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Research Article

Exploring the Prevalence of Migraine, Tension-Type Headaches, and Depression in Makkah: A Cross-sectional Study

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ABSTRACT

(1) Background/ Purpose of the research: Migraine, tension-type headache (TTH), and depression are prevalent conditions that significantly impact global populations. This study aimed to assess the prevalence of migraine, TTH, and depression in Makkah, Saudi Arabia.

(2) Materials/methods: A cross-sectional study was conducted among the general population of Makkah, Saudi Arabia, using an online, self-administered questionnaire. Individuals aged 18 and older were recruited via social media platforms, resulting in a sample of 522 participants selected through convenience sampling. Descriptive statistics were calculated using SPSS version 22, with population characteristics presented as frequencies and percentages. The Chi-square test and multivariable logistic regression assessed correlations, with statistical significance set at $P < 0.05$.

(3) Results: Among 522 participants, 66.7% were female. Tension-type headache (TTH) was reported by 74.1%, while 25.9% had migraines. Depression prevalence was 56%, higher in migraine sufferers (53.3%) than in those with TTH (43.3%) (P=0.046). Migraine patients had a significantly higher risk of depression (ADR=2.02, 95% CI= [1.03-2.70], P<0.001).

(4) Conclusions: This study highlights the high prevalence of TTH and the significant association between headaches and depression in the Saudi population. The findings emphasize the importance of raising awareness, facilitating early diagnosis, and improving the management of these conditions to reduce their impact on quality of life. Future research should further investigate these interrelationships to guide public health initiatives.

INTRODUCTION

Headache disorders, including migraines and tension-type headaches (TTH), are among the most prevalent and debilitating neurological conditions worldwide (Robbins, 2021). Migraines are characterized by recur-ring headaches often accompanied by nausea, vomit-ing, and heightened sensitivity to light, sound, or smell (Desouky, Zaid, & Taha, 2019). In contrast, TTH pre-sents as diffuse, pressing, or tightening head pain re-sembling a constricting band (Burch, 2019). It is typical-ly bilateral, of mild to moderate intensity, and does not worsen with routine physical activities (Bamalan et al., 2021; Caponnetto et al., 2021). Unlike migraines, TTH is not associated with nausea or vomiting and often lacks sensory hypersensitivity (Robbins, 2021). Both conditions are diagnosed using well-defined clinical cri-teria. Globally, headache disorders rank as the third leading cause of disability, with migraines being the sec-ond-largest contributor to years lived with disability (YLD) (Bendtsen, Ashina, Moore, & Steiner, 2016). Mi-graine prevalence varies with age and gender, increasing during puberty and affecting approximately 20% of adult females and 10% of adult males (Victor, Hu,

Campbell, Buse, & Lipton, 2010). Beyond middle age, prevalence stabilizes at around 5% in males and 5–10% in females (Victor et al., 2010). TTH is even more wide-spread, with an estimated prevalence of 30–70% in the general population (Rajeh, Awada, Bademosi, & Ogun-niyi, 1997; Victor et al., 2010).

Depression is a highly prevalent psychiatric condition, affecting over 264 million individuals worldwide (Desouky, Zaid, & Taha, 2019). According to the Diag-nostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), major depressive disorder (MDD) is characterized by persistent symptoms such as a de-pressed mood, significantly reduced interest or pleasure in most activities, feelings of worthlessness or ex-

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cessive guilt, sleep disturbances (insomnia or hypersomnia), psychomotor agitation or retardation, fatigue, signifi-cant weight or appetite changes, impaired concentra-tion, and re-current thoughts of death or suicide (ALJadani, Alshammari, Alshammari, Althagafi, & AlHarbi, 2021). These symptoms must cause clinically significant distress or impairment in so-cial, occupation-al, or other areas of functioning (ALJadani et al., 2021).

The global prevalence of MDD varies across countries, av-eraging around 6% (Al Jumah et al., 2020). It is esti-mated that approximately one in five individuals will experience at least one depressive episode in their life-time (Al Jumah et al., 2020; Malhi & Mann, 2018). In Saudi Arabia, MDD has a prevalence of 6%, making it the third most common mental health disorder in the country (Al Jumah et al., 2020). A 2020 cross-sectional study in Saudi Arabia involving 2,421 partici-pants iden-tified TTH as the most frequent headache type, ac-counting for 42.9% of cases, followed by migraines at 28.7% (Al Jumah et al., 2020).

The relationship between primary headaches, including mi-graines and TTH, and depression is complex, involv-ing bio-logical, psychological, and social mechanisms (Caponnetto et al., 2021). Epidemiological studies con-sistently demonstrate a strong association between pri-mary headaches and psychi-atric conditions, with de-pression being one of the most com-mon comorbid dis-orders (Bera, Khandelwal, Sood, & Goyal, 2014). Previ-ous research indicates a bidirectional relation-ship be-tween depression, migraines, and TTH, suggesting shared pathophysiological mechanisms. Neurochemical im-balances, particularly serotonin and dopamine, play a crucial role in mood regulation and pain perception (Fidaleo, Caval-lucci, & Pani, 2017; McWilliams, Good-win, & Cox, 2004). Additionally, lifestyle and environ-mental factors—such as chronic stress, inadequate sleep, and physical inactivity—ex-acerbate symptoms, reinforcing a cyclical relationship among these condi-tions. Understanding these mechanisms is essen-tial for developing integrated treatment strategies that address both neurological and psychiatric dimensions, ultimate-ly im-proving patient outcomes (Zhao et al., 2023).

A large population-based study found that individuals with depression have a 30% higher risk of developing migraines, while those with existing migraines are twice as likely to ex-perience depression and four times more likely to develop TTH (Giri, Tronvik, & Hagen, 2022; Hagen, Giri, & Tronvik, 2021). Furthermore, Amoozegar (2017) identified MDD as the most frequently observed psychiatric comorbidity among migraine sufferers. Among individuals with migraines, the prevalence of co-occurring psychiatric disorders ranges from 69% to 87%, significantly higher than the 45% to 56% ob-served among those with TTH (Amoozegar, 2017; Bera, Khandelwal, Sood, & Goyal, 2014).

Despite the significant public health implications, few stud-ies have explored the co-occurrence of migraines, TTH, and depression in Saudi Arabia. Most existing research on head-ache disorders and mental health is based on Western popula-tions, limiting understanding of the cultural, genetic, and life-style factors that may influence these conditions in the Saudi context (Santo-mauro et al., 2021). The co-occurrence of migraine, TTH, and depression presents a significant health-care burden and economic cost in Saudi Arabia (ALJadani, Alshammari, Alshammari, Althagafi, & AlHarbi, 2021). The scarcity of research on these conditions in the local context impedes effective healthcare planning and re-source alloca-tion. Targeted studies that look at treat-ment gaps can help with personalized interventions, better patient outcomes, and lowering the long-term effects on society and the economy. For example, a study among Saudi female students at Taif University found a notable prevalence of both migraine and TTH, with a significant association with depression (Desouky, Zaid, & Taha, 2019). This study is essential for three primary reasons: 1) Cultural relevance: The lifestyle, dietary patterns, healthcare accessibility, and mental health stigma in Saudi Arabia contrast significantly with those in Western countries. Examining these issues with-in the Saudi population yields a clearer understanding of the influence of these factors on the prevalence and impact of these disorders. 2) Healthcare plan-ning: Ana-lyzing the prevalence of headaches and depression in Saudi Arabia can inform policymakers regarding re-source distribution and the development of mental health and neurol-ogy services (ALJadani, Alshammari, Alshammari, Althagafi, & AlHarbi, 2021). 3) Public awareness and early intervention: This research aids in identifying at-risk populations and pro-motes early screening and intervention, which are essential for miti-gating the long-term impact of comorbid headaches and depression (Robbins, 2021).

This study aimed to determine the prevalence of de-pression among individuals experiencing migraine headaches and TTH in Makkah, Saudi Arabia. By ex-ploring the coexistence of these conditions, the research seeks to fill critical gaps in the literature, providing valu-able insights that can inform health-care strategies and interventions. This cross-sectional study's findings can guide future research on the relationship between prima-ry headaches and psychiatric comorbidities. Ultimately, these insights are intended to enhance the understand-ing of these overlapping conditions and contribute to improving the health and well-being of the Saudi popu-lation.

2. MATERIALS AND METHODS

2.1 Study Design and Population

We conducted a cross-sectional study in Makkah, Saudi Ara-bia, between December 2022 and August 2023, tar-geting individuals aged 18 and older. Makkah, a city of immense cultural and religious significance, attracts a diverse and tran-sient population. Therefore, to maintain the study's relevance and accuracy, we ensured that only permanent residents of Makkah were included. The study adhered to the Strength-ening the Reporting of Observational Studies in Epidemiol-ogy (STROBE) Statement Checklist to ensure methodological transpar-ency, completeness, and compliance with established guidelines for observational research (Cuschieri, 2019).

Participant recruitment was conducted online via social me-dia platforms, targeted digital advertisements, and local on-line community groups. This recruitment strate-gy allowed for broad outreach while maintaining acces-sibility and con-venience for participants. To ensure that only Makkah resi-dents were included, we incorporated a mandatory screening

question in the survey, requiring participants to confirm their residency. This precaution helped prevent the inadvertent inclusion of individuals from other regions of Saudi Arabia, thereby strengthen-ing the study's validity and ensuring that the findings were representative of the local population.

The study included adults who self-reported a physi-cian-confirmed diagnosis of migraines or TTH by re-sponding to a diagnostic confirmation question. Eligibil-ity criteria included a confirmed medical diagnosis of at least one of these conditions and a willingness to partic-ipate in the study. Individuals without a history of headaches or depression, as well as those who declined participation, were excluded. This strict eligibility criteri-on ensured the reliability of the findings by minimizing the inclusion of undiagnosed cases.

To determine the appropriate sample size, we utilized Epi Info software (version 2.1). The calculation, based on a 50% prevalence estimate, a 5% margin of error, a 95% confidence level, and a 1.5 design effect (to ac-count for potential variability in online recruitment), yielded a required sample size of 384 participants. However, to mitigate the risk of non-response bias and incomplete data, we increased the final sample size to 522 participants.

Data collection was conducted using a validated online questionnaire adapted from previous research (Desouky, Zaid, & Taha, 2019). To ensure linguistic accessibility and cultural appropriateness, the question-naire was translated from English into Arabic by two independent multilingual translators. This step ensured that the survey was comprehensible to Arabic-speaking participants while preserving the accuracy and consistency of the original content.

Before launching the main study, we conducted a pilot study with 20% of the target sample, approximately 104 participants, to assess the clarity, reliability, and validity of the translated questionnaire. The pilot study participants were recruited using the same eligibility cri-teria and online methods as the main study to ensure a representative sample. The primary objective was to identify ambiguities, assess participant understanding, and evaluate the internal consistency of survey items.

Pilot study feedback was systematically analyzed to identify unclear or confusing questions. Common issues in open-ended responses were reviewed, and descriptive statistics were used to evaluate missing or inconsistent data. Based on participant feedback, minor modifica-tions were made to improve clarity, including refining medical terminology and enhancing response options for severity scales. These adjustments helped optimize the questionnaire's effectiveness before full-scale im-plementation.

2.2 Study Questionnaire and Survey

The questionnaire included four sections: Initially, we collected sociodemographic information, which includ-ed fundamental demographic details such as age, gen-der, and educational background. In the second section, we identified the symptoms of depression. Third, mi-graine occurrence: This section evaluated the frequency and characteristics of migraine headaches. Fourthly, we analyzed the prevalence of TTH in this section.

At the beginning of the survey, participants provided their informed consent to participate in the study.

The primary outcomes of this study were the prevalence rates of migraine, TTH, and depression among the par-ticipants who lived in Makkah.

2.3 Methods of Assessment:

Patients with a prior diagnosis of migraine or TTH were asked about their family history, medical consultations for headaches, types of medications used, frequency of analgesic consumption, escalation of analgesic dosage over time, increase in headache frequency following analgesic use, and overall headache frequency. These questions were adapted from a previous study (Desouky, Zaid, & Taha, 2019).

Depression was assessed using a validated screening tool (likely a well-known scale like the Patient Health Questionnaire-9 (PHQ-9)) designed to identify depres-sive symptoms (Kroenke, Spitzer, & Williams, 2001). The assessment methods were consistent across all par-ticipants, regardless of their group (migraine, TTH, or both). This ensured uniformity in the evaluation of de-pression and headache conditions across the sample. By utilizing a cross-sectional design, this study aimed to provide a snapshot of the prevalence of these conditions within the Makkah population and identify poten-tial links between migraine, TTH, and depression.

2.4 Data Analysis

The statistical analysis utilized SPSS version 22 (IBM, Armonk, USA). We used descriptive statistics to sum-marize population characteristics, presenting categorical variables as frequencies and percentages. We organized sociodemographic data for clarity and generated cross-tabulations to examine relationships among variables. Chi-square test assessed the significance of these rela-tionships, with P-value <0.05 considered statistically significant. This method facilitated the assessment of possible correlations and patterns within the data. We excluded missing data from the analysis to maintain the validity of the findings. Explanatory variables in-clude gender, age, and sociodemographic factors, in-cluding smoking and marital status. Predictors involve pre-existing health conditions, including a history of headaches and psychiatric disorders. We assessed and controlled sociodemographic factors and effect modifi-ers using a structured online questionnaire, collecting data on age, gender, income status, education levels marital status, and smoking habits. Multivariable lo-gistic regression adjusted for confounders including age, gender income status, education levels smoking, and marital status, to evaluate their independent associa-tions. We did not explicitly conduct subgroup analyses, but we examined relationships among key variables via cross-tabulations to explain interactions.

2.5 Ethical approval

We obtained ethical approval from the Biomedical Eth-ics Council affiliated with Umm Al-Qura University in Makkah, Saudi Arabia. The alphanumeric code, Ap-proval No. (HAPO-02-K-012-2022-11-1250), serves as the unique iden-

tifier assigned to this approval.

3. RESULTS

The study analyzed data from 522 participants. Among the respondents, 72.2% were under the age of 30, and 66.7% were female. Most participants (72%) reported being single, with 43.6% indicating a household income ranging from 5,000 to 15,000 SR. Regarding education-al status, 33% held a bachelor's degree, while 32% were currently undergraduate students. Additionally, 83.3% of the respondents identified as non-smokers. In terms of headache types, 74.1% of participants reported ex-periencing TTH, while 25.9% reported having migraines. These findings highlight the demographic characteristics and headache prevalence within the study population (Table 1).

Table 1: Demographic characteristics of the adult population in Makkah, Saudi Arabia (N = 522).

Variable	Category	Number of respondents (N=522)	Percentage
Age	years 30>	377	72.2
	years or 30 more	145	27.8
Gender	Female	348	66.7
	Male	174	33.3
Household income	Less than 5000 SAR	108	20.6
(in SAR)	SAR 5000-15000	228	43.6
	15000-25000 SAR	77	14.7
	Above 25000 SAR	109	21.1
Education level	High school diploma	64	12.2
	Finished high school	82	15.8
	Undergraduate student	167	32
	Bachelor's degree	172	33
	Graduate degrees such as master's or PhD	37	7
Marital status	Single	376	72
	Married	146	28
Smoking status	No	435	83.3
	Yes	87	16.7
Headache type	TTH	387	74.1
	Migraine headache	135	25.9

Among those with migraines, around 71% stated that their headaches significantly interfered with academic activities and quality of life. Most participants (60%) rated their headache intensity as moderate. Stress and anxiety were the most commonly identified triggers for migraines. Furthermore, 86.7% of migraine sufferers experienced irregular sleep patterns, while 87.4% report-ed frequent migraine episodes. In terms of frequency, 48.9% experienced migraines on a monthly to yearly basis, and 31% endured headaches daily or weekly. Our findings revealed that around 52% of participants did not report a familial history of migraines, while 48% had a positive family history. Among those who sought treatment, 29.6% relied on analgesics for migraine relief. 42.1% of participants received advice to use analgesics from family members, while 34.7% received similar recommendations from physicians. Regarding analgesic use, around 39% reported taking these medications monthly to yearly, whereas 36.8% used them daily to weekly. Notably, 79% of participants reported no in-crease in headache frequency following analgesic use. However, 41% of individuals with migraines indicated they had increased their dosage over time. Paracetamol or Acetaminophen was the most commonly used analge-sic, employed by 54.7% of participants, followed by aspirin at 30.5% (Table 2).

Table 2: Characteristic of patients with migraine headache, Makkah, Saudi Arabia, (N = 135)

Variable	Category	Number of respondents (N=135)	Percentage
Headaches limit the ability to study or enjoy life	Yes	96	71.1
	No	39	28.9
Severity of migraine attacks	Mild	19	14.1
	Moderate	81	60
	Sever	35	25.9
Migraine triggers	Stress or anxiety	118	87.4
	Irregular sleep	117	86.7
	Menstruation	55	40.7
	Smoking	35	25.9
	Much reading	65	48.1
	Noise	101	74.8
	Exposure to sun	82	60.7
Frequency of migraine per month	Daily	18	13.3
	Daily to weekly	42	31.1
	Weekly to monthly	9	6.7
	Monthly to yearly	66	48.9
Family history of migraine	Yes	65	48.1
	No	70	51.9

Seeking medical care for migraine	Yes	40	29.6
	No	95	70.4
Using analgesics for migraine	Yes	95	70.4
	No	40	29.6
Advice to take analgesics was by	Physician	33	34.7
	Pharmacist	13	13.7
	Friends, colleagues, neighbors	9	9.5
	Family members	40	42.1
Frequency of analgesic use	Daily	11	11.6
	Daily to weekly	35	36.8
	Weekly to monthly	12	12.6
	Monthly to yearly	37	38.9
Increase in headache frequency after analgesic use	Yes	20	21.1
	No	75	78.9
Increase analgesic dose used over time	Yes	39	41.1
	No	56	58.9
Type of analgesic used	Paracetamol or Acetaminophen	52	54.7
	Ibuprofen	25	26.3
	Diclofenac sodium	10	10.5
	Aspirin	29	30.5

Table 3. highlights the significant impact of TTH on participants' daily lives, with 57% indicating disruption of their daily activities. Furthermore, 52.5% encoun-tered TTH episodes weekly to monthly. Among those affected, 51.7% reported no familial history of TTH. A significant observation is that the majority (91.7%) of individuals did not pursue medical treatment for their TTH, opting instead for self-management techniques. Analgesic utilization was widespread, with 53% indicat-ing its use for alleviating symptoms. Notably, 57% of individuals received recommendations from family members to utilize analgesics, while 52.7% indicated regular consumption of these medications on a weekly to monthly basis. Moreover, 95.1% indicated that their headache frequency remained unchanged with analge-sic use, whereas 13.2% acknowledged a rise in their dosage over time. Paracetamol or Acetaminophen was the most prevalent analgesic, selected by 69.8% of partici-pants, while ibuprofen was utilized by 20%. These find-ings emphasize the dependence on self-medication for TTH and underscore the necessity of education regard-ing effective headache management and the safe use of analgesics.

Table 3: Characteristics of patients with TTH, Makkah, Saudi Arabia, (N = 387)

Variable	Category	Number of respondents (N=387)	Percentage
Headache affecting daily activities	Yes	221	57.1
	No	166	42.9
Frequency of TTH per month	Daily	16	4.1
	Daily to weekly	104	26.9
	Weekly to monthly	203	52.5
	Monthly to yearly	64	16.5
Family history of TTH	Yes	187	48.3
	No	200	51.7
Seeking medical care for TTH	Yes	32	8.3
	No	355	91.7
Using analgesics for migraine	Yes	205	53
	No	182	47
Advice to taker analgesics was by	Physician	27	13.2
	Pharmacist	37	18
	Friends, colleagues, neighbors	24	11.7
	Family members	117	57.1
Frequency of analgesic use	Daily	11	5.4
	Daily to weekly	51	24.9
	Weekly to monthly	108	52.7
	Monthly to yearly		
Increase in headache frequency after analgesic use	Yes	10	4.9
	No	195	95.1
Increase analgesic dose used over time	Yes	27	13.2
	No	178	86.8

Our study demonstrates a significant and statistically meaningful difference in the prevalence of depression between individuals with migraine headaches and those with TTH. Depression was reported in 53.3% of partici-pants with migraines compared to 46.7% of those with-out depression. Among individuals with TTH, 43.3% had depression, while 56.7% did not, with this difference reaching statistical significance (P = 0.046) (Figures 1 and 2).

Figure 1. Prevalence of depression among patients with migraine headaches, Makkah, Saudi Arabia (N = 135)

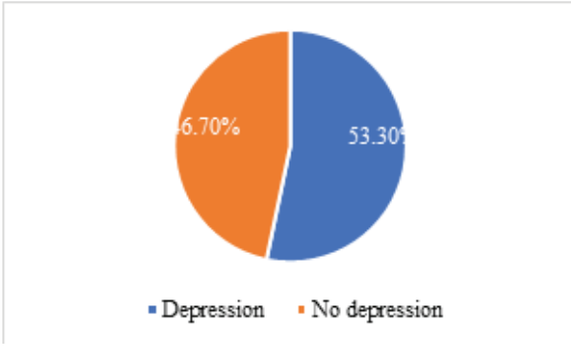
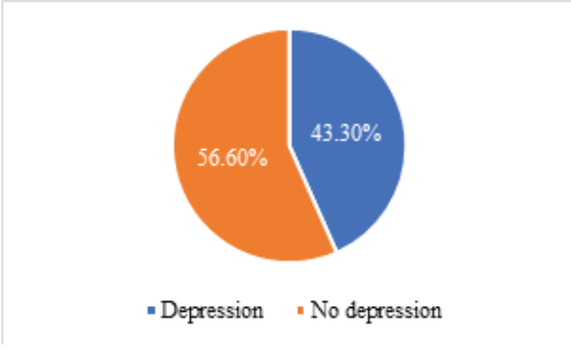


Figure 2. Prevalence of depression among patients with TTH, Makkah, Saudi Arabia, (N = 387)



Overall, the findings revealed that the prevalence of depression within the study population was 56%, under-scoring the substantial burden of mental health condi-tions among individuals experiencing primary headache disorders (Table 4).

Table 4: Chi-square reporting the prevalence of depression among individuals with migraine headaches and those with TTH, Makkah, Saudi Arabia (N= 522)

Variable	Category	Depression		No depression		P-value
		Number of responds	Percentage	Number of responds	Percentage	
Type of Headache	Migraine	72	53.3	63	46.7	0.046
	TTH	168	43.3	219	56.6	

The logistic regression analysis revealed several significant associations between demographic and socioeconomic factors and the likelihood of reporting depression. The analysis revealed that individuals with migraine headaches had a significantly higher likelihood of having depression compared to those who reported TTH (ADR=2.02, 95% CI= [1.03-2.70], P-value = <0.001). (see Table 5

Table 5. Logistic regression for the odds of reporting depression adjusting for individuals with migraine and TTH headaches, age, gender, education level, household income, marital status, smoking status, Makkah, Saudi Arabia (N= 522)

Variable	Categories	Adjusted OR	P-Value	Conf. 95% Interval	
				Lower)) ((Upper	
Headache	TTH (Reference)	Ref	Ref	Ref	Ref
	Migraine	2.02	< 0.00	1.03	2.7
Age	less than 30 years (Reference)	1.82	< 0.00	1.4	2.84
	years or more 30	Ref	Ref	Ref	Ref
Gender	Male (Reference)	Ref	Ref	Ref	Ref
	Female	1.5	0.02	1.18	2.52
Education Level	High school diploma	2.32	< 0.00	1.04	2.89
	Undergraduate student	1.83	0.01	1.07	2.49
	Finished high school but did not graduate	1.23	0.02	1.21	2.13
	Bachelor's degree	1.22	< 0.00	1.01	1.58
	Graduate degree such as master's or PhD (Reference)	Ref	Ref	Ref	Ref
Household Income	Less than 5000	3.35	< 0.00	1.55	3.71
	SAR 5000-15000	1.28	0.6	-0.53	3.24
	SAR 15000-25000	1.81	0.28	-0.62	2.89
	Above 25000 SAR	Ref	Ref	Ref	Ref
Marital Status	Single	1.24	0.08	-0.29	1.96
	Married	Ref	Ref	Ref	Ref
Smoking Status	Yes	1.38	0.07	-0.17	1.89

Individuals aged less than 30 years had a significantly higher likelihood of reporting depression compared to those aged 30 years or more (AOR = 1.82, 95% CI = [1.40–2.84], P-value < 0.001). Females had a significantly higher likelihood of reporting depression compared to males (AOR = 1.50, 95% CI = [1.18–2.52], P-value = 0.02). Education level was also significantly associated with depression. Participants with a high school diploma had a higher likelihood of reporting depression compared to those with a graduate degree (AOR

= 2.32, 95% CI = [1.04–2.89], P-value < 0.001). Similarly, undergraduate students (AOR = 1.83, 95% CI = [1.07–2.49], P-value = 0.01), individuals who finished high school but did not graduate (AOR = 1.23, 95% CI = [1.21–2.13], P-value = 0.02), and those with a bachelor's degree (AOR = 1.22, 95% CI = [1.01–1.58], P-value < 0.001) had significantly higher odds of reporting depression compared to those with a graduate degree

Household income also played a significant role in de-pression risk. Individuals earning less than 5000 SAR had significantly higher odds of reporting depression compared to those earning above 25000 SAR (AOR = 3.35, 95% CI = [1.55–3.71], P-value < 0.001). While the marital status and smoking status variables did not show statistically significant associations, the trend sug-gests that single individuals and smokers may have a higher likelihood of reporting depression.

4. DISCUSSION

This study is among the few that examine the preva-lence and impact of migraines, TTH, and depression in Makkah, Saudi Arabia. Our findings provide valuable insights into prevalence rates, demographic variations, comorbidities, and healthcare-seeking behaviors. The intricate relationship between migraines, TTH, and de-pression is influenced by biological, psychological, and environmental factors. Neurochemical imbalances, par-ticularly in serotonin and dopamine, affect both pain perception and mood regulation, contributing to their co-occurrence. Additionally, chronic headache pain may trigger depression, while depression heightens pain sensitivity. Environmental stressors, including poor sleep, sedentary lifestyles, and social isolation, further exacerbate these conditions (Fidaleo, Cavallucci, & Pani, 2017).

The existing literature indicates a significant association between primary headaches and depression, with de-pression frequently identified as a common comorbidity among individuals experiencing headaches (Bera, Khandelwal, Sood, & Goyal, 2014). The findings of the present study support the existence of a connection between migraine headaches, TTH, and depression. In particular, the research reveals a notably high preva-lence of depression (53.3%) among individuals with migraines. These results align with previous studies conducted in Saudi Arabia and the United States (Breslau, Davis, & Andreski, 1991; Robbins, 2021). However, the current findings contrast with previous research that reported a lower prevalence of depression among indi-viduals with migraines. For example, a study in the United States found a prevalence rate of 28.5%, while another study in Zurich reported a rate of 14.7%. Addi-tionally, a study in India reported a prevalence rate of 37.5% (McWilliams, Goodwin, & Cox, 2004; Merikangas, Angst, & Isler, 1990). The observed variations in findings may stem from methodological differences between the present study and others, such as the study conducted in Zurich. In this study, depression preva-lence was assessed exclusively using the PHQ-9. In con-trast, the Zurich study employed cohort design and in-corporated structured interviews conducted by psychia-trists and psychologists to evaluate psychiatric disor-ders, utilizing alternative diagnostic criteria (McWilliams, Goodwin, & Cox, 2004). Similarly, the Indian study adopted a more comprehensive approach by involving neurologists and psychiatrists in assessing neurological status and psychiatric comorbidities. De-pression diagnosis in the Indian study was made using the Mini International Neuropsychiatric Interview, a widely recognized diagnostic tool (Merikangas, Angst, & Isler, 1990). These methodological differences, includ-ing the use of diverse diagnostic tools and multidiscipli-nary evaluations, are likely to contribute to the ob-served discrepancies in depression prevalence rates across studies.

This study reported a TTH prevalence of 74.1%, align-ing with the global range of 12% to 78% documented in prior research on the general population (Stovner et al., 2007). However, a previous study in Saudi Arabia iden-tified a notably lower prevalence of 34.1%, while a simi-lar study conducted in Korea reported an even lower rate of 21.1% (Al Jumah et al., 2020; Song et al., 2016). The current study's higher prevalence may be due to its reliance on a less robust diagnostic tool for identifying TTH or migraine cases, which differs from the estab-lished diagnostic criteria commonly used in other stud-ies. Additionally, the use of an online self-reported questionnaire, which can introduce bias and variability in responses, might have further contributed to the elevat-ed prevalence rate. This highlights the need for stand-ardized diagnostic tools and methodologies in future research to ensure more reliable and comparable find-ings.

The present study identified a migraine prevalence of 25.9%, which is consistent with findings from a prior study conducted in Saudi Arabia reporting a similar prevalence of 25% (Al Jumah et al., 2020). In contrast, a global study on the general population reported a higher incidence rate of 37.2% (Bamalan et al., 2021). A study conducted in Thugbah, Saudi Arabia, reported a notably lower migraine prevalence of 5%, while an-other study in Qassim region reported an even lower rate of 2.6% (Rajeh, Awada, Bademosi, & Ogunniyi, 1997). The variation in prevalence rates observed in the Thug-bah study may be attributed to the implementation of more rigorous diagnostic protocols, including detailed physical examinations, laboratory testing, radiological imaging, and neurodiagnostic evaluations to confirm migraine diagnoses among individuals initially identified as positive through questionnaire screening (Rajeh, Awada, Bademosi, & Ogunniyi, 1997). Conversely, the lower prevalence in the Qassim study could be ex-plained by the use of thorough physical and neurologi-cal examinations aimed at ruling out secondary causes of headaches, such as papilledema, cranial neuropathy, and focal neurological deficits (Abduljabbar, Ogunniyi, Al Balla, Alballaa, & Al-Dalaan, 1996). Disparities in sampling methods, diagnostic criteria, and research pro-tocols across these studies likely account for differences in migraine and TTH prevalence rates when compared to our findings (Steiner et al., 2013).

Our findings align with previous studies indicating that younger age, female gender, lower education, and lower income are significant predictors of depression (Felm-ingham T et al, 2022; Klimesch, A et al, 2024). Similar studies reported higher depression rates in younger indi-viduals and females due to psychosocial stressors. Low-er education and income were linked to increased vul-nerability, consistent with research highlighting socioec-onomic disparities in mental

health (Felmingham T et al, 2022; Klimesch, A et al, 2024).

In this study, stress and anxiety emerged as the most common triggers for migraines, affecting 87.4% of cas-es. This finding is consistent with a previous study from Taif, Saudi Arabia. Additionally, 51.9% of migraine sufferers and 51.7% of TTH patients reported no family history of these conditions. This result contrasts with studies conducted in Yemen and Jordan, which reported a stronger familial link for these headaches (Abdo, Amood AL-Kamarany, Alzoubi, Al-Maktari, & Al-Baidani, 2014; Alzoubi et al., 2009).

Several factors may contribute to the discrepancies ob-served across studies, including nutritional status, envi-ronmental influences, cultural and ethnic backgrounds, genetic predispositions, and climate variations (Victor et al., 2010). Additionally, social and demographic varia-bles—such as smoking status, marital status, and socio-economic background—may independently influence both depression and headache disorders, complicating causal interpretations (Vgontzas, Pavlović, & Bertisch, 2023). For instance, individuals experiencing chronic stress due to financial instability or social isolation may be at a higher risk of developing both conditions. These findings underscore the importance of considering these factors in epidemiological research (Burch, Rizzoli, & Loder, 2018).

Also, gender and age are important effect modifiers that can change how strong or which way the links are be-tween these disorders (Giri, Tronvik, & Hagen, 2022; Hagen, Giri, & Tronvik, 2021). Epidemiological studies suggest that women exhibit a significantly higher preva-lence of both migraines and depression, likely due to hormonal influences and differential stress responses (Vetvik & MacGregor, 2017). Furthermore, younger people may say they have more headaches and depres-sion because of the stress of school and work, while older people may have a different pattern of symptoms because they have more than one medical condition (Dodick, 2018). Understanding these contextual differ-ences is crucial for tailoring prevention and manage-ment strategies to specific populations.

The proportion of individuals seeking medical consulta-tion for headache management was notably low (Abdo, Amood AL-Kamarany, Alzoubi, Al-Maktari, & Al-Baidani, 2014). Specifically, only 29.6% of migraine sufferers and 8.3% of those with TTH reported consult-ing a healthcare professional. These findings are con-sistent with previous studies conducted among adult populations in Jordan and Yemen, as well as among medical students in Oman (Abdo, Amood AL-Kamarany, Alzoubi, Al-Maktari, & Al-Baidani, 2014; Deleu, D., Khan, Humaidan, Al Mantheri, & Al Hashami, 2001).

In this study, participants primarily relied on family members for advice regarding the use of analgesics to manage both migraines and TTH. This trend aligns with prior research conducted in Saudi Arabia and Jordan. Furthermore, paracetamol emerged as the most com-monly used analgesic among individuals with migraines and TTH, a finding consistent with studies conducted in India, Yemen, and Oman (Abdo, Amood AL-Kamarany, Alzoubi, Al-Maktari, & Al-Baidani, 2014; Deleu, Dirk, Khan, & Al Shehab, 2002). The widespread use of paracetamol and acetaminophen can be at-tributed to their affordability and easy availability as over-the-counter medications, as highlighted in previous research (Deleu, D., Khan, Humaidan, Al Mantheri, & Al Hashami, 2001).

This study found a 56% prevalence of depression, which is different from previous research in Saudi Ara-bia. For instance, a study in Al-Ahsa reported a depres-sion prevalence of 8.6% in the general population (Al Rashed et al., 2019). Similarly, a study in Sharurah, a southeastern province of Saudi Arabia, found a preva-lence rate of 12. In Riyadh, a study among primary healthcare patients reported a prevalence of 20% (Abdelwahid & Al-Shahrani, 2011). Differences in diagnos-tic approaches and study populations may account for these variations in prevalence rates.

The current study identified a 56% prevalence of de-pression, significantly higher than previous estimates in Saudi Arabia and the broader Middle East. For instance, Al Rashed et al. (2019) reported an 8.6% prevalence in Al-Ahsa, while a study in Sharurah found a rate of 12%. In Riyadh, Abdelwahid and Al-Shahrani (2011) ob-served a 20% prevalence among primary healthcare patients (Abdelwahid & Al-Shahrani, 2011). A system-atic review by Nour et al. (2023) estimated a pooled depression prevalence of 37.35% in Saudi Arabia, with individual studies ranging from 8.64% to 88.99%. These discrepancies likely result from differences in study de-sign, diagnostic criteria, and population characteristics.

4.1 Strengths and Limitations

This study has several notable strengths. The inclusion of 522 participants represents a substantial sample size, offering robust statistical power and making it easier to apply the results to the whole population of Makkah. This large dataset facilitates a comprehensive analysis of the prevalence and impact of migraine, TTH, and depression, thereby contributing valuable knowledge to the existing literature. Another key strength is the study's integrative approach, which simultaneously examines the co-occurrence of migraine, TTH, and depression. By investigating these interrelated conditions together, the research provides a holistic perspective on their inter-play and combined impact on individuals in Saudi Ara-bia (Goadsby et al., 2017). This approach is particularly valuable for healthcare providers and policymakers aiming to address these health concerns in a more uni-fied and effective manner. The findings underscore the critical importance of recognizing depression as a com-mon comorbidity in patients with migraines, as it signifi-cantly influences both treatment outcomes and quality of life. This insight highlights the need for further re-search to elucidate the mechanisms linking these condi-tions and to inform the development of targeted, multi-disciplinary interventions for affected individuals. We should acknowledge the several limitations of this study. The cross-sectional design offers only a snapshot of the prevalence and impact of migraine, TTH, and depression at a single point in time, limiting the ability to establish causal relationships or track changes over time. Longitudinal studies would be more suitable for exploring the dynamic nature and progression of these conditions. Additionally, the use of convenience sam-pling may introduce selection bias, as participants who voluntarily participate may not represent the broader Saudi population. This

potential sampling bias affects the generalizability of the findings, as the prevalence and impact of these conditions might vary across dif-ferent subgroups.

The reliance on self-reported data, susceptible to recall bias or subjectivity, poses another limitation. Such reli-ance could affect the accuracy of prevalence rates and symptom assessments. Moreover, the absence of clini-cal diagnoses prevents a more precise determination of these health conditions. Clinical studies often report higher prevalence rates due to targeted recruitment of symptomatic individuals, whereas population-based surveys may underestimate the burden due to self-reporting biases. Furthermore, cultural factors, stigma surrounding mental health, and access to healthcare services may influence regional differences in depres-sion prevalence across Saudi Arabia and the Middle East. Standardized methodologies and comprehensive national surveys are needed to accurately assess and compare the burden of depression in these populations

5. CONCLUSION AND RECOMMENDATION

This study highlights the substantial burden of migraine, TTH, and depression in the Saudi population. The find-ings reveal significant associations between demograph-ic and socioeconomic factors and the likelihood of de-pression, with individuals suffering from migraines ex-hibiting a notably higher risk than those with TTH. These insights provide a critical foundation for future research to explore underlying risk factors, regional dis-parities, and potential interventions. By improving our understanding of these conditions, healthcare strategies can be refined to enhance early diagnosis, targeted treatment, and overall patient outcomes. Addressing this public health challenge through evidence-based policies and interventions is essential to mitigating the impact of these disorders on affected individuals and the broader healthcare system.

AUTHOR CONTRIBUTION

Conceptualization, JS, AA, and OB; Data curation, JS, AA, OA and OB; Formal analysis, JS Naser; Investiga-tion, , JS, AA, HA and OB; Methodology, JS, AA, HA, and OB; Project administration, , JS, AA, and OB; Re-sources, , JS, AA, OA, MA and OB; Supervision, JA and OB; Validation, JS and HA; Writing original draft, JS, AA, HA, OA, MA, NA, FB, MA and OB; Writing – re-view & editing, All authors.

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CONFLICT OF INTEREST

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