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Cognition, mental health, and quality of life in patients with chronic and episodic migraine during the interictal period

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Abstract

Introduction Migraine is a highly prevalent and disabling condition, not only due to its painful symptoms but also because of its significant impact on mental health and cognitive functioning, leading to a considerable deterioration in quality of life. This study aimed to evaluate the cognitive profile, mental health, and quality of life in patients with chronic and episodic migraine during the interictal period, and to explore their relationship with sociodemographic and clinical variables.

Method This observational, descriptive, cross-sectional analytical study included 60 patients diagnosed with chronic or episodic migraine, who were enrolled in a health program for headache patients between 2010 and 2016. Cognitive function, anxiety and/or depression symptoms, and quality of life during the interictal period were assessed. Descriptive analyses were conducted, and associations were evaluated by configuring primary (type of migraine) and alternative events (cognitive impairment, depression and/or anxiety, and poor quality of life).

Results The mean age of the participants was 45 years (SD ± 8), with 83.3% being women and 93.3% belonging to middle and low socioeconomic strata. Of the 60 patients, 83.3% (50) were diagnosed with chronic migraine, while the remaining had episodic migraine. The use of one or more cognition-altering medications was observed in 90% of patients with chronic migraine and 60% of those with episodic migraine ($p = 0.02$). Anxiety was more prevalent in patients with episodic migraine, whereas depression was more common among those with chronic migraine. Female gender, middle socioeconomic status, and longer disease duration were significantly associated with chronic migraine. Among the 57 patients who completed the Mini-Mental State Examination, 38.6% had cognitive impairment, which decreased with longer migraine duration and better social interaction. Memory and selective attention were the most affected cognitive domains in both groups. No significant associations were found for the other variables after adjusting for confounders.

Conclusions Chronic migraine significantly impacts mental health, cognition, and quality of life, with depression and cognitive impairments being prevalent. Social interaction and longer disease duration may protect against

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cognitive decline, highlighting the need for multidisciplinary, personalized interventions addressing neurological and psychosocial challenges.

Keywords Chronic migraine, Episodic migraine, Interictal, Cognitive dysfunction, Memory, Selective attention, Mental health, Depression, Anxiety, Quality of life, Social support

Introduction

It is estimated that 1.04 billion people worldwide suffer from migraine, corresponding to a global prevalence of 14.4%, with the condition being more prevalent in women at a 3:1 ratio [1]. Episodic migraine (EM) occurs in 17.4% of women and 5.7% of men, and 2.5% of individuals with EM progress to chronic migraine (CM) each year [2]. CM affects 1–2% of the global population [3].

Migraine is a major cause of disability worldwide, ranking among the top ten causes of years lived with disability. It affects various aspects of life, including work, education, social interactions, family, and personal life [4]. Additionally, migraine has a significant negative impact on health-related quality of life, which, along with disability assessment, has often been underestimated by healthcare professionals. These aspects are essential for adapting and optimizing treatment plans based on disease severity and improving treatment outcomes [5].

A distinguishing feature of migraine as a chronic disorder is its association with other medical comorbidities, including neurological disorders (epilepsy, cerebrovascular disease, sleep disorders, multiple sclerosis), cardiovascular diseases (angina, myocardial infarction), psychiatric conditions (depression, anxiety), and pain disorders (fibromyalgia) [3].

Regarding cognitive impairment, many migraine patients, compared to control groups, frequently report lower general cognitive function and reduced language abilities. However, no significant differences have been found in visuospatial ability, attention, memory, or executive function [6]. During the ictal period, patients report intellectual decline, which ranks second among the most disabling symptoms. The domains of greatest concern include attention, memory (verbal and non-verbal), speed, and executive function [7]. In the interictal periods, the data are mixed. A meta-analysis of 17 studies found a moderate negative effect on immediate attention, memory, spatial cognition, and executive functioning [8]. Other studies have not found significant impairments in neuropsychological evaluations but have reported differences in cortical networks on MRI between migraine patients without aura and those with aura [9]. In contrast, a study conducted in China found significantly lower scores in five of the seven neurocognitive subdomains of the Montreal Cognitive Assessment (MoCA) (language, executive functions, calculation, memory, orientation), as well as prolonged cognitive processing time compared to controls, measured through an electrophysiological study [10].

While there is consensus that cognitive performance declines during migraine attacks, the data are conflicting regarding the interictal periods. Clinical studies indicate poor cognitive performance during the interictal phase, whereas population studies show no notable differences in cognitive function between migraine sufferers and controls. Although there is no evidence of progressive cognitive decline over time in migraine patients, preventive medications and comorbidities such as depression and anxiety may influence cognitive function but do not fully explain the cognitive impairment observed in these cases. Unlike migraine, tension-type headaches or cluster headaches do not appear to be associated with cognitive impairment, at least during pain-free periods [8].

Just as cognitive impairments seem to represent a morbidity burden for migraine patients, psychiatric disorders are among the most widely described and disabling comorbidities. In the literature, a strong association between primary headaches and psychiatric disorders has been documented, describing this relationship as bidirectional, with common pathophysiological mechanisms. Psychiatric disorders are three times more frequent in patients with headaches, and migraine is more common among patients with major affective disorders [11]. Some of the most prevalent psychiatric conditions in patients with migraine include depression, with a variable incidence ranging from 8.6 to 47.9%, and anxiety, affecting between 51% and 58% of migraine patients. Other psychosocial factors associated with the development of migraine include a history of post-traumatic stress, childhood trauma, and sexual abuse [12].

The objective of this study was to evaluate the cognitive profile, quality of life, and mental health during the interictal period in a group of patients with chronic and episodic migraine and their relationship with sociodemographic and clinical variables.

Methods

An observational, descriptive, cross-sectional analytical study was conducted (see Supplementary Material Fig. 1). The reference population consisted of 160 patients from the Headache Unit of a private institution, treated between 2010 and 2016. These patients were part of a specialised headache programme involving a transdisciplinary team of professionals who provided comprehensive follow-up in neuropsychological, neurological,

mental health, and quality of life domains. Based on the specific complaints of each patient, targeted evaluations and interventions were implemented, including neuropsychological rehabilitation recommendations when indicated.

Patients who reported cognitive symptoms during their consultations underwent a complete battery of neurocognitive tests, as requested by the treating neurologist. From the initial pool of 160 patients, a convenience sample of 60 patients was selected for the study. These patients met the inclusion and exclusion criteria, which ensured the selection of individuals with a clinical diagnosis of episodic or chronic migraine, aged over 18 years, and excluded those with a history of neurological diseases other than headache, traumatic brain injury, psychotic, dissociative, or personality disorders, post-traumatic stress disorder, bipolar affective disorder, or those who attended only one consultation in the headache programme.

Cognitive, mental health, and quality of life instruments

Below, we present the instruments utilised in this study to assess cognitive function, mood disturbances, and quality of life within the study population. Each instrument has been validated in the Colombian context, and the corresponding references—along with the specific cut-off points—are provided below. This approach ensures that our measures are both culturally appropriate and replicable for future research.

- **Mini-Mental State Examination (MMSE)**: Developed in 1975 [13] for cognitive screening, it assesses orientation, immediate memory, calculation, naming, verbal comprehension, drawing, reading, repetition, and writing, with a maximum score of 30. It was validated in Spanish with an explanatory capacity of 60.6% and a cut-off score of 23, yielding better screening capability (97% sensitivity and 88% specificity) [14].
- **Memory Disorders Scale**: This scale quantifies the patient's daily memory functioning and includes metamemory evaluation. The scale is administered to both the patient and a family member. It consists of 15 items, each with 4 response options: never (0), rarely (1), sometimes (2), and almost always (3). The cut-off score is 19 points, with a maximum score of 45 [15].
- **Rey Complex Figure (RCF)**: This test evaluates visuoconstructional abilities in the copy phase and visual memory in delayed recall trials [16].
- **Trail Making Test (TMT) Part A and Part B**: This test provides information on attention processes, visual scanning, processing speed, and mental flexibility. In TMT-A, the participant must connect 25 numbers in ascending order, randomly distributed in circles on a sheet. In TMT-B, participants alternate between numbers and letters (1-A, 2-B, etc.), making it more challenging. TMT-B is widely used to measure executive functions such as complex attention, planning, cognitive flexibility, and response inhibition. Age and education levels influence performance on this test [16].
- **SF-36 Health Survey**: Evaluates general health status across multiple dimensions. It can be used with the general population or patients with specific conditions to assess health-related quality of life (HRQoL) [17]. The quality of life in migraine patients has been assessed with this instrument since the 1990s [18].
- **Hospital Anxiety and Depression Scale (HADS)**: Frequently used in clinical settings, anxiety often precedes or coexists with depression. Due to its simplicity, it is also commonly used in research. It contains seven questions for anxiety and seven for depression, both of which are useful for screening depression and anxiety symptoms [19]. It has been used in some studies involving migraine patients [20].

Data collection and analysis

Data were collected retrospectively using an ad hoc data collection form. Sociodemographic, clinical, cognitive, quality of life, and mental health variables were extracted from patient medical records. Cognitive, quality of life, and mental health data were collected by a neuropsychologist, while sociodemographic and clinical information was gathered by a trained medical student and a resident physician. To minimize bias, data collectors were trained, and a variable table was established to standardize data collection.

For the holistic evaluation, one primary event and three alternative events (dependent events) were considered. The primary event was the type of migraine, where groups consisted of patients with chronic or episodic migraine, according to the third edition of the International Classification of Headache Disorders (ICHD-3) [21]. The alternative events were global cognitive impairment, quality of life, and mental health.

To establish the alternative events, results from the MMSE, SF-36, and HADS [22] were used. Initially, SF-36 and HADS scores were categorized into quartiles (25th, 50th, 75th), and then all measures were re-categorized into two groups for analysis (with or without impairment in cognitive function, quality of life, and mental health). The previous categories of evident and probable impairment were grouped into a single category for patients with impairment for each of the alternative events.

Descriptive statistics were used to characterize the sample. Qualitative variables were presented as absolute and relative frequencies. Quantitative variables, based on the normality distribution (Shapiro-Wilk test), were analysed using means and standard deviations or medians and interquartile ranges.

Hypothesis testing for independent samples was used to compare analysis groups based on variables to identify confounding variables for each scenario. Binomial logistic regression was used to calculate crude odds ratios (ORs) for bivariable analysis and adjusted ORs for multivariable analysis. Due to the high prevalence (>20%) of CM, cognitive impairment, and poorer quality of life, the ORs were converted to crude and adjusted prevalence ratios (PRs) using Miettinen's conversion formula [23], which determined the association between global cognitive impairment and quality of life with sociodemographic, clinical variables, and analgesic overuse.

All statistical analyses were performed using the open-source software Jamovi (version 2.5.5). A p-value of less than 0.05 was considered significant for all analyses.

This study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. The study received approval from the Ethics Committee (record number 170) and was registered by the Universidad Cooperativa de Colombia under code INV3391.

Results

The average age of the patients was 45 years (SD ± 8), with 83.3% (50) being women, and 93.3% (52) belonging to middle and low socioeconomic status (SES). Only two patients had a family history of migraine.

Of the 60 patients, 83.3% (50) were diagnosed with CM, while the remaining patients had EM. Table 1 provides a description of the sociodemographic, clinical, and neurocognitive variables by migraine type. Notable differences between patients with chronic and episodic migraine included time since diagnosis, migraine severity, psychiatric history, history of alcohol consumption, and health-related quality of life in the mental health domain.

In the CM group, 90% of the patients experienced moderate to severe pain or had pain crises that were refractory to NSAIDs, and 42% suffered from depression. In contrast, 70% of patients with EM scored higher in mental health-related quality of life.

Association analysis revealed that disease duration, middle SES, and female gender were significantly associated with CM (Table 2) (for converted OR to PR values, see Table 2S in supplementary materials).

Among the abortive medications for pain crises, acetaminophen and naproxen were the most consumed by patients with CM (82% and 70%, respectively). Valproic acid was the prophylactic drug with a significantly higher consumption rate among patients with CM compared to those with EM (76% vs. 40%, respectively). No statistical differences were found in the consumption rates of other medications between the groups.

Medications with neurocognitive side effects included tramadol, topiramate, amitriptyline, and imipramine. Among patients with CM, 90% were using one or more of these medications, compared to 60% of patients with EM ($p = 0.02$) (see supplementary material Table 1S and 2S).

Analysis of alternative events

Out of the 60 patients, three did not have available MMSE results. Of the 57 remaining patients, 38.6% (22) had cognitive impairment. Table 3 and supplementary table 3 S describe the sociodemographic, clinical, and neurocognitive variables according to the MMSE results. Differences were observed between patients with and without cognitive impairment, particularly in SES, memory, and social quality of life.

In the group with cognitive impairment, most patients were from lower SES, scored from normal to low on the Rey memory test, and reported better social quality of life. Additionally, 50% of the individuals in this group did not have available data for the TMT-B test. Conversely, in the group without cognitive impairment, the majority of patients belonged to middle SES, scored from normal to high on the memory test, and reported worse results in the social quality of life domain.

Association analysis

The association analysis of sociodemographic and clinical variables with cognitive impairment revealed a significant relationship between disease duration and quality of life according to social support with the presence of cognitive impairment. As disease duration increased, cognitive impairment decreased [adjusted estimator −0.14, $p = 0.02$]. Additionally, better quality of life in terms of social support was found to protect against cognitive impairment [crude PR 0.98 (95% CI 0.89–1.0); adjusted PR 0.05 (95% CI 0.0001–0.001)] (see supplementary material, Table 4S for other variables).

Of the 60 patients, seven had missing data for the HADS. Therefore, out of the remaining 53 patients, 66.03% (35) had symptoms of anxiety and/or depression. Table 4 describes the sociodemographic, clinical, cognitive, and quality of life variables according to the presence or absence of psychoaffective disorders, as assessed by the HADS. Differences between the groups with and without mood disturbances were noted in patient age, the absence of previous psychiatric conditions, self-reported stress, cognitive impairment as assessed by the patient and family members, and overall quality of life.

Patients in the group with mood disturbances, as identified by the HADS, were on average 5 years older than those in the group without mood disturbances

Table 1 Sociodemographic, clinical, and neurocognitive characteristics by migraine type

Variable			Chronic Migraine[1] *N* 50 *n* (%)	Episodic migraine[1] *N* 10 *n* (%)	*p*
Mean age* ± SD			45.3 ± 8.9	43.3 ± 7.6	0.47
Time since migraine diagnosis* mean ± SD or median** [IQR]			20 ± 12.7*	10 ± 7*	0.007
Sex		Female	42 (84)	8 (80)	0.76
		Male	8 (16)	2 (20)	
Educational level		Primary	14 (28)	3 (30)	0.9
		Secondary	15 (30)	3 (30)	
		Professional (undergraduate/postgraduate)	21 (42)	4 (40)	
Age of onset of migraine		Childhood (5–12 years)	11 (22)	0	0.2
		Adolescence (13–20 years)	13 (26)	1 (10)	
		Adult (21–50 years)	23 (46)	7 (70)	
		Older adult (≥ 51 years)	1 (2)	1 (10)	
		No data	2 (4)	1 (10)	
Migraine severity[2]		Mild to moderate (1–5)	3 (6)	4 (40)	< 0.001
		Moderate to severe (6–10) or refractory to NSAIDs	45 (90)	4 (40)	
		No data	2 (4)	2 (20)	
General comorbidities		Hypertension	15 (30)	2 (20)	0.76
		Hypothyroidism	15 (30)	1 (10)	0.61
		Fibromyalgia	14 (28)	2 (20)	0.82
		Dyslipidaemia	12 (24)	4 (40)	0.47
		Diabetes	3 (6)	0	0.72
		Coronary disease	2 (4)	1 (10)	0.73
		Chronic kidney disease	2 (4)	0	0.94
		Rheumatoid arthritis	1 (2)	0	0.94
		Lupus	1 (2)	0	0.94
Psychiatric comorbidities		No	7 (14)	2 (20)	NC
		Depression	21 (42)	0	0.02
		Anxiety	2 (4)	3 (30)	0.024
		MADD	16 (38)	3 (30)	0.46
		No data	1 (2)	2 (20)	NC
Toxic history		Alcohol	0	1 (10)	0.004
		Active smoking	6 (12)	3 (30)	0.13
Self-reported sleep disturbances (initiation and/or maintenance		Yes	30 (60)	6 (60)	0.99
		No	15 (30)	3 (30)	
		No data	2 (4)	1 (10)	
Self-reported stress			20 (40)	4 (40)	0.89
Age of onset of self-perceived cognitive disturbances** median (IQR)			40 (9.25)	40 (10.5)	0.95
Mental health (HADS)	Anxiety	Absence of symptomatology	15 (30)	3 (30)	0.15
		Probable symptomatology	14 (28)	0	
		Presence of symptoms	16 (32)	5 (50)	
		No data	5 (10)	2 (20)	
	Depression	Absence of symptomatology	26 (52)	4 (40)	0.7
		Probable symptomatology	6 (12)	2 (20)	
		Presence of symptoms	14 (28)	2 (20)	
		No data	4 (8)	2 (20)	

Table 1 (continued)

Variable			Chronic Migraine[1] *N* 50 *n* (%)	Episodic migraine[1] *N* 10 *n* (%)	*p*
Neurocognitive	General	Mild to moderate impairment	5 (10)	1 (10)	0.98
		Doubtful or possible impairment	13 (26)	3 (30)	
		Without impairment	35 (70)	6 (60)	
		No data	3 (6)	0	
	Cognitive impairment (patient)	Without impairment	16 (32)	2 (20)	0.4
		Suggestive of cognitive impairment	27 (54)	7 (70)	
		No data	7 (14)	1 (10)	
	Cognitive impairment (family)	Without impairment	20 (40)	2 (20)	0.2
		Suggestive of cognitive impairment	21 (42)	6 (60)	
		No data	9 (18)	2 (20)	
	Memory or Recall	Low	11 (22)	2 (20)	0.42
		Normal	25 (50)	7 (70)	
		High	14 (28)	1 (10)	
	Attention (selective)	Low	8 (16)	1 (10)	0.75
		Normal	18 (36)	4 (40)	
		High	17 (34)	5 (50)	
		No data	7 (14)	0	
	Attention (divided)	Low	2 (4)	0	0.7
		Normal	16 (32)	3 (30)	
		High	17 (34)	5 (50)	
		No data	15 (30)	2 (20)	
Quality of life	Physical	Worse quality	23 (46)	4 (40)	0.95
		Better quality	22 (44)	4 (40)	
		No data	5 (10)	2 (20)	
	Mental	Worse quality	26 (32)	1 (10)	0.02
		Better quality	19 (38)	7 (70)	
		No data	5 (10)	2 (20)	
	Social	Worse quality	29 (58)	6 (60)	0.6
		Better quality	16 (32)	2 (2)	
		No data	5 (10)	2 (20)	
	General	Worse quality	29 (58)	7 (70)	0.2
		Better quality	16 (32)	1 (10)	
		No data	5 (10)	2 (20)	

[1]Chronic migraine: ≥15 episodes per month and episodic migraine: <15 episodes per month, according to ICHD-3 (The International Classification of Headache Disorders)

[2]Severity adjusted according to the guidelines of the Canadian Headache Society

* Normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using Student's t-test

** Non-normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using the Mann-Whitney U test

MADD: Mixed Anxiety and Depression Disorder

NC = Not calculated

(47.3 ± 7.43 vs. 42.2 ± 8.1; $p = 0.02$). In addition, 94.3% of subjects had no history of depression and/or anxiety. Approximately 50% of these patients self-reported stress, compared to 33.3% in the group without mood disturbances ($p = 0.04$).

Patients with mood disorders scored over 70% suggestive of memory impairment according to the MDS. A total of 55.6% of patients without mood symptoms had a better quality of life, while 84.8% of patients with mood symptoms had lower quality of life scores according to the SF-36.

In the association analysis between sociodemographic and clinical variables and mood disturbances, no significant relationship was found (see supplementary material, Tables 5S and 6S).

Of the 60 patients, seven had missing data for the SF-36. Therefore, of the 53 remaining patients, 67.9% (36) had a poorer overall quality of life. Table 5 describes the sociodemographic, clinical, psychological, and cognitive

Table 2 Association analysis of chronic migraine with sociodemographic, clinical, and analgesic overuse variables

Variable (reference category)	Chronic migraine	
	Crude OR (95% CI)[1]	Adjusted OR (95% CI)[1]
Age	16.4 (0.01–16.4)	4,60 (0.01–22.9)
Sex (female)	0,006 (0.01 – 0.006)*	0,01 (0.001–0.01)*
Low socioeconomic status (high)	2,93 (0.01–2.93)	2,22 (0.01-6)
Middle socioeconomic status (high)	0,135 (0.01–0.135)*	0,16 (0.001–0.01)*
Duration of migraine evolution	0,56 (0.01–0.56)*	0,60 (0.01–0.1)*
Migraine severity (mild-moderate)	2,6 (0.01–2.6)	2,05 (0.01–5.3)
History of depression	11043,4 (0.01–11043)	6,00 (0.01–11061)
History of anxiety	1721,13 (0.01–1721)	5,99 (0.01–1735)
Sleep disorders	3,11 (0.01–3.11)	2,30 (0.01–6.4)
Use of medications that alter cognition	1,28 (0.01–1.28)	1,22 (0.01–1.9)
MMSE	1,3 (0.01–1.3)	1,24 (0.01–1.9)
TMT A low	8,54 (0.01–8.54)	3,79 (0.01-14)
TMT A high	1,9 (0.01–1.9)	1,65 (0.01–3.7)
TMT B low	3,2 (0.01–3.2)	2,34 (0.01–6.5)
TMT B high	2,7 (0.01–2.7)	2,10 (0.01–5.6)
Rey figure: Normal	4,5 (0.01–4.5)	2,84 (0.01–8.7)
Rey figure: high	7,11 (0.01–7.11)	3,52 (0.01–12.2)

*$p < 0.05$

[1] Prevalence of exposure in the unexposed group (episodic migraine) = 0.1666

Table 3 Differential sociodemographic, clinical, and neurocognitive characteristics between the group with cognitive impairment and without cognitive impairment

Variable		Cognitive impairment		
		With cognitive impairment	Without cognitive impairment	p
		N 22	N 35	
		n (%)	n (%)	
Socioeconomic status	Low	13 (59.1)	8 (22.9)	0.02
	Middle	8 (36.4)	24 (68.6)	
	High	1 (4.5)	3 (8.6)	
Memory or Recall	Low	8 (36.4)	5 (14.3)	0.03
	Normal	12 (54.5)	17 (48.6)	
	High	2 (9.1)	13 (37.1)	
Social quality of life	Worse quality	8 (36.4)	25 (71.4)	0.02
	Better quality	10 (45 0.5)	8 (22.9)	
	No data	4 (18.2)	2 (5.7)	

variables comparing patients with poorer quality of life to those with better quality of life. Notable differences were found in terms of the duration of disease progression relative to the age of migraine onset, self-reported cognitive changes, the age at which patients first noticed cognitive decline, and anxiety symptoms.

Regarding disease progression, it was observed that patients with poorer quality of life had a shorter duration of migraine. In this group, 91.7% self-reported cognitive changes and experienced more anxiety symptoms.

In the association analysis of sociodemographic and clinical variables with overall quality of life, no significant relationships were found. However, in the crude analysis, the duration of migraine progression was significantly associated with poorer quality of life [Crude PR 1.02 (95% CI 1.0-1.17); Adjusted PR 0.98 (95% CI 0.82–1.07)] (see supplementary material, Table 7S and 8S).

Discussion

The aim of this study was to explore the cognitive, mental health, and quality of life profile during the interictal period in a group of patients with chronic and episodic migraine, who were part of a headache programme, and to assess the relationship with sociodemographic and clinical variables.

In this group of patients, the majority were women, a finding consistent with the literature, which describes how the prevalence of migraine is higher in women than in men across all age groups [24]. Although biological and psychosocial factors influence sex differences in migraine, it seems that sex hormones play a predominant

Table 4 Mental health analysis (HADS) with sociodemographic, clinical, and analgesic use variables

Variable			Psychoaffective disorder		
			With mood disturbance	Without mood disturbance	p
			N 35	N 18	
			n (%)	n (%)	
Mean age* ± SD			47.3 ± 7.43	42.2 ± 8.1	0.02
Psychiatric comorbidities		None	33 (94.3)	13 (72.2)	0.03
		Depression	14 (40)	6 (33)	0.6
		Anxiety	3 (8.6)	1 (5.6)	1 F
		MADD	13 (37.1)	5 (27.8)	0.6 F
Self-reported stress			16 (45.7)	6 (33.3)	0.04
Neurocognitive	Memory impairment (MDS-patient)	Without impairment	7 (23.3)	10 (58.8)	0.02
		Suggestive of cognitive impairment	23 (76.7)	7 (41.2)	
		No data	9 (25.7)	1 (5.6)	
	Memory impairment (MDS-family member)	Without impairment	8 (28.6)	13 (81.3)	0.001 F
		Suggestive of cognitive impairment	20 (71.4)	3 (18.8)	
		No data	7 (20)	2 (11.1)	
Overall quality of life		Worse quality	28 (84.8)	8 (44.4)	0.004 F
		Better quality	5 (15.2)	10 (55.6)	
		No data	2 (5.7)	0	

* Normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using Student's t-test

** Non-normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using the Mann-Whitney U test

F: Fisher's exact test

MADD: Mixed Anxiety and Depression Disorder

Table 5 Analysis of quality of life (SF-36) with sociodemographic, clinical, and analgesic use variables

Variable			Quality of life (QoL)		
			Worse QoL	Better QoL	p
			N 36	N 17	
			n (%)	n (%)	
Time since migraine diagnosis * mean ± SD or ** median [IQR]			13.5 [18.5] **	28 [16.5] **	0.02
Age of onset of migraine		Childhood (5–12 years)	2 (5.6)	9 (52.9)	0.001
		Adolescence (13–20 years)	11 (30.6)	2 (11.8)	
		Adult (21–50 years)	21 (58.3)	6 (35.3)	
		Older adult (≥ 51 years)	2 (5.6)	0	
Age of onset of self-perceived cognitive disturbances ** median [IQR]			43 [10]	38 [6]	0.04
Mental health (HADS)	Anxiety	Absence of symptomatology	8 (22.2)	10 (58.8)	0.02
		Probable symptomatology	10 (27.8)	3 (17.6)	
		Presence of symptoms	17 (47.2)	3 (17.6)	
		No data	1 (2.8)	1 (5.9)	
	Depression	Absence of symptomatology	17 (47.2)	12 (70.6)	0.218 F
		Probable symptomatology	7 (19.4)	1 (5.9)	
		Presence of symptoms	12 (33.3)	3 (17.6)	
		No data	0	1 (5.9)	

* Normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using Student's t-test

** Non-normal distribution according to the Shapiro-Wilk test. Statistical significance analysis using the Mann-Whitney U test

F: Fisher's exact test

role. Migraine can be affected by factors such as menstruation, pregnancy, menopause, and the use of hormonal contraceptives and hormone replacement therapy. It has been observed that high oestrogen levels, large fluctuations in this hormone, and hormone replacement therapy are linked to worse migraine outcomes [25–27].

Other sociodemographic aspects identified here, such as the age of onset, between 40 and 45 years, and belonging to a middle-lower socioeconomic stratum, align with findings from Burch et al. [28], where a higher incidence of migraine was observed in people aged 18 to 44 who were unemployed and had low household incomes. These results may be attributed to greater exposure to migraine triggers and limited access to treatment and healthcare services [29].

Regarding mental health outcomes, patients with chronic migraine showed a higher proportion of depression (28%) compared to those with episodic migraine (20%), while the latter group displayed higher anxiety levels (50% vs. 32%). These findings are consistent with the literature, which has focused on describing how individuals with migraine are generally more susceptible to mental health conditions [30]. A meta-analysis reported that the incidence of depression in migraine patients varied widely, ranging from 8.6 to 47.9% [31]. Alwhaibi et al. [32] found in a population of 1,713 adults identified with migraine that 11.2% had depression, 14.6% had anxiety, and 13.7% had both conditions.

Analysing by migraine subtype, the literature has indicated a higher presence of psychiatric comorbidities in patients with chronic migraine, where the association appears to be more dependent on headache frequency [33, 34]. Buse et al. [35] reported that patients with chronic migraine were twice as likely to have depression and anxiety compared to those with episodic migraine. It has also been reported that among individuals with episodic migraine, depression was associated with an increased risk of transformation to chronic migraine [36].

Investigating the presence of psychiatric comorbidities in these migraine populations can provide important epidemiological, clinical, and biological data, in addition to helping differentiate between chronic and episodic migraine. These comorbidities can exacerbate the deterioration of health-related quality of life, negatively influence treatment outcomes, therapeutic adherence, and overall quality of life [35]. Therefore, understanding the complex interaction between both conditions holistically could lead to the development of programmes that allow for a transdisciplinary approach, which would positively impact this population.

Regarding the cognitive impairment in these patients, similar percentages in both groups showed potential deterioration based on the MMSE, as well as in memory and selective attention. Among patients with migraine, subjective cognitive impairment is a frequent complaint. Objectively, during pain crises, the literature has reported varying degrees of impairment, while findings during interictal periods are inconsistent [37]. Few studies have focused on neurocognitive differences between chronic and episodic migraine patients during interictal periods. In our study, the impairment was similar for both chronic and episodic migraine patients, a finding that contrasts with Latysheva et al. [38], who reported that chronic migraine patients exhibited more pronounced impairment in delayed memory recall, attention, abstraction, and language compared to episodic migraine patients.

In a 2022 meta-analysis conducted by Braganza et al. [39], it was found that during the interictal period, patients showed moderate impairment in parameters such as attention, immediate and delayed memory, spatial cognition, and executive functioning. However, the authors emphasised that the lack of control for confounding factors, such as the presence of psychopathologies and the use of migraine medications, may overestimate the effect size.

The current literature reveals a paucity of studies investigating cognitive variations between the ictal and interictal phases of migraine within the same cohort. The study conducted by Ray et al. [40] provides objective evidence of cognitive dysfunction—specifically reduced performance in working memory, simple reaction time, and choice reaction time—during the headache and postdrome phases in patients with episodic migraine. Given the prevalence of cognitive symptoms as prodromal manifestations in migraine, it is imperative for future research to focus on evaluating how these cognitive alterations fluctuate across the different migraine phases within the same cohort. This approach would enable a more precise understanding of the relationship between prodromal symptoms and cognitive variations during migraine episodes, thereby facilitating the development of more effective and personalized therapeutic strategies.

One of the most notable and potentially contradictory findings is the relationship between the duration of migraine and its positive influence on cognitive health. It is important to remember that this group of patients was part of a comprehensive headache management programme. Considering this, it could be hypothesised that participation in such a programme might act as a protective factor for these patients, as described by Zheng Y. et al. [41], who evaluated a comprehensive and intensive chronic pain rehabilitation programme in patients with chronic headache, finding improvements in pain intensity, as well as reductions in mood impairment and disability. Similarly, Smith et al. [42] assessed the efficacy of an educational programme for migraine patients, noting improvements in headache frequency, quality of life,

and the cognitive and emotional aspects of migraine management.

On the other hand, the natural history of migraine rarely leads to complete resolution or recovery, and it is precisely the tendency toward chronicity that represents one of the greatest challenges for those affected. As migraine episodes become recurrent, and in some cases more frequent and intense, patients are faced with the need to develop adaptation and coping strategies to manage the disorder's impact on their daily lives [43]. This adaptation process includes identifying and managing triggers, developing routines that minimise exposure to adverse stimuli, and learning self-care techniques. Furthermore, the longer the time since the onset of symptoms, the more opportunities there are for individuals to develop cognitive strategies to better cope with episodes, such as relaxation techniques, stress management, cognitive restructuring, and modifying habits that may act as triggers for crises. These strategies do not eliminate the disease, but they do facilitate living with it, reducing its interference with the patient's quality of life [44].

This study found that adequate social support improves cognition in this population. The scientific literature does not provide specific data on how this variable functions as a protective factor against cognitive decline in patients with chronic migraine. However, it has been proposed in the literature that social isolation is a strong determinant of poor health [45] and that the protective effects of social support on cognitive decline could be related to increased communication and interpersonal interactions, which require greater use of cognitive resources [46]. Dhand et al. [47] emphasise the importance of considering the neurological patient as an individual embedded in a social network, where this network plays a crucial role in their health process. In light of this, they highlight the importance of mapping and tracking these patients' personal networks to develop intervention programmes that promote healthy behaviours, optimise risk factor monitoring, therapeutic adherence, and functional recovery.

Among the limitations to declare are the study design and the neurocognitive and psychological instruments used. Regarding the study design, being retrospective, there was a limitation in the absence of data; however, the percentages of missing data were low in all cases. Additionally, as a cross-sectional analytical study, only a single measurement was taken within a specific timeframe, and the association between variables was analysed. However, there was no longitudinal follow-up to definitively establish causal relationships.

Regarding the use of neurocognitive and psychological instruments, neurocognitive tests are essential tools for assessing cognitive functions, though they exhibit notable limitations, particularly in terms of construct validity, with a significant lack of factor analyses and more robust psychometric techniques [48]. This deficiency reflects insufficient research to verify whether these instruments effectively measure the specific cognitive constructs they are intended to assess. Consequently, this may lead to misinterpretations of individuals' cognitive abilities or deficits, resulting in the implementation of inappropriate interventions. Factor analyses play a critical role in this context, as they provide empirical evidence on the internal structure of the evaluated constructs. Furthermore, these limitations become more pronounced in multicultural settings or when the tests are applied to populations different from those on which they were originally standardized, thereby increasing the risk of diagnostic biases and limiting the generalizability of the findings.

One important limitation of this study is that only patients who self-reported cognitive symptoms were referred for neuropsychological testing and consequently included in the analysis. This selection criterion may have introduced bias and limits the generalizability of our findings to the entire population of migraine patients. Future research should consider evaluating a more representative sample, including individuals without self-reported cognitive concerns, to gain a comprehensive understanding of cognitive impairment in migraine.

As strengths, this study highlights the application of strategies to reduce information bias. The research team consisted of highly qualified individuals with a transdisciplinary perspective, which, combined with the analysis of the various events studied, provided a comprehensive view of migraine type, cognitive impairment, mental health, and quality of life. Additionally, prevalence ratios were used as the measure of association, which is conservative and appropriate for the study design [23, 49]. Other notable aspects include the type of population studied (patients with CM and EM), as few studies make this distinction, as well as the finding that social support exerts a protective effect on cognitive health in this population. This reinforces the importance of implementing programmes that provide a transdisciplinary approach for managing patients with migraine.

Conclusions

Female gender, middle socioeconomic status, and longer disease duration were significantly associated with CM. The duration of migraine was positively related to reduced cognitive impairment. Furthermore, strong social relationships protect against cognitive decline in these patients.

Abbreviations

EM	Episodic migraine
CM	Chronic migraine
MMSE	Mini-Mental State Examination
MDS	Memory Disorders Scale
RCF	Rey Complex Figure
TMT-A, TMT-B	Trail Making Test Part A and Part B

SF-36	36-Item Short Form Health Survey
HADS	Hospital Anxiety and Depression Scale
SES	Socioeconomic Status

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12883-025-04122-7.

Supplementary Material 1

Author contributions

MHP, DCLM, AAR and SRD generated and formulated the idea led the research team, interpreted the data and wrote the manuscript. SRD, AAJ and CBH recruited the participants and collected the data and revised the manuscript. MHP, DCLM, AAR and SRD designed the study. RZC interpreted the data and manuscript writing and revision. All the authors have reviewed and approved the final manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding authors on reasonable request.

Declarations

Ethics approval and consent to participate

This study received approval from the Ethics and Research Committee of the Fundación Instituto Neurológico de Colombia (minute number 170). In accordance with national regulations, all patients provided written informed consent, authorising access to their medical records and test results for research purposes. This study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. All procedures involving human participants adhered to established ethical standards, ensuring the protection of participants' rights, safety, and well-being throughout the research process.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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