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# Health-related quality of life and its determinants in patients with migraine relating to the coronavirus disease 2019 pandemic in the Eastern Province of Saudi Arabia

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## Abstract:

**BACKGROUND:** Migraine is a neurological disorder associated with different levels of disability that can impact health-related quality of life (HRQoL). The management of this condition worsened with the challenges posed by the coronavirus disease 2019 (COVID-19) pandemic. This study sought to evaluate the effects of migraine on HRQoL and identify key factors contributing to these outcomes in migraineurs in relation to the COVID-19 pandemic.

**MATERIALS AND METHODS:** A cross-sectional study was carried out on 198 migraine patients between October 2022 and April 2023. HRQoL was assessed using the EQ-5D-5L comprising five domains. Data was collected by both face-to-face interviews and a self-administered online questionnaire. Categorical variables were described as frequencies and percentages while means with standard deviations or medians with interquartile ranges (IQRs) were computed for continuous variables. Chi-square test was used to assess associations of COVID-19 infection with migraine complications and HRQoL.

**RESULTS:** The majority of the cohort were predominantly females (67.7%), university graduates (79.8%), and unemployed (63.3%). About 53% of migraineurs who reported no COVID-19 infection, indicated an increase in migraine attacks during the pandemic, whereas 51.9% of the participants who had COVID-19 reported an increase in attacks ( $P = 0.894$ ). Migraineurs aged <30 years reported a significantly higher HRQoL score (median=0.94, IQR = 0.17,  $P < 0.001$ ). Participants with higher income levels reported better HRQoL (median: 0.89). Those with multi-comorbidities (median= 0.84 vs. 0.99,  $P < 0.05$ ) showed significantly lower HRQoL.

**CONCLUSION:** Study highlighted significant impact of COVID-19 on increasing frequency of migraine attacks in individuals infected with COVID-19, which in turn led to a decline in HRQoL. Correlates of poor HRQoL included advancing age, low income, presence of multiple comorbidities, and unhealthy body mass index. An urgent intervention to improve the HRQoL should be implemented after the pandemic.

## Keywords:

Coronavirus disease 2019, health-related quality of life, migraine, predictors

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## Introduction

Migraine is a primary headache disorder characterized by throbbing pain or

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a pulsing sensation, typically localized on one side of the head.<sup>[1,2]</sup> This debilitating condition often reduces productivity and can increase the number of disability-adjusted life years owing to its potential to cause chronic disabilities and thereby disrupt

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patients' social lives and daily activities.<sup>[1-3]</sup> Frequent migraine attacks and prolonged headaches particularly in individuals aged 25–55, also negatively affect work performance, leading to job instability, financial challenges, and economic loss for organizations and society.<sup>[4-6]</sup>

Globally, the prevalence of migraine ranges from 0.9% to 5.1% in the general population, with most estimates between 1.4% and 2.2%. Migraine is more common in women, with a 2.5–6.5 times higher prevalence compared to men, peaking between the ages of 18–29 and 40–49.<sup>[2,7]</sup> In Saudi Arabia, prevalence rates are generally consistent with global figures.<sup>[5,8]</sup>

The coronavirus disease 2019 (COVID-19) pandemic, as a global crisis, was widely regarded as a significant source of stress. The fear of having COVID-19 infection and the worsening of headache symptoms were of the greatest concern to the population.<sup>[1]</sup> Notably, the fear of migraine exacerbation from COVID-19 infection was perceived with nearly the same gravity as the risk of contracting the potentially life-threatening virus.<sup>[1]</sup> This provides an indication of the significant psychological and emotional burden experienced during the pandemic.<sup>[1]</sup> Worsening headaches and migraine impacted significantly on the health-related quality of life (HRQoL) of individuals with migraine.<sup>[1,2,5]</sup>

Assessing HRQoL in migraine patients is very essential for grasping the severity of the condition and informing professionals in hospitals and decision-makers about patients' concerns.<sup>[9,10]</sup> This information can help improve patients' quality of life, promote self-management, and guide interventions to prevent further negative health outcomes.<sup>[9-11]</sup>

Given its chronic nature, evaluation of the impact of migraine on HRQoL is important. A number of studies have assessed the effects of migraine and its treatments on HRQoL.<sup>[1,2,12-16]</sup> The disease's impact on HRQoL is primarily evident through discomfort, pain, anxiety, and significantly depressed mood.<sup>[1,2,12-16]</sup> For example, a study conducted in China revealed that migraines significantly impact HRQoL across various dimensions, including physical functioning, role limitations because of physical health, social functioning, and mental health.<sup>[3]</sup> In Saudi Arabia, however, only a limited number of such studies have been conducted.<sup>[4,5,16]</sup> These studies suggest that migraine patients often experience psychological issues, including anxiety and depression as well as physical symptoms such as fatigue, nausea, vomiting, and photophobia, all of which exacerbate the deterioration of HRQoL.<sup>[4,5,16]</sup> This research sought to investigate HRQoL and its predictors in patients with migraine in relation to COVID-19.

## Materials and Methods

This study was carried out between October 2022 and April 2023 as a cross-sectional study, targeting migraine patients by both face-to-face interviews and an online survey. In-person interviews were held in the outpatient pharmacy areas of King Fahd Hospital of the University at Al-Khobar, Saudi Arabia. To enhance participant reach, interviews were also conducted in community pharmacies, and the online survey link was disseminated across social media platforms including WhatsApp, Telegram, Facebook, and X (former Twitter). Eligible participants were adults aged 18 years or older diagnosed with migraine, who provided complete data. Excluded were pregnant women and individuals with concurrent psychiatric disorders. The reason for excluding pregnant women was because of the impact of pregnancy on the frequency, severity, and characteristics of migraine attacks. This variability in migraine experience during pregnancy could confound the study's assessment of the relationship between migraine and HRQoL when compared with that of nonpregnant women. In addition, patients with psychiatric illnesses were excluded as their condition could affect their ability to accurately self-report their experiences. These exclusions were made to minimize potential confounding factors and ensure the validity of the study outcome. A total of 198 migraine patients were enrolled based on these criteria. Ethical approval was obtained from the Institutional Review Board vide Letter No. IRB-2022-05-228 dated 14/06/2022, and written informed consent was taken from all participants in the study.

To evaluate HRQoL, the EQ-5D-5L, a widely validated generic instrument commonly used for various diseases, including migraine was used.<sup>[17,18]</sup> A key advantage is its capacity to transform each domain into a single quantifiable score, facilitating direct comparison across different studies.<sup>[2,9,17,18,19]</sup> The self-administered questionnaires comprised the following five domains: physical activity, personal care, daily activities, pain/discomfort, and emotional distress. Each domain consisted of five response options, from "no problems" to "extreme problems."

The Arabic version of the EQ-5D-5L system consisted of five core dimensions. Each domain is assessed on a five-level scale, ranging from 1 (no limitations) to 5 (extreme limitations).<sup>[2,17]</sup> This structure allows for the classification of several unique health states. Each health state is represented by a single summary value, referred to as the EQ-5D-5L index.<sup>[2,17]</sup> EQ-5D-5L includes a visual analog scale (EQ VAS), which is a vertical scale ranging from 0 (the worst imaginable health state) to 100 (the best imaginable health state). The VAS provides a subjective self-assessment of HRQoL.<sup>[2,17,18]</sup>

EQ-5D-5L in Arabic was utilized for the assessment.<sup>[17,18]</sup> Arabic was used in the interview, and participants' sociodemographic and other information was collected simultaneously.

The primary outcome of interest was the impact of migraine on HRQoL during the COVID-19 pandemic, measured by the EQ-5D-5L. Each of the five domains in the questionnaire had different options of choice: no problems (assigned a code of 1), slight (assigned a code of 2), moderate (assigned a code of 3), severe (assigned a code of 4), and extreme problems (assigned a code of 5). A profile of "11111" denoted optimal health, while "55555" represented the most compromised health state.<sup>[10]</sup> The UK-based utility scores were estimated using the time trade-off and discrete choice experiment hybrid model, yielding values that range from -0.281 to 1, where negative values signified a state of health worse than death.<sup>[20]</sup> In other words, a value of 1 represented perfect health, 0 represented a health state equivalent to death, and negative values represented health states considered worse than death, such as extreme pain, immobility, or severe anxiety/depression.

The sociodemographic variables included age, gender, level of education, employment status, and monthly income. Clinical variables were body mass index (BMI), comorbid conditions, migraine status, and medications used. In addition, such COVID-19-specific variables assessed were the frequency of migraine attacks during the pandemic, whether the individual worked on the COVID-19 frontline, and whether they had contracted the virus.

In descriptive statistics, frequencies (N) and percentages (%) were used to report the categorical while means with standard deviations or medians with interquartile ranges (IQRs) were used to express the continuous variables. The EQ-5D-5L utility score was assessed for normality using the Kolmogorov-Smirnov test and visual inspection of distribution plots.

A generalized linear model (GLM) with a normal log link function was applied to investigate the relationship between the EQ-5D-5L utility score and various demographic and medical variables. This model was chosen to address the skewness and heteroscedasticity of the data, as determined by the modified park test.<sup>[21]</sup> Nonparametric Mann-Whitney U-tests were used for variable selection, and those with  $P < 0.25$  were included in the multivariate GLM. Statistical analyses were performed using Statistical Package for the Social Sciences software version 25 (SPSS, IBM Corporation, Armonk, NY: USA) and Microsoft Excel. Using  $P < 0.25$  for variable selection in the bivariate analysis could help to ensure that potentially important variables were not

prematurely excluded from the model, particularly in exploration studies or when dealing with smaller sample sizes in which some effects may be underestimated. However, this could lead to overfitting if too many variables were included.

The sample size was calculated for this specific group of patients using the prevalence of the disease. A sample of 198 migraine patients can achieve 80% power allowing for marginal error and prevalence of the disease.<sup>[7]</sup> Because the population size was not known, the formula  $n = (Z_{1-\beta})^2 [p(1-p)] / d^2$  was used for the minimum number of samples and ensure the minimum power of the study where,  $n$  = required sample size,  $Z_{1-\beta}$  = Z value at power  $1-\beta$  (minimum power 80% value = 0.84),  $d$  = margin of error (ideal value is 0.05). Considering the 80% power of test and 3% marginal error, the formula calculated the number of minimum samples as 183.15.

## Results

The study cohort consisted of 198 participants. Table 1 presents the sociodemographic and clinical characteristics of the participants. The predominant proportion was female (67.7%) and 32.3% was male. Employment data indicated that 36.9% were employed, and 63.1% were unemployed. Most participants (79.8%) had college degrees. In terms of income, 51% of the participants earned less than SAR 5000 monthly while 23.7% and 24.7% of participants earned SAR 5000–10,000 and more than SAR 10,000, respectively. More than half of the migraineurs (54.5%) were generally healthy, while 46% reported they had one or more comorbidities. The most common conditions were arthritis (osteoarthritis and rheumatoid arthritis) and hypertension, both (11.6%) followed by atrial fibrillation (11.1%), hyperlipidemia (10.6%), and diabetes (8.6%).

Table 2 shows the migraine and COVID-19 characteristics of participants. Most of them (58.1%) indicated they had suffered from migraines for 10 or more years. A smaller percentage of participants reported shorter durations of 5–9 years (15.2%), 1 year (5.1%), 2 years (3.5%), 3 years (6.6%), 4 years (5.1%), and <1 year (6.6%). Regarding the frequency of migraine attacks per month during the COVID-19 pandemic, more than half of the patients (51.5%) indicated only 1 migraine attack per month, while 23.2% experienced 2 attacks. Fewer participants reported higher frequencies of attacks, including 3 attacks (15.2%), 4 attacks (3.5%), 5–9 attacks (3.5%), and 10 or more attacks (3.0%). With regard to COVID-19 infection, 47.5% of participants reported they had been infected but not hospitalized. A smaller percentage (4.5%) were hospitalized but not admitted to the Intensive Care Unit (ICU), while only 1.0% had been admitted to ICU. However, 47.0%

**Table 1: Sociodemographic and clinical characteristics of migraine patients in the Eastern Province, Saudi Arabia, 2023 (n=198)**

Characteristics	N (%)
Gender	
Male	64 (32.3)
Female	134 (67.7)
Age (years)	
Below 30	63 (31.8)
30–40	37 (18.7)
41–50	52 (26.3)
51–60	32 (16.2)
61–70	11 (5.6)
71-above	3 (1.5)
Employment status	
Employed	73 (36.9)
Not employed	125 (63.1)
Education level	
Primary or lower	4 (2.0)
High/secondary	36 (18.2)
College graduates	158 (79.8)
Monthly income (SAR)	
<5000	102 (51.5)
5000–10,000	47 (23.7)
More than 1000	49 (24.7)
BMI (kg/m <sup>2</sup> )	
Underweight	13 (6.6)
Healthy	108 (54.5)
Overweight	60 (30.3)
Obese	17 (8.6)
Comorbidity	
No	107 (54.0)
Yes	91 (46.0)
Alzheimer's disease and related dementia	3 (1.5)
Atrial fibrillation	22 (11.1)
Cancer (breast, colorectal, lung, and prostate)	2 (1.0)
Chronic kidney disease	3 (1.5)
Depression	7 (3.5)
Diabetes	17 (8.6)
Hyperlipidemia (high cholesterol)	21 (10.6)
Hypertension (high blood pressure)	23 (11.6)
Osteoporosis	7 (3.5)
Schizophrenia and other psychotic disorders	1 (0.5)
Stroke	3 (1.5)

BMI=Body mass index

of participants reported not being infected with COVID-19.

Regarding the treatments used for migraine during COVID-19, prescribed medications were the most common treatment (41.9%), followed by over-the-counter (OTC) painkillers (33.3%); 24.7% of the participants reported they had used no medication for their migraine during the pandemic.

Table 3 presents the association of migraine complications, COVID-19 infection, and HRQoL for those infected

**Table 2: Migraine and coronavirus disease 2019 related characteristics of migraine patients in the Eastern Province, Saudi Arabia, 2023 (n=198)**

Characteristics	N (%)
How long have you suffered from migraine? (years)	
<1	13 (6.6)
1	10 (5.1)
2	7 (3.5)
3	13 (6.6)
4	10 (5.0)
5–9	30 (15.2)
10 or more	115 (58.1)
How many migraine attacks did you get per month during COVID-19?	
1	102 (51.5)
2	46 (23.2)
3	30 (15.2)
4	7 (3.5)
5–9	7 (3.5)
10 or more	6 (3.0)
Compared to years before pandemic, did the number of migraine attacks increase during the pandemic?	
Yes	108 (54.5)
No	90 (45.5)
Were you working on the frontline for COVID-19?	
Yes	44 (22.2)
No	154 (77.8)
Were you infected with COVID-19?	
Yes, but not hospitalized	94 (47.5)
Yes, hospitalized but not admitted to ICU	9 (4.5)
Yes, hospitalized and admitted to ICU	2 (1.0)
Not infected	93 (47.0)
What medication did you use for migraine during COVID-19?	
No medication	49 (24.7)
Painkillers (OTC)	66 (33.3)
Prescribed medications	83 (41.9)

COVID-19=Coronavirus disease 2019, OTC=Over-the-counter, ICU=Intensive Care Unit

and those not infected with COVID-19 by using the Chi-square/fisher exact test for categorical outcome and nonparametric Mann–Whitney U-test for nonnormal scale outcome. Of those who had no COVID-19 infection, more than half (52.9%) indicated an increase in migraine attacks during the pandemic, whereas less than half (47.1%) of the participants reported no change. In the other group who were infected with COVID-19 infection, 51.5% reported an increase in attacks, while 48.5% experienced no change. The difference between these two groups was not statistically significant ( $P = 0.894$ ). Regarding to the duration of migraine, it was found that more than a third of the participants (24.1%) who were not infected with COVID-19, reported they had suffered from migraines for 1–4 years, and 20.7% of individuals had suffered for 5–9 years, and more than half the patients (55.2%) had had migraine for 10 years or more. However, in the group with a history



**Table 3: Association of migraine complications, coronavirus disease 2019 infection, and health-related quality of life among migraine patients by coronavirus disease 2019 status (n=198)**

Migraine complications	Not infected with COVID-19 N (%)	Infected with COVID-19 N (%)	P-value
Compared to years before pandemic, did the number of migraine attacks increase during the pandemic?			
Yes	46 (52.9)	52 (51.5)	0.894
No	41 (47.1)	49 (48.5)	
How long have you been suffering from Migraine?			
1–4	21 (24.1)	28 (27.7)	0.384
5–9	18 (20.7)	13 (12.9)	
10 or more years	48 (55.2)	60 (59.4)	
How many migraine attacks do you get per month during COVID-19?			
1–4	80 (92.0)	95 (94.1)	0.03618*
5–9	4 (4.6)	2 (2.0)	
10 or more	3 (3.4)	4 (4.0)	
HRQoL (score), median (IQR)	0.844 (0.199)	0.897 (0.234)	0.740 <sup>s</sup>

\*Fisher's exact test, <sup>s</sup>Nonparametric Mann–Whitney U-test. HRQoL=Health-related quality of life, IQR=Interquartile ranges, COVID-19=Coronavirus disease 2019

of COVID-19 infection, 27.7% reported having had migraines for 1–4 years, and a large proportion (59.4%) had had migraine for 10 years or more. The association between migraine duration and COVID-19 infection status was not statistically significant ( $P = 0.384$ ). Regarding the frequency of migraine attacks per month during the pandemic, of those not infected with COVID-19, 80 patients reported 1–4 attacks per month, while only three patients reported 10 or more attacks. Nevertheless, of those infected with COVID-19, the majority (95 patients) reported 1–4 attacks per month, while only 4 reported 10 or more attacks. This difference was statistically significant ( $P = 0.038$ ). A comparison of the HRQoL of the two groups shows that participants with no history of COVID-19 infection had a median HRQoL score of 0.844 (IQR = 0.199), while those who had had COVID-19 infection had a slightly higher median score of 0.897 (IQR = 0.23). The difference between these scores was not statistically significant ( $P = 0.740$ ).

Table 4 presents the association between patient demographic characteristics, medical conditions, and HRQoL scores. Migraineurs aged <30 years reported a significantly higher HRQoL median score (0.94, IQR = 0.17) compared to those aged 30 years and older (0.85, IQR = 0.16), with  $P < 0.001$ . Regarding the gender variable, male participants demonstrated a significantly higher HRQoL score (0.94, IQR = 0.18) than females (0.85, IQR = 0.18), with a  $P = 0.001$ . Although college graduates had a slightly higher median HRQoL score (0.87, IQR = 0.23) compared to those educated up to the higher secondary level (0.85, IQR = 0.22), the difference was not statistically significant ( $P = 0.420$ ). Unemployed participants had a higher median HRQoL score (0.91, IQR = 0.22) than those who were employed (0.85, IQR = 0.18). However, this difference was not statistically significant ( $P = 0.130$ ). With regard to income, migraineurs who earned up to 10,000 SAR

reported higher scores (0.88, IQR = 0.22) compared to those who earned more than 10,000 SAR (0.85, IQR = 0.21), and the association with HRQoL was statistically significant ( $P = 0.027$ ). Regarding comorbidities, participants without comorbidities had a median HRQoL score of 0.92 (IQR = 0.20), while those with comorbidities scored lower (0.83, IQR = 0.10) and the association was statistically significant ( $P = 0.002$ ). Finally, participants with a healthy BMI reported higher HRQoL scores (0.90, IQR = 0.20) compared to those classified as underweight, overweight, or obese (0.85, IQR = 0.19). The association was statistically significant ( $P = 0.029$ ).

Table 5 presents only the significant predictors of HRQoL for the participants using multivariate regression analyses (Normal Log link function) with backward selection method. Migraineurs aged <30 years had a positive  $\beta$  coefficient of 0.08, with a  $P = 0.01$ . Participants with no comorbidities had a positive  $\beta$  coefficient of 0.06 with a  $P = 0.01$ , and individuals who had a healthy BMI showed a positive  $\beta$  coefficient of 0.05 with a  $P = 0.04$ .

Figure 1 illustrates the distribution of patient responses across the five HRQoL domains. Over half of the participants reported no issues in most domains. The highest percentage of no problems was reported in the self-care domain (83%), while the lowest was observed in the pain/discomfort domain (43%). For the other three domains, 66% reported no issues with usual activities, 58% with mobility, and 50% with anxiety/depression. Notably, 13% of patients reported experiencing severe or extreme levels of pain/discomfort.

## Discussion

HRQoL is a critical metric used by decision-makers to assess the impact of disease and medication on patients' physical, emotional, and social well-being.<sup>[9,10,12,22]</sup> In

**Table 4: Association between patient demographics and health-related quality of life among migraine patients (n=198)**

Characteristics	Median (IQR)	P-value*
Age (years)		
<30	0.94 (0.17)	<0.001
30 and more	0.85 (0.16)	
Gender		
Male	0.94 (0.18)	0.001
Female	0.85 (0.18)	
Education level		
College graduates	0.87 (0.23)	0.420
Up to higher secondary level of education	0.85 (0.22)	
Occupation		
Employed	0.85 (0.18)	0.130
Not employed	0.91 (0.22)	
Income (SAR)		
Up to 10,000	0.88 (0.22)	0.027
More than 10,000	0.85 (0.21)	
Medical conditions		
Comorbidity		
No	0.92 (0.2)	0.002
Yes	0.83 (0.1)	
BMI		
Healthy	0.90 (0.2)	0.029
Others (underweight, overweight and obese)	0.85 (0.19)	

\*Applied Nonparametric "Mann-Whitney U-test." Model fitness: Pearson Chi-square=6.67,  $P=0.037$ , AIC=-72.05, BIC=-36.45. Omnibus test- ( $\chi^2=15.295$ ,  $P=0.083$ ). BMI=Body mass index, BIC=Bayesian information criterion, AIC=Akaike's information criterion, IQR=Inter quartile range

**Table 5: Multivariate regression analysis: Predictors of health-related quality of life of migraine patients**

Predictors	$\beta$ (coefficients) with 95% CI	SE	P-value
Age (years)			
<30	0.08 (0.01–0.17)	0.05	0.01
30 and more (reference)	-	-	-
Comorbidity			
No	0.06 (0.008–0.146)	0.03	0.01
Yes (reference)	-	-	-
BMI			
Healthy	0.05 (0.01–0.12)	0.03	0.04
Others (underweight, overweight, and obese) (reference)	-	-	-

CI=Confidence interval, SE=Standard error, BMI=Body mass index

Saudi Arabia, migraine imposes a significant burden, and the management of this condition, as well as its impact on HRQoL, became even more challenging during the COVID-19 pandemic. This study examined the impact of migraine on HRQoL during the COVID-19 pandemic, with a focus on identifying the factors associated with this relationship. Findings revealed that participants generally reported poor to average HRQoL, and the pandemic further exacerbated these outcomes. This decline is consistent with similar findings reported in other

countries, where the pandemic affected the HRQoL of patients with chronic conditions such as migraine.<sup>[1,12,13,15,16]</sup>

The results of this study showed that the COVID-19 pandemic had impacted on the frequency of migraine attacks. Patients infected with COVID-19 reported an increase in the number of migraine attacks during the pandemic compared with those not infected. However, a large proportion of migraineurs infected with COVID-19 reported 1–4 migraine attacks per month during the pandemic. The observed statistical significance ( $P = 0.038$ ) between the two groups suggests that COVID-19 infection may have contributed to the increase in the frequency of migraine attacks during the pandemic. This increase in migraine frequency could be attributed to several factors, psychological (e.g., stress or anxiety), or environmental factors included. These findings are consistent with the findings of other studies which indicate that there was an increase in the frequency of migraine during the pandemic compared to earlier periods.<sup>[12,14,15]</sup> According to Al-Hashel and Ismail (2020), a substantial proportion of study participants reported a marked escalation in both the frequency and severity of migraines compared to the period before the pandemic.

However, the study findings revealed diverse patterns in medication use by individuals with migraine during the pandemic. Notably, 24.7% of participants did not take any medication for their migraines, while 33.3% relied on OTC pain relievers, and nearly 40% used prescription medications. This trend suggests that patients increasingly recognized that migraine was a condition that required professional medical treatment rather than sole reliance on OTC painkillers like paracetamol, recommended as a first-line treatment for migraines because of its efficacy and safety profile.<sup>[1,23]</sup> The findings underscore the importance of structured and comprehensive migraine management strategies, as highlighted in previous studies.<sup>[24]</sup> In doing so, healthcare providers can not only enhance treatment outcomes but also improve overall patient care and quality of life.

A range of sociodemographic and health-related factors have been identified as affecting the quality of life of individuals with migraines. The findings of our study suggest that age has a significant association with HRQoL. Migraineurs under the age of 30 demonstrated better HRQoL than those aged 30 years and older. This might indicate that as people age, their HRQoL declines, possibly a reflection of the cumulative burden of living with chronic migraines over many years. However, the results of our study are in conflict with results from other studies. A study from Riyadh, for instance, reported that older migraineurs had better HRQoL than younger ones.<sup>[4]</sup> Interestingly, research conducted in Qassim

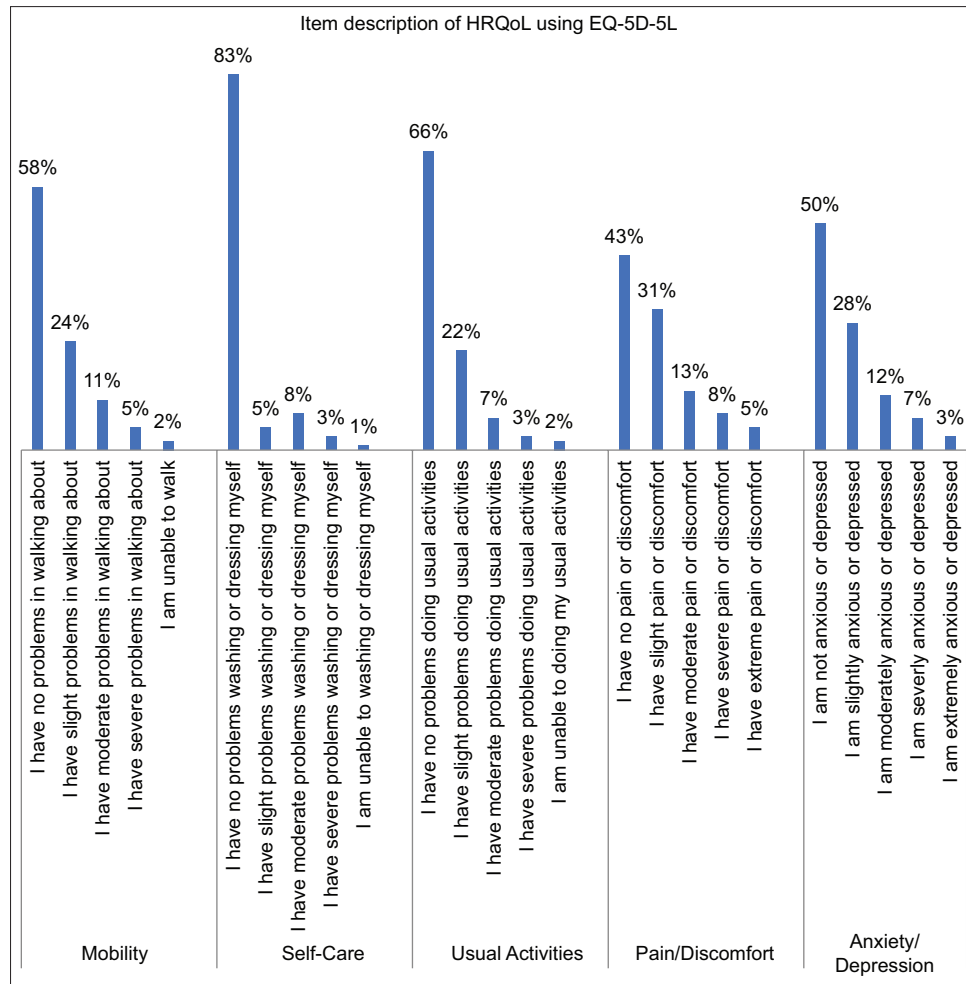


Figure 1: Overall health-related quality of life for patients with migraine ( $n = 198$ )

suggests that there were no significant associations between age and HRQoL among migraine patients.<sup>[16]</sup> A gender disparity was evident in the findings of this study. Male participants demonstrated a significantly higher HRQoL score than female participants with a  $P = 0.001$ . This result aligns with findings from other studies that have consistently reported that women had poorer HRQoL than men.<sup>[4,5,25]</sup> This finding could be attributed to the biological, psychological, and social factors that affect women but not men, which might contribute to their reduced quality of life. Nevertheless, other studies have reported no association between gender and HRQoL.<sup>[4,16]</sup>

Income level emerged as a critical determinant of HRQoL in migraine patients in this study. Participants on higher incomes reported better HRQoL compared to those with lower incomes. This supports previous findings that link low socioeconomic status with more severe impairment in HRQoL in migraine patients.<sup>[4]</sup> Studies have also indicated that patients with chronic illnesses and lower monthly incomes report significantly worse HRQoL than those with moderate or high incomes.<sup>[26,27]</sup> These observations might give a clear picture of the broader

impact of socioeconomic disparities on health outcomes and quality of life in chronic diseases such as migraine.

The presence of comorbidities was independently associated with lower HRQoL after adjusting for confounding factors. Participants with comorbid conditions, such as diabetes or psychological disorders, reported poorer HRQoL compared to those without comorbidities. This finding is consistent with other research showing that comorbidities significantly impair HRQoL of migraine patients.<sup>[2,28,29]</sup> An epidemiological study has determined that individuals experiencing migraines accompanied by anxiety exhibit a diminished quality of life and greater levels of disability than those without comorbid anxiety.<sup>[22]</sup> Studies also suggest that the severity of migraine increases the risk of comorbid conditions such as gastrointestinal ulcers, inflammatory disorders, and sleep disturbances, all of which contribute to lower HRQoL.<sup>[30]</sup>

The study findings highlighted a significant relationship between BMI and HRQoL of individuals with migraine. More specifically, migraineurs with a healthy BMI

reported higher HRQoL scores than those classified as underweight, overweight, or obese. These findings are consistent with logical expectations that healthy migraineurs have a high chance of a better quality of life than those who are not healthy. In support of this perception, other research has revealed a compelling association between body weight and the occurrence of migraines. For example, Huang *et al.*, found that patients experiencing migraines demonstrated a noticeably higher likelihood of being classified as overweight, or obese when compared to individuals in a healthy control group.<sup>[31]</sup> These findings suggest that interventions aimed at achieving and maintaining a healthy BMI may contribute not only to physical health but also to improved quality of life outcomes in patients with migraine.

The study's findings revealed that there was a slight decline in HRQoL of participants in relation to COVID-19. The decrease in HRQoL was observed within the anxiety/depression, and pain/discomfort domains. In contrast, the domains associated with mobility, self-care, and routine activities appeared to be relatively less influenced by migraines during the pandemic. These results are consistent with prior research underscoring the profound psychological burden of migraines on mood disorders, anxiety, and depression.<sup>[2,14,15-17,32]</sup> A study conducted in Alahsa identified the emotional functioning domain as the most significantly affected by migraines, with a score of 61.5%, whereas the role function restrictive domain showed a comparatively lower impact, scoring 46%.<sup>[5]</sup>

This study represents one of the initial investigations into the effects of migraines on HRQoL in relation to the COVID-19 pandemic in Saudi Arabia. Nonetheless, several limitations require consideration. First is the cross-sectional design of the study which precluded the establishment of direct causal links between migraines and HRQoL during the pandemic. The observed increase in the frequency of migraine and the corresponding decline in HRQoL may not be solely due to pandemic-related stress or anxiety, as other unmeasured factors could have contributed to these outcomes. Moreover, recall bias poses a potential limitation, as participants might not have accurately recalled events from the pandemic period. In addition, the sample may not accurately reflect the broader Saudi population, thereby restricting the generalizability of the findings to other regions. While our descriptive statistics indicated a low incidence of migraine episodes before the pandemic compared to the period of the pandemic, conducting a comparative analysis to assess the HRQoL for migraine patients before and after the pandemic would have provided a more comprehensive understanding of the true impact of migraines during this period. Another limitation of this study is the selection of participants

with migraines. While a distinction between migraine subtypes such as acute, chronic, with aura, or without aura is essential and may have an effect on HRQoL, our study did not account for these classifications. Instead, the methodology relied solely on self-reported migraine cases without the application of specific diagnostic criteria. This limitation may have contributed to variability within the study population and potentially impacted the validity of the findings.

## Conclusion

The current research underscored the profound negative effect of COVID-19 on increasing the frequency of migraine attacks in infected individuals, which in turn contributed to a deterioration in HRQoL. Key predictors of diminished HRQoL identified in this study include advancing age, the presence of comorbidities, low income, and unhealthy BMI. These findings offer valuable insights into the substantial burden of migraine, and provide a foundation for policymakers to develop targeted strategies to enhance the HRQoL of individuals living with this should focus on conducting cost-utility analyses of various migraine treatment options to guide evidence-condition. Future research-based decision-making and optimize management strategies. Furthermore, collaborative efforts between healthcare providers, researchers, and policymakers are essential for ensuring comprehensive and sustainable approaches to mitigating the burden of migraine on HRQoL beyond the pandemic.

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## Conflicts of interest

There are no conflicts of interest.

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