided a more comprehensive representation of primary headache disorders in the study population.

Limitations

The current study offers significant insights into the prevalence, demography, and characteristics of numerous headache syndromes; nevertheless, its single-centre design may introduce bias and restrict generalizability throughout the diverse Middle Eastern region. The study notably lacks longitudinal data on MRI findings, particularly regarding the growth of white matter hyperintensities (WMHs), hence limiting comprehension of their clinical importance over time. The lack of treatment outcome analysis and follow-up data constrains the evaluation of the efficacy of personalized management methods derived from clinical and radiological characteristics, underscoring a potential avenue for further investigation.

Recommendations

The discrepancies in incidence rates among various studies underscore the necessity for focused genetic and environmental studies in the Middle

East. Large-scale genome-wide association studies (GWAS) and whole-exome sequencing in Middle Eastern populations should be prioritized to uncover distinct genetic risk variants for migraine and related headache diseases, as evidenced by recent studies of Arab and East Asian cohorts. Moreover, multicentre collaborations throughout the region leveraging successful frameworks such as the Mediterranean Neurosciences Network can enhance standardized data collection, facilitate environmental exposure evaluations, and promote longitudinal studies to elucidate gene environment interactions and inform the formulation of population-specific therapeutic strategies.

Conclusion

This study indicates that migraine is the most prevalent headache disorder, followed by TTH and TAC. Individuals with migraine exhibited diverse auras, ages, sexes, familial histories, headache patterns, and triggers, emphasizing the need for precise diagnosis and therapy. While the majority of MRI findings were unremarkable, patients with migraine with aura exhibited T2 hyperintensities, highlighting the role of neuroimaging in evaluation and treatment planning. The study also underscores the importance of understanding primary headache trends and demographic shifts, while variations in prevalence across comparative studies suggest racial and ethnic influences.

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Conflicting Interest (If present, give more details):

The authors declare no conflicts of interest.

References

1. Stovner LJ, Hagen K, Linde M, *et al.* The global prevalence of headache: an update, with analysis of the influences of methodological factors on prevalence estimates. *J Headache Pain.* 2022;23(1):34.
2. WHO. Migraine and other headache disorders. Fact Sheets. Geneva: World Health

- Organization; 2024 [cited 2024 Nov 7]. Available from: <https://www.who.int/news-room/fact-sheets/detail/migraine-and-other-headache-disorders>
3. Rizzoli P, Mullally WJ. Headache. *Am J Med.* 2018;131(1):17-24.
 4. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia* 2018;38(1):1-211.
 5. Wang Z, Yang X, Zhao B, *et al.* Primary headache disorders: From pathophysiology to neurostimulation therapies. *Heliyon.* 2023;9(4):e14786.
 6. Zhang Y, Huang W, Pan S, *et al.* New management strategies for primary headache disorders: Insights from P4 medicine. *Heliyon.* 2023;9(11):e22285.
 7. Lee MJ, Peng KP. Other primary headaches: Distinct clinical features and uncertain pathophysiology. *Cephalalgia.* 2023;43(3):03331024221147870.
 8. Ge R, Chang J, Cao Y. Headache disorders and relevant sex and socioeconomic patterns in adolescents and young adults across 204 countries and territories: an updated global analysis. *J Headache Pain.* 2023;24(1):110.
 9. Ge R, Chang J. Disease burden of migraine and tension-type headache in non-high-income East and Southeast Asia from 1990 to 2019. *J Headache Pain.* 2023;24(1):32.
 10. Buse DC, Reed ML, Fanning KM, *et al.* Comorbid and co-occurring conditions in migraine and associated risk of increasing headache pain intensity and headache frequency: results of the migraine in America symptoms and treatment (MAST) study. *J Headache Pain.* 2020;21:1-6.
 11. Hassan M, Belavadi R, Gudigopuram SV, *et al.* Migraine and stroke: in search of shared pathways, mechanisms, and risk factors. *Cureus.* 2021;13(12):e20202.
 12. Burish MJ, Rozen TD. Trigeminal autonomic cephalalgias. *Neurol Clin.* 2019;37(4):847-69.
 13. Safiri S, Kolahi AA, Noori M, *et al.* Burden of tension-type headache in the Middle East and North Africa region, 1990-2019. *J Headache Pain.* 2022;23(1):77.
 14. Benamer HT, Deleu D, Grosset D. Epidemiology of headache in Arab countries. *J Headache Pain.* 2010;11(1):1-3.
 15. Al Jumah M, Al Khathaami AM, Kojan S, *et al.* The prevalence of primary headache disorders in Saudi Arabia: a cross-sectional population-based study. *J Headache Pain.* 2020;21:1-9.
 16. Liu H, Dong M, Liu K, *et al.* Status of diagnosis and preventative treatment for primary headache disorders: real-world data of unmet needs in China. *J Headache Pain.* 2023;24(1):119.
 17. Li XY, Yang CH, Lv JJ, *et al.* Correction: Global, regional, and national epidemiology of migraine and tension-type headache in youths and young adults aged 15–39 years from 1990 to 2019: findings from the global burden of disease study 2019. *J Headache Pain.* 2023;24(1):156.
 18. Vosoughi K, Stovner LJ, Steiner TJ, *et al.* The burden of headache disorders in the Eastern Mediterranean Region, 1990-2016: findings from the Global Burden of Disease study 2016. *J Headache Pain.* 2019;20:1-3.
 19. Lucas C. Migraine with aura. *Revue Neurologique (Paris).* 2021;177(7):779-784.
 20. Genc H, Baykan B, Bolay HA, *et al.* Cross-sectional, hospital-based analysis of headache types using ICHD-3 criteria in the Middle East, Asia, and Africa: the Head-MENAA study. *J Headache Pain.* 2023;24(1):24.
 21. Alsaadi T, Al Madani A, Alhatou M, *et al.* Prevalence, treatment, and unmet needs of migraine in the Middle East: A systematic review. *Pain Ther.* 2025;14(1):145-183.
 22. Elzayat MA, Kassab SA, Nada MAF, *et al.* Burden of hidden migraine among the Arab general population: a cross-sectional study. *J Headache Pain.* 2025;26(1):45.

23. Al Harbi A, Alzahrani NH, Alsuhibany HA, *et al.* Environmental triggers in migraine patients in Riyadh: A cross-sectional study. *Middle East J Fam Med.* 2021;19(12):18-26.
24. Straube A, Andreou A. Primary headaches during lifespan. *J Headache Pain.* 2019;20:1-4.
25. Peng KP, Takizawa T, Lee MJ. Cluster headache in Asian populations: Similarities, disparities, and a narrative review of the mechanisms of the chronic subtype. *Cephalalgia.* 2020;40(10):1104-12.
26. Delaruelle Z, Ivanova TA, Khan S, *et al.* Male and female sex hormones in primary headaches. *J Headache Pain.* 2018;19:1-2.
27. Harder AV, Terwindt GM, Nyholt DR, *et al.* Migraine genetics: Status and road forward. *Cephalalgia.* 2023;43(2):03331024221145962.
28. Ravishankar K. 'Hair wash' or 'head bath' triggering migraine-observations in 94 Indian patients. *Cephalalgia.* 2006;26(11):1330-4.
29. El-Metwally A, Toivola P, AlAhmary K, *et al.* The epidemiology of migraine headache in Arab countries: a systematic review. *Sci World J.* 2020;2020(1):4790254.
30. Pellegrino AB, Davis-Martin RE, Houle TT, *et al.* Perceived triggers of primary headache disorders: a meta-analysis. *Cephalalgia.* 2018; 38(6):1188-98.
31. Uggetti C, Squarza S, Longaretti F, *et al.* Migraine with aura and white matter lesions: an MRI study. *Neurolog Sci.* 2017;38:11-3.
32. Eikermann-Haerter K, Huang SY. White matter lesions in migraine. *Am J Pathol.* 2021;191(11):1955-62.
33. Hansen JM, Charles A. Differences in treatment response between migraine with aura and migraine without aura: lessons from clinical practice and RCTs. *J Headache Pain.* 2019;20(1):96.
34. Chong CD, Schwedt TJ, Trivedi M, *et al.* The characteristics of White matter hyperintensities in patients with migraine. *Frontiers Pain Res.* 2022;3:852916.
35. Alturkustani A, Bock Y, Bajunaid K, *et al.* Significant incidental brain magnetic resonance imaging findings in migraine headache patients: retrospective cross-sectional study. *Clin Neurol Neurosurg.* 2020;196:106019.
36. Evans RW, Burch RC, Frishberg BM, *et al.* Neuroimaging for migraine: The American Headache Society systematic review and evidence-based guideline. *Headache.* 2020;60 (2):318-36.
37. Øie LR, Kurth T, Gulati S, *et al.* Migraine and risk of stroke. *J Neurol Neurosurg Psychiatry.* 2020;91(6):593-604.
38. Dobrynina LA, Suslina AD, Gubanov MV, *et al.* White matter hyperintensity in different migraine subtypes. *Sci Rep.* 2021;11(1):10881.
39. Swartz RH, Kern RZ. Migraine is associated with magnetic resonance imaging white matter abnormalities: A meta-analysis. *Arch Neurol.* 2004;61(9):1366–1368.
40. Negm M, Housseini AM, Abdelfatah M, *et al.* Relation between migraine pattern and white matter hyperintensities in brain magnetic resonance imaging. *Egypt J Neurol Psychiatr Neurosurg.* 2018;54(1):24.
41. Kincses ZT, Veréb D, Faragó P, *et al.* Are migraine with and without aura really different entities? *Front Neurol.* 2019;10:982.