

Central sensitization in adults with chronic neck pain: cross-cross study exploring differences by gender

Sensibilização central em adultos com dor cervical crônica: estudo transversal explorando as diferenças por sexo

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ABSTRACT

BACKGROUND AND OBJECTIVES: The presence of central sensitization (CS) in people with chronic neck pain requires clarification, as does the possible disparities between genders. Therefore, this study aimed to evaluate the presence of CS in chronic neck pain according to gender.

METHODS: Cross-sectional study with the participation of 260 adults (18-59 years old) with chronic neck pain, carried out between September 2022 and September 2023. Instruments were applied to collect sociodemographic profile, pain characteristics, cervical functional disability and presence of SC. The software SPSS 23.0 was used for comparative analyzes.

RESULTS: Regarding disparities between genders, there were no differences in the intensity of pain and cervical functional disability ($p=0.134$ and $p=0.277$, respectively). However, SC was higher in women (43.5 ± 14.0 ; $p=0.003$). In females, CS was related to “pain interference” in the aspects of walking ($r=0.311$; $p=0.001$), relationships with people ($r=0.309$; $p=0.001$), appreciation of life ($r=0.321$; $p=0.001$) and with cervical functional disability ($r=0.570$; $p=0.001$). In males, CS was related to “pain interference” in aspects such as general activity ($r=0.311$; $p=0.008$), mood ($r=0.376$; $p=0.001$), walking ($r=0.313$; $p=0.007$), relationships with people ($r=0.477$; $p=0.001$), sleep ($r=0.321$; $p=0.006$), appreciation of life ($r=0.427$; $p=0.001$) and functional disability ($r=0.667$; $p<0.001$).

CONCLUSION: Women with chronic neck pain showed a greater presence of CS, while CS in men was related to a variety of aspects that negatively affect life. Given this, differences between genders could be considered in the management of patients with chronic neck pain.

Keywords: Adult, Central nervous system sensitization, Chronic pain, Gender, Neck pain.

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HIGHLIGHTS

- Women have higher levels of central sensitization compared to men.
- Central sensitization is associated with several aspects that negatively affect life, such as pain interference (general activity, mood, interpersonal relationships, sleep and enjoyment of life) and functional disability of the cervical spine, but with greater involvement in males.
- Although there were no significant differences in pain intensity and functional disability between genders, both groups had moderate pain intensity and high functional disability associated with chronic neck pain.
- The differences found between men and women in central sensitization and factors associated with chronic neck pain highlight the need to consider these disparities in the clinical management of patients.

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RESUMO

JUSTIFICATIVA E OBJETIVOS: A presença de sensibilização central (SC) em pessoas com dor cervical crônica carece de esclarecimentos, bem como as possíveis disparidades entre os sexos. Portanto, objetivou-se avaliar a presença de SC na dor cervical crônica de acordo com o sexo.

MÉTODOS: Estudo transversal com a participação de 260 adultos (18-59 anos) com dor cervical crônica, realizado entre setembro de 2022 a setembro de 2023. Foram aplicados instrumentos para coletar perfil sociodemográfico, características da dor, incapacidade funcional da cervical e presença de SC. Para análises comparativas foi utilizado o SPSS 23.0.

RESULTADOS: Nas disparidades entre os sexos, não houve diferenças na intensidade da dor e incapacidade funcional cervical ($p=0,134$ e $p=0,277$, respectivamente). No entanto, a SC foi mais elevada nas mulheres ($43,5 \pm 14,0$; $p=0,003$). No sexo feminino, a SC apresentou relação com a “interferência da dor” nos aspectos: caminhar ($r=0,311$; $p=0,001$), relacionamento interpessoal ($r=0,309$; $p=0,001$), apreciação da vida ($r=0,321$; $p=0,001$)



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e com incapacidade funcional da cervical ($r=0,570$; $p=0,001$). Já no sexo masculino, a SC teve relação com a “interferência da dor” em aspectos como atividade geral ($r=0,311$; $p=0,008$), humor ($r=0,376$; $p=0,001$), caminhar ($r=0,313$; $p=0,007$), relacionamento interpessoal ($r=0,477$; $p=0,001$), sono ($r=0,321$; $p=0,006$), apreciação da vida ($r=0,427$ $p=0,001$) e incapacidade funcional ($r=0,667$; $p<0,001$).

CONCLUSÃO: Mulheres com dor cervical crônica mostraram maior presença da SC, enquanto nos homens a SC esteve relacionada a uma variedade de aspectos que afetam negativamente a vida. Diante disso, as diferenças entre os sexos poderiam ser consideradas no gerenciamento de pacientes com dor cervical crônica.

Descritores: Adulto, Cervicalgia, Dor crônica, Sensibilização central, Sexo.

INTRODUCTION

Chronic neck pain (CNP) is considered a health condition with a high prevalence in the world and has a negative social and economic impact on society¹. This condition is characterized by the presence of pain in the posterior region of the neck up to the upper region of the scapulae, which lasts for a period of more than three months², involving biological, psychological, and social aspects of an individual¹. In addition, it is a condition that can lead to functional limitations and influence daily and work activities, which generates the need for health care and, consequently, leads to high costs related to treatment and early retirement³.

Worldwide, this condition affects around 200 million people, with a prevalence rate of 2450 per 100000 individuals. In Brazil, the prevalence rate is estimated at 2600 per 100 000 individuals, with women and economically active adults being the most affected. In addition, neck pain is one of the main disabling conditions, ranking 11th among diseases with years lived with disability since 1990⁴. It is considered a global burden that contributes to the worsening of quality of life⁵.

As it is a multifactorial condition, it results in a series of symptoms, including decreased range of motion, asthenia, hyperalgesia and tension in the superficial and deep neck muscles⁶. Structural and sensitivity changes can occur in response to the persistence of pain over long periods, attributed to maladaptation of the central nervous system (CNS). This, in turn, can lead to elevated nociceptor activity and, along with other factors, predisposes to the development of central sensitization (CS)⁷.

CS is characterized by generalized hyperalgesia, beyond the site of impairment, which involves inefficient downward modulation of pain by varying impulses, due to an imbalance of nociceptive pathways along the pain conduction pathways (medulla, trunk and cerebral cortex), which consequently leads to a decrease in the CNS's ability to inhibit pain signals and sensory hypersensitivity⁸. In addition, it can influence the increase in pain intensity and the occurrence of functional incapacity. It also acts as an amplifier, prolonging the pain condition and interfering with quality of life and the ability to perform certain activities⁹.

Despite advances in understanding CS in contexts of chronic musculoskeletal pain, its presence in neck pain remains controversial. Its comprehension is clearer in subgroups of patients with traumatic causes than in cases of idiopathic origin¹⁰. In addition, few studies have explored the disparities between women and men with CNP, in terms of pain characteristics, intensity, interference in general aspects of life, among others¹¹. In line with this, the International Association for the Study of Pain (IASP) reinforces the importance of addressing gender-related differences in both the investigation and treatment of pain¹².

Thus, the need to investigate CS in men and women is essential for a comprehensive view of the condition of CNP and for comprehensive and effective care in pain management¹³. Given this context, the present study's objective was to assess the presence of CS in chronic neck pain according to gender.

METHODS

This is a cross-sectional quantitative study, developed in accordance with the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline. The study was carried out at the *Núcleo de Atenção Médica Integrado* (NAMI - Integrated Medical Care Center) of the University of Fortaleza (UNIFOR), as part of a larger project entitled “Evaluation of the clinical-epidemiological, functional and biomarker profile of adults with CNP”. Data collection took place between September 2022 and September 2023. NAMI provides multidisciplinary care and a range of services, through the Brazilian public health system (SUS - *Sistema Único de Saúde*) or by agreement. It is recognized as a type II rehabilitation center.

Ethical aspects

This study was approved by the ethics committee of University of Fortaleza (CAAE no. 53206121.3.0000.5052), respecting the bioethical aspects of Resolution 466/12 of the Brazilian National Health Council. All participants signed a Free and Informed Consent Term (FICT).

Study population

260 adults (18-59 years old), regardless of gender, with neck pain lasting three months or more took part in the study. The group was made up of patients in care, workers and university students who were in the health service at the time of collection. Participants who reported trauma and/or surgery in the cervical spine, cancer and neurological disorders (neuropathies, amyotrophic lateral sclerosis, stroke, epilepsy, Parkinson's disease, myasthenia, Alzheimer's disease and muscular dystrophy) were excluded.

The sample size was calculated based on the adult population of Fortaleza ($n=1930479$), a standard deviation of 2.51 for the pain intensity variable¹⁴, a margin of error of 0.5 and a 95% confidence interval. The minimum sample size was estimated at 105 participants.

Participants were recruited through a direct approach in different sectors of the health service, as well as through a public call,

which included the use of social networks and posters in various parts of NAMI, containing information about the objectives and risks, as well as the days and times of the assessments.

Collection instruments and procedures

Data was collected using four self-administered instruments: 1 - a sociodemographic and lifestyle questionnaire; 2 - the Brief Pain Inventory (BPI); 3 - the Neck Disability Index (NDI); and 4 - the Central Sensitization Inventory. This collection was carried out by a team of health professionals and academics who had undergone prior training.

The first questionnaire prepared by the researchers consisted of questions related to demographic and socioeconomic characteristics, health conditions and lifestyle. The demographic and socioeconomic profile included questions about age, gender, marital status, race/color, schooling, paid work and social class by minimum wage (MW). The social class variable was categorized as Class A/B (> 10 MW), Class C/D/E (≤ 10 MW). As for lifestyle, the following were investigated: hours of sleep, screen time, smoking, alcohol consumption and physical activity.

The BPI is a multidimensional instrument that assesses various dimensions of pain, validated for Portuguese with a good level of reliability. It has 15 items, divided into two parts: pain intensity (8 items) and pain interference in aspects of life (ability to walk, sleep, work, interpersonal relationships, and enjoyment of life), measured on a scale between zero (no interference) and 10 (worst interference) for each activity mentioned. The score for this instrument was obtained from the average of the respective items¹⁵.

The NDI is an instrument for assessing the functional capacity of the cervical region, validated for Portuguese with a good level of reliability. It consists of 10 questions related to activities of daily living and pain, with answers ranging from 0 to 5. The final score consists of the sum of the answers, summing up a total of 50 points. In this study, the results were classified in two ways: 1 - absence of disability (score ≤ 4) and presence of disability (score > 4); and 2 - absence of disability (0 to 4 points); mild disability (5 to 14 points); moderate disability (15 to 24 points); severe disability (25 to 34 points) and complete disability (>34 points)¹⁶.

The Central Sensitization Inventory (CSI) is an instrument that evaluates the presence of symptoms and diseases associated with CS, validated for Portuguese with a good level of reliability. The CSI has two components: the first consists of 25 statements scored from 0 (never) to 4 (always); and the second component includes questions about the diagnosis of diseases related to the CS syndrome and the year of diagnosis. The final score is obtained from the sum of the answers (ranging from 0 to 100), which can be categorized into levels of severity: subclinical (0 to 29), mild (30 to 39), moderate (40 to 49), severe (50 to 59) and extreme (60 to 100)¹⁷. In the present study, the presence of CS was considered the outcome and only the first component was analyzed.

Statistical analysis

A descriptive analysis was carried out to calculate the mean, standard deviation (SD) and relative frequency (%) of the male and female groups. To compare the difference between

the sociodemographic variables, lifestyle, pain characteristics, functional disability and CS with gender (male and female), the Mann-Whitney and Pearson's chi-square tests were applied, calculating the odds ratio (OR) and 95% confidence interval (95% CI).

Spearman's correlation test was used to compare the relationship between the selected variables and the presence of CS in each group separated by gender. The non-parametric tests applied were defined according to the Shapiro-Wilk results. Statistical analyses were carried out using the SPSS Statistics 23.0 software. A significance level of 5% ($p < 0.05$) was adopted.

RESULTS

As for the sociodemographic profile of the female sex ($n=188$; 72.3%), there was a higher proportion of single women, with 71.3% ($n=134$), of brown skin color, with 46.8% ($n=88$), incomplete higher education, with 53.7% ($n=101$), no paid work, with 52.9% ($n=99$) and of social classes C/D/E, with 75.5% ($n=142$). The mean age was 30 years (SD: 11.7). As for males ($n=72$; 27.7%), there was a higher proportion of single men, with 70.8% ($n=51$), of brown skin color, with 48.6% ($n=35$), complete higher education, with 40.3% ($n=29$), paid work, with 70.8% ($n=51$) and from social classes C/D/E, with 70.8% ($n=51$). The mean age of men was 30 years (SD: 10.6) (Table 1).

As for matters of lifestyle in the female sex, sleep time was 6 hours (SD: 1.2) and screen time was 7 hours (SD: 3.8), 15.4% ($n=29$) were smokers and 51.1% ($n=96$) consumed alcohol (Table 1). In males, sleep time was 6 hours (SD: 1.5) and screen time was 7 hours (SD: 3.6), 8.3% ($n=6$) were smokers and 58.3% ($n=42$) consumed alcoholic beverages, but there were no significant differences ($p > 0.05$). There was a significantly higher proportion of women who did not do any activities compared to men (OR=2.650; $p=0.002$) (Table 2).

As for pain characteristics, the average intensity reported by women was 6.4 (SD: 1.8) and by men was 6.1 (SD: 1.5), with a predominance of moderate pain for the female and male sexes (65.4% and 75.0%, respectively). Women and men reported constant pain (50.3% and 62.0%, respectively) and pain lasting more than 1 year (62.8% and 59.7%, respectively) (Table 2). In addition, the interference of pain in different aspects of life showed higher values for mood (5.0 ± 3.5 for women and 4.2 ± 3.3 for men) and sleep (4.9 ± 3.5 for women and 4.8 ± 3.5 for men). It should also be noted that the interference of pain on the job was significant for women (4.0 ± 3.4) compared to men (3.1 ± 3.3) ($p=0.040$) (Table 3).

Regarding functional disability in the cervical region, there was no significant difference between women (13.5 ± 5.9) and men (12.3 ± 5.3) ($p=0.134$), but 97.9% ($n=184$) of women and 97.2% ($n=70$) of men had mild to severe disability. The presence of CS was significantly higher in women (43.5 ± 14.0) compared to men (37.4 ± 13.9) ($p=0.003$). When classifying the presence of CS in the sample, 84.0% ($n=158$) of women and 68.1% ($n=49$) of men had a mild to extreme level (Table 4).

Table 1. Distribution of sociodemographic variables and lifestyle of adults with chronic non-specific neck pain according to gender. Fortaleza, Ceará, 2022-2023

Sociodemographic variables	Gender						p-value ^a	OR ^a IC95%
	Male			Female				
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)		
Age			30.1 (10.6) 27.0 (22.0-34.7)			30.5 (11.7) 25.0 (21.0-39.0)	0.900	
Marital status							0.619	
Married	18	25		40	21.3			
Single	51	70.8		134	71.3			
Divorced	3	4.2		13	6.9			
Separated#	0.0	0.0		1	0.5			
Race/color							0.973	
White	30	41.7		82	43.6			
Brown	35	48.6		88	46.8			
Black	4	5.6		11	5.9			
Indigenous#	0.0	0.0		1	0.5			
Yellow	3	4.2		6	3.2			
Schooling							0.103	
Incomplete elementary school	1	1.4		8	4.3			
Complete elementary school #	0.0	0.0		1	0.5			
High school incomplete	2	2.8		2	1.1			
High school complete	12	16.7		21	11.2			
Higher education incomplete	28	38.9		101	53.7			
Higher education incomplete	29	40.3		55	29.3			
Gainful employment							0.001*	0.36 0.20-0.65
No	21	29.2		99	52.7			
Yes	51	70.8		88	46.8			
Not declared#	0.0	0.0		1	0.5			
Social class							0.454	1.26 0.68-2.34
A/B	20	27.8		44	23.4			
C/D/E	51	70.8		142	75.5			
Not declared#	1	1.4		2	1.1			

SD = standard deviation; p25-75 = 25%-75% percentile; OR = odds ratio; 95% CI = 95% confidence interval; MW = minimum wage value for 2022: R\$1,212.00 and current value for 2023: R\$1,320.00; # = Removed from analysis; a = comparison between males and females; *p<0.05 using the Mann-Whitney and Pearson's Chi-square tests.

Table 2. Distribution of lifestyle variables of adults with chronic non-specific neck pain according to gender. Fortaleza, Ceará, 2022-2023

Variables	Gender						p-value ^a	OR ^a IC95%
	Male			Female				
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)		
Lifestyle								
Hours of sleep			6.1 (1.5) 6.0 (5.0-7.0)			6.1 (1.2) 6.0 (5.0-7.0)	0.947	
Screen time			7.3 (3.6) 6.5 (4.3-10.0)			7.2 (3.8) 7.0 (4.0-10.0)	0.641	

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Table 2. Distribution of lifestyle variables of adults with chronic non-specific neck pain according to gender. Fortaleza, Ceará, 2022-2023 – continuation

Variables	Gender						p-value ^a	OR ^a IC95%
	Male			Female				
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)		
Smoking							0.310	
Non-smoker	61	84.7		145	77.1			1
Smoker	6	8.3		29	15.4			2.03 0.80-5.41
Ex-smoker	5	6.9		14	7.4			1.178 0.40-3.41
Alcohol consumption							0.293	
No	30	41.7		92	48.9			1
Yes	42	58.3		96	51.1			0.741 0.43-1.29
Physical activity							0.002*	
Yes	56	77.8		107	56.9			1
No	16	22.2		81	43.1			2.650 1.41-4.95

SD = standard deviation; p25-75 = 25%-75% percentile; OR = odds ratio; 95% CI = 95% confidence interval; a = comparison between males and females; *p<0.05 by Mann-Whitney and Pearson's Chi-square tests.

Table 3. Distribution of adult pain characteristics according to gender. Fortaleza, Ceará, 2022-2023

Variables	Gender						p-value ^a
	Male			Female			
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)	
Pain intensity			6.1 (1.5) 6.0 (5.0-7.0)			6.4 (1.8) 7.0 (5.0-8.0)	0.277
Pain intensity classification							
Mild	2	2.8		11	5.9		
Moderate	54	75.0		123	65.4		
Severe	16	22.2		54	28.7		
Worst pain you've felt in the last 24 hours			5.1 (2.6) 5 (3.2-7.0)			5.5 (2.7) 6.0 (4.0-8.0)	0.221
Weakest pain you've felt in the last 24 hours			2.0 (1.8) 2.0 (0.2-3.0)			2.2 (2.0) 2.0 (1.0-3.7)	0.506
Timing of pain							
Constant	44	62.0		94	50.3		
Recurrent	22	31		67	35.8		
Constant with worsening period	5	7.0		26	13.9		
Days of pain in the month			12.2 (10.0) 8.0 (4.0-19.0)			13.14 (10.4) 10.0 (3.5-20.0)	0.777
Time of neck pain			3.0 (3.3) 2.0 (1.0-5.0)			3.4 (4.0) 2.0 (1.0-5.0)	0.628
≥ 1 year	43	59.7		118	72.8		
< 1 year	29	40.3		70	37.2		
Interference of pain on different aspects							
General activities			3.9 (2.9) 4.0 (1.0-7.0)			4.25 (3.3) 4.0 (1.0-6.0)	0.755
Mild	35	48.6		86	45.7		
Moderate	27	37.5		76	40.4		
Severe	10	13.9		26	13.8		

Continue...

Table 3. Distribution of adult pain characteristics according to gender. Fortaleza, Ceará, 2022-2023 – continuation

Variables	Gender						p-value ^a
	Male			Female			
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)	
Mood			4.2 (3.3) 4.5 (1.0-7.0)			5.0 (3.5) 5.0 (2.0-8.0)	0.106
Mild	34	47.2		72	38.3		
Moderate	21	29.2		55	29.3		
Severe	17	23.6		61	32.4		
Walking			2.6 (3.2) 1.0 (0.0-4.7)			2.6 (3.1) 0.0 (0.0-5.0)	0.819
Mild	47	65.3		127	67.6		
Moderate	16	22.2		42	22.3		
Severe	9	12.5		19	10.1		
Work			3.1 (3.3) 2.0 (0.0-6.0)			4.0 (3.4) 4.0 (0.0-7.0)	0.040*
Mild	47	65.3		91	48.3		
Moderate	14	19.4		56	29.8		
Severe	11	15.3		41	21.8		
Interpersonal relationships			2.6 (2.8) 2.0 (0.0-5.0)			3.3 (3.4) 2.0 (0.0-6.0)	0.120
Mild	48	66.7		111	59		
Moderate	19	26.4		42	22.3		
Severe	5	6.9		35	18.6		
Sleep			4.8 (3.5) 5.5 (1.0-8.0)			4.9 (3.5) 5.0 (2.0-8.0)	0.886
Mild	28	38.9		71	37.8		
Moderate	22	30.6		61	32.4		
Severe	22	30.6		46	37.7		
Appreciation of life			3.1 (3.2) 2.0 (0.0-6.0)			3.6 (3.5) 3.0 (0.0-7.0)	0.464
Mild	44	61.1		99	52.7		
Moderate	18	25		52	27.7		
Severe	10	13.9		37	19.7		

SD = standard deviation; p25-75 = 25%-75% percentile; OR = odds ratio; 95% CI = 95% confidence interval. a = comparison between males and females of the results of the means of each variable only. *p<0.05 by Mann-Whitney test.

Table 4. Analysis of functional disability and the presence of central sensitization in adults with chronic non-specific neck pain by gender. Fortaleza, Ceará, 2022-2023

Variables	Gender						p-value ^a
	Male			Female			
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)	
Functional disability of the cervical region			12.3 (5.3) 11.0 (9.0-15.0)			13.5 (5.9) 13 (10.0-17.0)	0.134
Classification of functional disability of the cervical region							
No disability	2	2.8		4	2.1		
Mild	50	69.4		112	59.6		
Moderate	19	26.4		63	33.5		
Severe	1	1.4		9	4.8		

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Table 4. Analysis of functional disability and the presence of central sensitization in adults with chronic non-specific neck pain by gender. Fortaleza, Ceará, 2022-2023 – continuation

Variables	Gender						p-value ^a
	Male			Female			
	n	%	Mean (SD) Median (p25-75)	n	%	Mean (SD) Median (p25-75)	
Involvement of central sensitization			37.4 (13.9) 35.5 (26.2-49.0)			43.5 (14.0) 42.0 (33.0-54.0)	0.003*
Classification of central sensitization							
Subclinical	23	31.9		30	16.0		
Mild	20	27.8		50	26.6		
Moderate	11	15.3		48	25.5		
Severe	13	18.1		35	18.6		
Extreme	5	6.9		25	13.3		

SD = standard deviation; p25-75 = 25%-75% percentile; OR = odds ratio; 95% CI = 95% confidence interval; ^a = comparison between males and females of the results of the means of each variable only; *p<0.05 using the Mann-Whitney test.

Table 5. Analysis of the association between the presence of central sensitization, pain characteristics and disability of adults with chronic non-specific neck pain by gender. Fortaleza, Ceará, 2022-2023

Variables	Central Sensitization				
	Male		Female		
	r	P value ^a	r	p-value ^a	
Age	-0.105	0.379	0.630	0.387	
Hours of sleep	-0.144	0.227	-0.340	<0.001*	
Screen time	0.105	0.380	0.057	0.442	
Pain intensity	0.108	0.364	0.184	0.012*	
Time of pain	-0.198	0.097	-0.081	0.276	
Interference of pain in various aspects					
General activity	0.311	0.008*	0.283	<0.001*	
Mood	0.376	0.001*	0.261	<0.001*	
Walking	0.313	0.007*	0.311	<0.001*	
Work	0.108	0.367	0.026	0.724	
Interpersonal relationships	0.477	<0.001*	0.309	<0.001*	
Sleep	0.321	0.006*	0.277	<0.001*	
Appreciation of life	0.427	<0.001*	0.321	<0.001*	
Functional disability of the cervical region	0.671	<0.001*	0.570	<0.001*	

r = Spearman's correlation; *p<0.05 relationship between the presence of CS and the variables of interest by gender.

In females, the presence of CS showed an inversely proportional relationship with hours of sleep ($r=-0.34$; $p<0.001$) and a directly proportional relationship with the interference of pain in different aspects of life, including general activity ($r=0.283$; $p=0.001$), mood ($r=0.261$; $p=0.001$), walking ($r=0.311$; $p=0.001$), interpersonal relationships ($r=0.309$; $p=0.001$), sleep ($r=0.277$; $p=0.001$) and enjoyment of life ($r=0.321$; $p=0.001$), as well as with functional disability ($r=0.570$; $p=0.001$) (Table 5).

In males, the presence of CS was directly proportional to the interference of pain on general activity ($r=0.311$; $p=0.008$), mood ($r=0.376$; $p=0.001$), walking ($r=0.313$; $p=0.007$), interpersonal relationships ($r=0.477$; $p=0.001$), sleep ($r=0.321$; $p=0.006$) and enjoyment of life ($r=0.427$; $p=0.001$). CS and cervical functional disability were also directly proportional ($r=0.667$; $p<0.001$) (Table 5).

DISCUSSION

This study sought to investigate the presence of CS in CNP and its relationship with gender, contributing to a comprehension of the influence of these factors on the maintenance of this chronic health condition. It is also worth noting that the disparities between men and women need to be explored in the clinical practice of health professionals¹⁸.

As for the findings of this study, there was a higher proportion of women with CNP in the sample. These findings have been observed in the literature and are explained by the interaction between social and biological factors¹¹. These factors include a lower tolerance and pain threshold in women, as well as a higher risk of developing chronic pain compared to men. These differences can be explained by hormonal changes and the

functions of endogenous opioids, which play an important role in the differences between genders¹⁹.

On the other hand, a systematic review that investigated the epidemiology, trends and risk factors in neck pain highlights the lack of evidence regarding female predominance, since the epidemiological studies found no statistical differences. In addition, physical inactivity is one of the risk factors for the permanence and severity of pain¹. This may explain the association between females and the lack of physical activity found in this study.

Regarding the characteristics of CNP, a higher proportion of people with moderate pain intensity and functional disability were found, regardless of gender. These findings are similar to a study conducted in Japan in 2020, which indicated that these variables are equivalent in both women and men with degenerative spine disease. However, the authors point out some differences, such as the association between pain intensity and functional disability in women, as well as the association between functional disability and insomnia in men¹³. In view of this, it is possible to see a lack of consistency in relation to the differences and characteristics of pain between genders, which in turn highlights the complexity of the subject, including the influence of multiple factors and the individual nature of the painful experience.

Regarding the presence of CS in this study's sample, the values found were higher in women, with 57.4% of women showing values above the subclinical threshold. In line with these results, a study conducted in Spain with patients with chronic musculoskeletal pain revealed a higher proportion of women with CS compared to men²⁰. However, it is important to note that the mean CS scores found in the Spanish study were lower than those observed in this study, with discrepancies of 17 points for men and 14 points for women. These findings are based on knowledge of the differences between alterations in brain structure and psychosocial characteristics related to pain and gender²⁰.

This study also found a relationship between CS and "pain interference" in aspects such as walking, interpersonal relationships and enjoyment of life, as well as an association with cervical functional disability in women. In males, CS was related to these same aspects, including mood and sleep.

These results reveal a close association between pain perception, psychological aspects and CS, which can be explained by alterations in supraspinal processing. Thus, negative emotions lead to damage to the descending inhibitory pathways, by distorting synapses in the central nervous system and, consequently, increasing CS²¹. It should also be noted that adults with CS can manifest generalized hyperalgesia, as well as fear-avoidance beliefs and catastrophic thoughts. These factors can result in physical inactivity, which in turn leads to reduction in neural plasticity, making it difficult for the central nervous system to adapt to pain.

Although this study highlighted the higher level of CS in women, there was a moderate correlation between disability and CS in both sexes. Studies indicate that high levels of CS are associated with functional disability, and this association is justified by the impact of changes in the mechanisms of pain intensity, the ability to carry out daily activities and social issues^{22,23}.

Although there is little evidence on gender differences in the presence of CS and neck pain, it is possible to see divergences in the findings due to the socioeconomic, cultural and environmental characteristics of the populations studied^{1,13,24}. Therefore, there is a need for more studies that explore biopsychosocial aspects and use assessments of pain modulation and specific neurotrophic biomarkers.

In view of this, gender differences should be considered in the management of patients with CNP, due to the influence of gender on pain perception and health-related quality of life, possibly resulting from differences in the underlying physiological mechanisms of pain, including the involvement of different genes, proteins and interactions between hormones¹⁸, as well as the influence of lifestyle and health care seeking²⁵.

Finally, some limitations should be acknowledged. The first is recall bias, which can be considered an influencing factor in the participants' responses. In addition, the lack of data related to therapeutic interventions, such as pharmacological and physiotherapeutic treatment, and variables on psychosocial aspects, including measures of catastrophism, kinesiphobia and the assessment of anxiety and depression, could have had an impact on the lack of justification for the associations established. It is also worth noting that, due to the characteristics of a cross-sectional study, the ability to establish causal relationships is limited.

CONCLUSION

Women with CNP showed a greater presence of CS, while in men CS was related to a variety of aspects that negatively affect life. Therefore, differences between genders could be considered in the management of patients with CNP.

AUTHORS' CONTRIBUTIONS

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Statistical analysis, Funding acquisition, Resource Management, Project Management, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Supervision

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