Sleep disorders in patients with chronic pain: cross-sectional study

Distúrbios do sono em pacientes com dor crônica: estudo transversal

Michelle dos Santos Severino Costa[1], Caroline Carvalho Mageste[2], Dierisson Souza Simão[3], Renato Santiago Gomez[1]

DOI 10.5935/2595-0118.20230077-en

ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic pain and its relationship with sleep disturbance are common conditions with great influence on the individual's quality of life. The simultaneous occurrence of these two entities results in greater suffering, reduced functionality and well-being. The objective of this research was to evaluate the influence of chronic pain on sleep and its impact on quality of life.

METHODS: This is an observational, cross-sectional, individual, uncontrolled study carried out at the Multidisciplinary Pain Center of the Clinical Hospital of the Federal University of Minas Gerais (*Hospital das Clínicas da Universidade Federal de Minas Gerais* - HC-UFMG). The patients answered a semi-structured, face-to-face interview via the pain center's own computer system (avaliaDor®), using internet-connected mobile devices. Socioeconomic and pain data was collected, and then instruments were applied to assess pain intensity (Visual Numerical Scale - VNS), quality of life (Medical Outcomes Study 36 - Short Form Health Survey - SF-36), presence of psychiatric disturbances (Hospital Depression Anxiety Scale - HAD) and sleep (Mini Sleep Questionnaire - MSQ).

RESULTS: One hundred and three patients participated in the study. Seventy two percent were women, the median age was 55 years, and the patients were predominantly married, white and with a low level of schooling. Of the entire study population 74.76% presented "severe difficulty" in sleeping, while 22.33% had "good quality" sleep. Regarding pain intensity, patients in the moderate and severe pain groups had a higher percentage of "severe difficulty" in sleeping, when compared to patients with mild pain. About the presence of anxiety and depression, it was observed lower scores on: "restless sleep", "tiredness for no apparent reason", "wakes up with a headache", "wakes up and goes back to sleep", "wakes up tired in the morning", and finally "wakes up and does not go back to sleep". The general data from the SF-36 points to a low quality of life for the patients in the present study and, based on the multivariate analysis, the items "SF-36-Pain and SF-36-Vitalidade" were shown to be protective factors for the presence of sleep disturbances.

CONCLUSION: Sleep disorders in patients with chronic pain are common and show a worsening in quality of life. The frequency of this disturbance was higher in patients with anxiety and depression compared to patients without these psychiatric disorders. The early identification of sleep disturbances in individuals with chronic pain is necessary to improve well-being.

Keywords: Chronic pain, Quality of life, Sleep.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor crônica e os distúrbios do sono são condições comuns. A ocorrência simultânea dessas duas entidades resulta em maior sofrimento pessoal e redução do bem-estar e da funcionalidade. O objetivo desta pesquisa foi avaliar a influência da dor crônica no sono e o seu impacto na qualidade de vida.

MÉTODOS: Trata-se de um estudo observacional, transversal, individual e não controlado, realizado no Centro Multidisciplinar de Dor do Hospital das Clínicas da Universidade Federal de Minas Gerais (HC-UFMG). Os pacientes responderam a uma entrevista semiestruturada, face a face, por meio do sistema de computador do próprio centro de dor (avaliaDor®), utilizando dispositivos móveis conectados à internet. Foram coletados dados socioeconômicos e de dor; em seguida foram aplicados instrumentos para avaliar a intensidade da dor (Escala Visual Numérica - EVN), a qualidade de vida (*Medical Outcomes Study* 36 - *Short Form Health Survey* - SF-36), a presença de distúrbios psiquiátricos (*Hospital Depression Anxiety Scale* - HAD) e o sono (*Mini Sleep Questionnaire* - MSQ).

Michelle dos Santos Severino Costa – https://orcid.org/0000-0002-8559-1246;
Caroline Carvalho Mageste – https://orcid.org/0000-0002-2148-3617;
Dierisson Souza Simão – https://orcid.org/0000-0003-1257-3263;
Renato Santiago Gomez – https://orcid.org/0000-0001-9725-4020.

1. Federal University of Minas Gerais, School of Medicine, Department of Surgery, Belo Horizonte, MG, Brazil.
2. Federal University of Minas Gerais, Teaching hospital, Surgery and Anesthesia Unit, Belo Horizonte, MG, Brazil.
3. Federal University of Minas Gerais, Belo Horizonte, MG, Brazil.

Submitted on May 22, 2023.
Accepted for publication on September 16, 2023.
Conflict of interests: none - Sponsoring sources: none.

HIGHLIGHTS

- This article analyzed chronic pain and sleep disorders, two relevant topics due to their high prevalence and influence on quality of life.
- This research linked sleep disorders with mood and anxiety disorders, common psychiatric comorbidities in chronic pain patients.
- The importance of assessing patients with chronic pain for the presence and severity of sleep disorders was demonstrated, with the aim of adapting multidimensional pain treatment.

Responsible associate editor: Juliana Barcellos de Souza
https://orcid.org/0000-0003-4657-052X

Correspondence to:
Michelle dos Santos Severino Costa
E-mail: michelle.s.severino@hotmail.com

RESULTADOS Cento e três pacientes participaram do estudo. Setenta e dois por cento eram do sexo feminino, com mediana de idade de 55 anos, com predominância de brancos com baixo nível de escolaridade. De toda a população estudada, 74,76% dos participantes apresentaram "dificuldade grave" para dormir, enquanto 22,33% tiveram "boa qualidade" de sono. Em relação à intensidade da dor, os pacientes dos grupos de dor moderada e intensa apresentaram maior percentual de "dificuldade grave" para dormir quando comparados aos pacientes com dor leve. Em relação à presença de ansiedade e depressão, observou-se maior pontuação nos itens: "sono agitado", "cansaço sem motivo aparente", "acorda com dor de cabeça", "acorda e volta a dormir", "acorda cansado pela manhã" e, por fim, "acorda e não volta a dormir". Os dados gerais do SF-36 apontam para uma baixa qualidade de vida dos doentes do presente estudo e, com base na análise multivariada, os itens "SF-36-Dor e SF-36-Vitalidade" revelaram-se fatores protetores da presença de perturbações do sono.

CONCLUSÃO: Os distúrbios de sono em pacientes com dor crônica são comuns e determinam piora na qualidade de vida. A frequência desse distúrbio foi maior nos pacientes com ansiedade e depressão, em comparação com os pacientes que não apresentaram essas desordens psiquiátricas. A identificação precoce dos distúrbios do sono, em indivíduos com dor crônica, é fundamental para alcançar maior bem-estar.

Descritores: Dor crônica, Qualidade de vida, Sono.

INTRODUCTION

Chronic pain (CP) and sleep disturbance are prevalent conditions throughout adults wordwide[1] and it is considered a public health problem that affects 20% to 35% of the global population[2]. Sleep functioning is essential for learning and memory[3]. Sleep disorders are common in patients with CP, with a prevalence of up to 88%[4]. CP can be defined as severe, persistent, moderate or long-term, disrupting daily life. It results in the deterioration of the individual's health and functional capacity[1].

Although the relationship between sleep and pain seems explicit, its direction is still the subject of debate. Studies on pain and sleep disturbances suggest a bidirectional relationship, where pain could be predictive of sleep disturbances and, likewise, poor sleep quality aggravates pain, particularly in cases of CP[5,6]. This can be explained, in part, by similar neurobiological mechanisms between those conditions[7].

The underlying mechanisms involved in cases of pain, associated with sleep alterations, are still uncertain. The effects of sleep on endogenous pain modulation have been investigated in different studies and some authors have suggested that the descending inhibitory pathway could be the most affected[8]. In this sense, disordered sleep would lead to a reduction in serotonin production and, consequently, a reduction of pain modulation, as well as an increase in the levels of substance P. These alterations, combined with changes in the sympathetic nervous system, would result in muscle ischemia and increased sensitivity to pain[9]. Inflammatory cytokines, such as IL1beta, TNF alpha and IL-6, present in various painful conditions, are involved in sleep regulation by acting on the central nervous system[10]. Another mechanism that could hypothetically explain the relationship between pain and sleep disturbances would be an imbalance in the mesolimbic dopaminergic system. Down-regulation of this system could affect the reward system and pain modulation systems[11].

Common sleep problems include insomnia (characterized by difficulty initiating sleep, frequent night-time awakenings and early morning awakenings), restless legs syndrome, and breathing disturbances[12,13]. These conditions have been related to different causes of pain, such as fibromyalgia, headaches, musculoskeletal and neuropathic pain[14]. When assessing sleep alterations in the population with CP, one should be aware of possible confounding variables, such as mood disorders, use of drugs and patient expectations regarding their analgesia. Mood disorders such as anxiety and depression are often associated with CP and poor sleep quality. According to a study[15], depressive symptoms partially influence the relationship between insomnia and CP, while another study[16] described the modulation of anxiety on insomnia symptoms and pain incidence.

CP, when associated with sleep alterations, cause limitation in daily activities, functional incapacity, worsening of quality of life[17,18] and an increase in general morbidity[19-23]. In addition, it is observed that the simultaneous occurrence of these two entities determines a reduction in productivity and an increase in healthcare expenses[20]. It is believed that a vicious cycle is created, in which pain triggers sleep disorders and these increase and worsen the perception of pain[21].

The aim of this study was to evaluate the sleep and quality of life in patient suffering from CP, associating them to the mood and anxiety disorders.

METHODS

This was an observational, cross-sectional, individual, uncontrolled study, carried out at the Multidisciplinary Pain Center of the Teaching Hospital of the Federal University of Minas Gerais (*Hospital das Clínicas da Universidade Federal de Minas Gerais* - HC--UFMG). This research complied with the ethical norms of Resolution number 196/96 of the Brazilian National Health Council (*Conselho Nacional de Saúde*) and was approved by the UFMG Research Ethics Committee (*Comitê de Ética em Pesquisa da UFMG* - Opinion Number 21291119.0.0000.5149). This research took place from January 2020 to June 2021. To participate in this study, patients signed the Free and Informed Consent Term (FICT).

Selection of participants

Those patients who agreed to participate in the interviews were of both genres, over 18 years of age, and attending regular follow-up consults at the Multidisciplinary Pain Center. Patients with cognitive deficits and dementia were excluded. The sample was defined by convenience, with a total of 103 patients being interviewed, randomly selected according to the order of attendance and the availability of an interviewer.

Bias

The selection of patients from a quaternary specialist center which implicates in cases of recognized severity was a bias that needs to be considered.

Data sources and measurement

The patients answered a face-to-face structured interview, containing socioeconomic, general health and pain questions. Following this, instruments were applied to assess pain intensity by th Visual Numerical Scale (VNS), presence of anxiety and depression disorders by the Hospital Anxiety and Depression Scale (HAD), quality of life *(*Medical Outcomes Study 36 - Short Form Health Survey - SF-36) and sleep by the Mini Sleep Questionnaire (MSQ). Data was collected from mobile devices connected to the internet and the center's own computer system (avaliaDor©). The data collected on avaliaDor© platform was extracted from the system and subjected to rigorous cleaning and formatting procedures. The data was then exported to Excel for use in the statistical phases.

Quantitative variables

Pain intensity was evaluated by VNS, and patients were categorized according to the result of this instrument, with "mild pain" for those who responded with VNS from zero to 3, "moderate pain" for those who responded with VNS from 4 to 7 and "severe pain" for those who responded with VNS greater than 8[22]. Sleep assessment was performed using MSQ, an instrument used for measuring subjective sleep quality, considering its general aspect, its quality, and the behavioral factors associated and the frequency of complaints[24]. This instrument provides a global score that classifies individuals as presenting "good sleep quality" (10-24 points), "mild sleep difficulty" (25-27 points), "moderate sleep difficulty" (28-30 points) or "severe sleep difficulty" (≥31 points). To determine the presence of anxiety and depression, it was applied the HAD instrument, which was developed to identify symptoms of anxiety and depression in non-psychiatric individuals[2]. A result below eight was considered negative for anxiety and depression separately. SF-36 is a generic quality of life instrument, easy to administer and understand, consisting of 36 items, divided into eight domains. It presents a final score from zero to 100, in which zero means the worst state of health and 100 the best state of health[3].

Statistical analysis

The analysis of the scores obtained by MSQ was presented with mean values (± standard deviation) and the minimum and maximum values of each analyzed parameter. Considering the nonparametric nature of the data, the continuous variables were presented through measures of central tendency. For the categorical variables, the frequency and percentage for each category were calculated. For comparisons of scores involving more than two groups, Tukey's test was employed. In order to determine the variables involved in sleep quality, a linear regression model was applied, with the total MSQ score as the dependent variable.

A bivariate analysis was initially performed, in which variables with p-value less than or equal to 0.3 were included in the final multivariate regression model. An unpaired t-test was used for two-by-two comparisons between means of depressed and anxious *versus* non-depressed and non-anxious populations. Only the variables that presented a statistically significant level (p≤0.05) remained in the final model. The strength of the association was determined by the Odds Ratio (OR), with a 95% confidence interval (CI). Model adjustments were performed considering the RMSE values[26]. All data analysis was performed using the Graphpad Prism© program, (GraphPad Software, version 8.0, La Jolla California USA, www.graphpad.com) for Windows, and the Stata© program, (version 14.0, Stata Corporation, College Station, Texas, USA).

RESULTS

The patients had a median age of 55 years. Women were predominant in the sample, 72.82% to 27.18% men. The groups of patients with different pain intensities were homogeneous, with no significant differences between them in terms of age and gender (p>0.05). Most patients declared themselves white (39.81%), followed by brown (36.89%), black (22.33%) and yellow (0.97%). With reference to marriage, the majority of patients were married (57.28%). Regarding schooling, most patients registered as having completed high school (33.98%), with another 28.16% claiming incomplete elementary school and finally 20.39% complete elementary school.

In the research population (n=103), the median pain time was 60 months. Considering the intensity of pain, patients in severe pain group had a median time of pain statistically higher than that presented by the patients in the moderate pain group (84 *versus* 48 months, respectively - p=0.051). The most frequent causes were neuropathic pain (34.95%), low back pain and lumbosciatic pain (13.59%), persistent postoperative pain (10.68%) and cancer pain (10.68%). In this study, there was no significant difference between the groups in terms of frequency, location and cause of pain (p>0.05).

The MSQ instrument was employed in this study to assess the quality of sleep in patients suffering from CP. The results obtained indicate that most of the general population (n=103) present "severe difficulty" to sleep (74.76%). Patients with "good quality" sleep represented 22.33% of the sample. With regards to pain intensity, most patients in the moderate and severe pain groups also had "severe difficulty" as the main characteristic of sleep quality (75.56% and 82.61%, respectively). As for the groups subdivided by pain intensity, the results indicated that the majority of patients with moderate and severe pain always indicated: "difficulty to fall asleep at night" (46.67% and 36.96%, respectively), "wakes up at night and does not go back to sleep" (34.78%) and "uses drugs in order to fall sleep" (47.83%).

Regarding patients with moderate and severe pain, 24.44% and 30.43% always "wake up tired in the morning", respectively. Considering the data presented by the general population, the questionnaire items that presented the highest scores were (1st) "wakes up at night and goes back to sleep", (2nd) "difficulty to fall asleep at night", (3rd) "wakes up at night and does not go back to sleep", (4th) "wakes up tired in the morning", and (5th) "use of drug in order to sleep".

The values presented both by the general population and by the moderate and severe pain groups indicated that the patients in this study had severe sleep disturbances (table 1). Among the items addressed by MSQ, "difficulty to fall asleep at night" and "wakes up tired in the morning" were the parameters that presented differences between pain intensities.

Table 1. Comparative analysis of score values (mean) obtained by the Mini Sleep Questionnaire, according to pain intensity (VNS).

	General (n=103)		Mild pain (n=12)		Moderate pain (n=45)		Severe pain (n=46)		p-value [TK]
	Mean (± SD)	Min - Max	Mean (± SD)	Min - Max	Mean (± SD)	Min - Max	Mean (± SD)	Min - Max	
Difficulty to fall asleep at night	4.80 (± 2.12)	1 - 7	2.75 (± 1.77)	1 - 6	5.11 (± 2.12)	1 - 7	5.02 (± 1.94)	1 - 7	0.001* [a,b]
Wakes up at night and does not go back to sleep	4.52 (± 1.94)	1 - 7	3.58 (± 2.28)	1 - 7	4.31 (± 1.84)	1 - 7	4.96 (± 1.86)	1 - 7	0.058
Use of drug in order to fall asleep	4.01 (± 2.83)	1 - 7	3.00 (± 2.95)	1 - 7	3.80 (± 2.84)	1 - 7	4.48 (± 2.75)	1 - 7	0.220
Daytime sleeping	2.62 (± 1.76)	1 - 7	2.42 (± 1.83)	1 - 7	2.78 (± 1.87)	1 - 7	2.52 (± 1.66)	1 - 7	0.721
Wakes up tired in the morning	4.44 (± 2.07)	1 - 7	3.33 (± 2.23)	1 - 7	4.24 (± 2.11)	1 - 7	4.93 (± 1.88)	1 - 7	0.043* [b]
Snoring	3.13 (± 2.49)	1 - 7	2.83 (± 2.76)	1 - 7	3.31 (± 2.45)	1 - 7	3.02 (± 2.50)	1 - 7	0.784
Wakes up at night and goes back to sleep	5.01 (± 2.04)	1 - 7	4.50 (± 2.32)	2 - 7	5.00 (± 2.01)	1 - 7	5.15 (± 2.02)	1 - 7	0.619
Wakes up with a headache	3.01 (± 2.13)	1 - 7	2.42 (± 1.62)	1 - 5	3.20 (± 2.20)	1 - 7	2.98 (± 2.18)	1 - 7	0.525
Tiredness for no apparent reason	3.87 (± 2.10)	1 - 7	3.33 (± 2.23)	1 - 7	3.78 (± 2.17)	1 - 7	4.11 (± 2.01)	1 - 7	0.487
Restless sleep	3.12 (± 2.41)	1 - 7	2.17 (± 2.04)	1 - 7	3.04 (± 2.34)	1 - 7	3.44 (± 2.54)	1 - 7	0.260
Total score	38.51 (± 13.24)	12 - 60	30.33 (± 14.27)	12 - 55	38.58 (± 13.49)	12 - 60	40.59 (± 12.14)	15 - 60	0.050

SD = Standard deviation; TK = Tukey test; [a] Significant difference between patients in the Mild pain and Moderate pain groups (p<0.05); [b] Significant difference between patients in the mild pain and Severe pain groups (p<0.05).

Patients with moderate and severe pain had mean score values higher than those obtained by patients in the mild pain group (p=0.001) for the item "difficulty to fall asleep at night". Regarding the item "wakes up tired in the morning", the values presented by severe pain group were higher than those found in mild pain group (p=0.043). These results indicate worse sleep quality in these patients compared to the mild pain group (Figure 1).

The general SF-36 data points to a low quality of life of the patients in the present study. The components with the worst results in descending order were: "limitation due to emotional and physical aspects", "pain", "functional capacity", "general state of health", "vitality", "mental health" and "social aspects". The categorization between the groups with mild, moderate, and severe pain allowed this research to identify that in relation to "social aspects" and "functional capacity", patients with severe

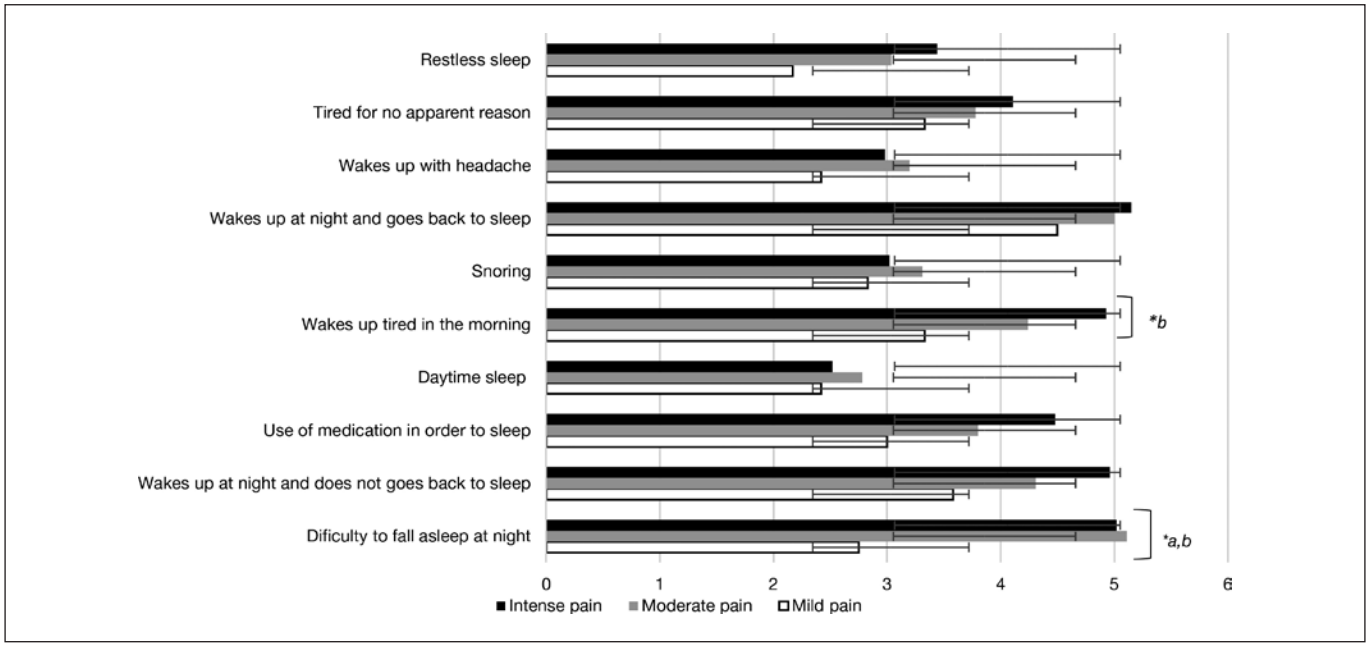

Figure 1. Mean score obtained by patients with mild (n=12), moderate (n=45) and severe (n=46) pain in each MSQ item.

* = significant p-value (p<0.05); [a] = Significant difference between patients in the mild pain and moderate pain groups; [b] = Significant difference between patients in the mild pain and severe pain groups. The bars represent the population mean and the ends represent the standard deviation values.

pain presented a lower score than those with mild pain (p=0.042 and p=0.006, respectively). The "pain" component, as expected, presented a significantly higher score in the group with mild pain than in the general group and in the groups with moderate and severe pain (p<0.0001 - table 2).

According to the HAD data, anxiety and depression were highly prevalent: 16.5% of patients were diagnosed with symptoms of anxiety, 13.59% with depression and 34.95% presented symptoms of both anxiety and depression. Considering the presence of anxiety and depression in patients with CP, the data obtained showed that the frequency of "severe difficulty" to sleep was higher in anxious, depressed, and anxious+depressed patients, compared to patients who did not have these symptoms. The items that presented differences in relation to the mean scores obtained among depressed and anxious patients *versus* non-depressed and non-anxious patients were: "wakes up at night and does not go back to sleep" (p=0.009), "wakes up tired in the morning" (p=0.000), "wakes up at night and goes back to sleep" (p=0.001), "wakes up with a headache" (p=0.028), "tiredness for no apparent reason" (p=0.001) and "restless sleep" (p=0.018). In six items evaluated by MSQ, the average score obtained by depressed and anxious patients was higher than non-depressed and non-anxious patients (Figure 2). The analysis of the total score value also identified differen-

Table 2. Quality of life characterization, according to the SF-36 instruments.

Instruments	General (n =103)	Mild pain (n=12)	Moderate pain (n=45)	Severe pain (n=46)	p-value
	Mean	Mean	Mean	Mean	
SF-36					
Social aspects	50.0	81.25 [a]	50.0	43.75 [a]	0.042*
Functional capacity	25.0	65.00 [a]	35.0	15.0 [a]	0.006*
Pain	12.0 [c]	42.0 [a,b,c]	12.0 [b]	0.0 [a]	<0.0001*
General state of health	40.0	64.5	37.0	38.5	0.212
Limitation - emotional aspects	0.0	66.67	0.0	0.0	0.244
Limitation - physical aspects	0.0	0.0	0.0	0.0	0.068
Mental health	48.0	68.0	52.0	44.0	0.115
Vitality	40.0	40.0	40.0	37.5	0.665

* Significant values of p; [a] Significant differences were observed between the mild pain and severe pain groups. [b] Significant differences were observed between the mild pain and moderate pain groups; [c] Significant differences were observed between the Mild and General Pain groups; KW = Kruskal Wallis test.

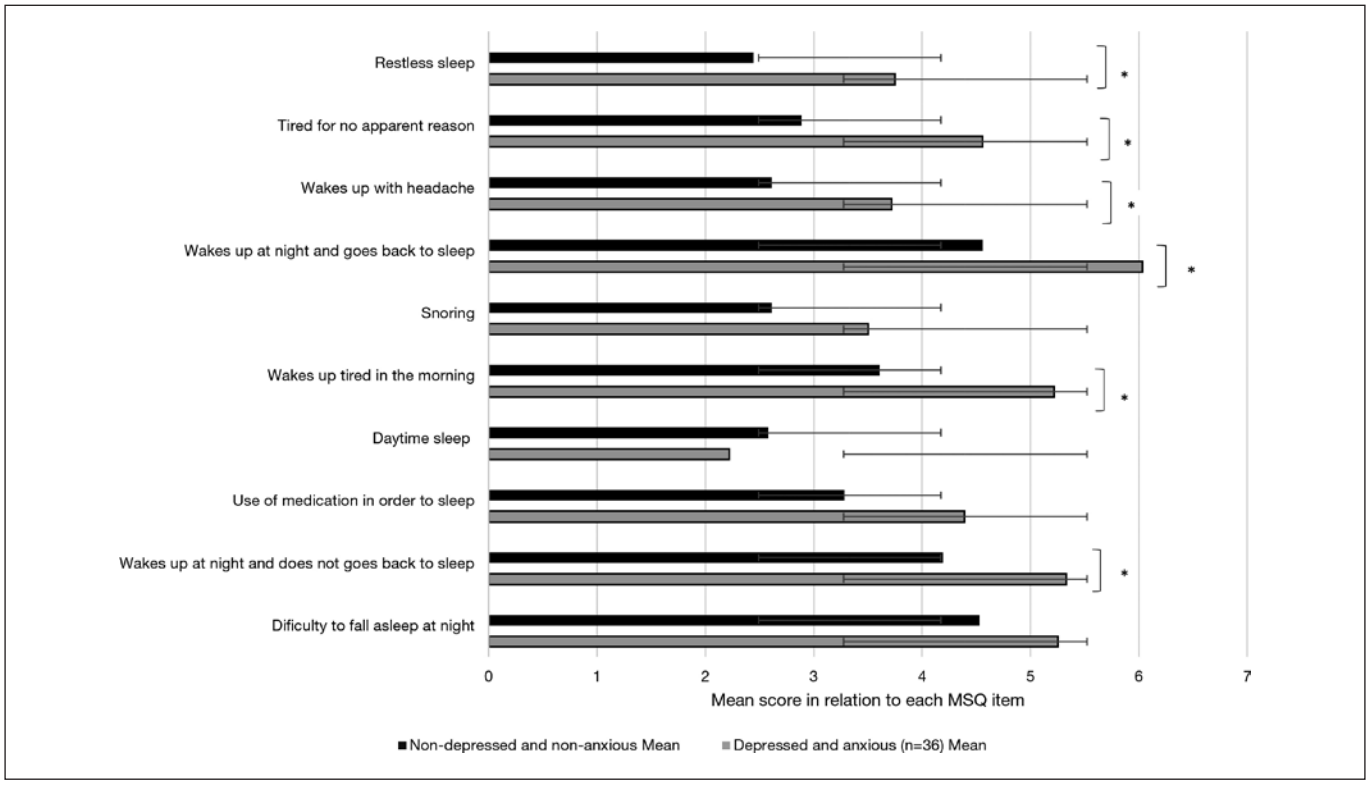

Figure 2. Mean score obtained by depressed and anxious patients (n=36) and non-depressed and non-anxious patients (n=36) in relation to each MSQ item.

* = significant difference between depressed and non-depressed patients (p<0.05).
The bars represent the population mean and the ends the standard deviation values.

ces between these patients (p=0.000). Despite the mean value of depressed and anxious patients being statistically higher than non-depressed and non-anxious patients, both groups had a total score above 30 points, indicating the presence of severe sleep disturbance.

Considering the total score obtained from the patients by MSQ in the variables: "marital status", "race/color", "schooling", "duration of pain" and "cause of pain", the SF-36 items presented a significant p-value (≤0.3) in the bivariate analysis and were pre-selected for the full multivariate linear regression model. However, despite presenting statistical significance in the bivariate analysis, when tested in a multivariate model, only the "SF-36-Pain and SF-36-Vitality" variables remained in the final model. According to the data obtained, "SF-36-Pain and SF-36-Vitality" were protective factors for the presence of sleep disturbances. Therefore, the higher the values obtained in the "pain" item (determined by SF-36), the lower the chances of the patient developing a sleep disturbance (OR = 0.89/CI = 0.79 to 1.00). Likewise, patients with good "vitality" (as determined by SF-36) are also less likely to develop a sleep disturbance (OR = 0.80/CI 0.72 to 0.89 - table 3).

Table 3. Linear regression (factors associated with sleep quality - MSQ) - Final model

Explanatory variables	Odds Ratio	Final model** CI (95%)		p-value
SF-36 – Pain	0.89	0.79	1.00	0.048*
SF-36 - Vitality	0.80	0.72	0.89	0.000*

*Significant p-values (p<0.05); **RMSE = 11.729/No. of observations = 103/R^2 = 0.23.

DISCUSSION

Sleep disorders are common in patients with CP. Probably due to pain, initiating sleep becomes a difficult process and sleep occurs in a fragmented way, causing fatigue, tiredness, drowsiness and non-restorative sleep. A study[18] concluded that pain and sleep dysfunction commonly coexist, with 40% of individuals with CP meeting criteria for alterations in sleep quality. The results of the present study corroborate the high incidence presented in the literature, with a sleep disorder prevalence of 77.67% found in the sample.

The bidirectional relationship between pain intensity and sleep disturbance has been proven, with an ineffective night's sleep predicting pain the following day[25,26]. Inadequate sleep results in increased pain perception during the day and predicts a new episode of sleep disturbance in the subsequent night, creating a vicious cycle. This finding suggests that sleep disturbances can mediate and at the same time be mediated by a complex psychological process related to pain somatization[18,28]. In the present study, individuals with moderate and severe pain presented a higher percentage of "severe sleep difficulties". A population-based study demonstrated that patients with poor sleep quality were more likely to have pain than those with good sleep quality[29], corroborating the results found in this research.

A study[30] on sleep quality in individuals with CP in a group of 121 patients, reported that 63.6% of people woke up at night and 60.3% had non-restorative sleep. In the present study, these items also presented higher scores, respectively 72,81% and 71,84%, suggesting that the presence of pain at night causes nocturnal awakenings, and this fragmented sleep possibly triggers the complaint of non-restorative sleep.

The relationship between demographic variables such as gender, ethnicity, age and schooling with pain and sleep was ambiguous. For some authors, female individuals have a worse objective and subjective quality of sleep and more intense pain than males[31,32]. In other studies, no association was observed between sleep quality, pain and demographic variables[30]. The sample was predominantly feminine, and no association was founded between gender and pain or sleep quality. Regarding schooling, high school and elementary school were the most cited, with 33.98% and 48.55%, respectively. However, the "schooling" variable was not shown to be a factor related to sleep disturbances in the studied population.

According to a study[30], initiating sleep is not the main difficulty for most patients with CP, despite having found an association between overall pain intensity and sleep latency, showing that the higher the pain scores are, the longer is the time required to fall sleep. This finding agrees with the results of this study, in which most patients with moderate and severe pain always have difficulty to fall asleep at night, with a percentage of 36.96% and 46.67%, respectively. In this study, the item "difficulty to sleep" presented the second highest score on the sleep questionnaire. Another relevant finding was the prevalence of individuals who "use a drug to fall asleep", which was 47.83%, contributing to polypharmacy in the treatment of CP.

The general population of the present study presented an overall MSQ score greater than 30, which indicates severe sleep difficulty in those individuals with CP; especially in those with severe pain. Nowadays, it remains unclear how continuous and persistent pain is in relation to severe insomnia, but many hypotheses are possible[6]. Some researchers have proposed the idea that unlike acute pain, CP is associated with functional alterations in the cells of the raphe magnus nucleus that both modulate and trigger pain[33]. Studies on rats have already indicated a mechanism of hyperactivity of these cells with excitatory neuronal discharge associated with maintenance of the alert state[34]. These concepts complement the hypothesis that CP can lead to lasting functional changes in the nervous system that modulates both sleep and pain[35].

In this research, when in the presence of anxiety and depression, patients with CP presented, comparatively, worse quality of sleep than those patients who did not present these psychiatric disorders. Pain is associated with somatic symptoms very similar to those found in depression, with inadequate sleep being one of the most common overlapping factors[36]. The presence of emotional suffering, depression and/or anxiety in people with CP represents a challenge in the evaluation of sleep alterations, as the symptoms can be the result of the pain itself or of drugs prescribed to control pain[37]. Furthermore, it must be considered that the presence of sleep

disturbances worsens depression in cases of CP, exacerbating this risk factor[38].

A study[39] showed that in the general population individuals with poor sleep quality have lower quality of life scores when compared to those with good sleep quality. Pain was one of the independent factors that was related to poor sleep quality, and poor sleep quality was in turn associated with poorer quality of life. This data corroborates the findings of the present study, where SF-36 results indicated a low quality of life for patients. Moderate and severe pain was associated with worse quality of life scores than mild pain, as observed in the literature. Although there is a growing interest in sleep disturbances in patients with CP and their relationship with a factor that worsens quality of life, in a study[30], when separating the physical and psychological dimensions of quality of life, the association between pain and sleep quality parameters was reduced and lost statistical significance[30]. In the present study, the multivariate analysis led to the conclusion that pain and vitality are protective factors for the presence of sleep disturbances. Therefore, the better the quality of life in relation to these items, the lower the chances of the patient developing a sleep disturbance.

The high prevalence of sleep disturbances in patients with CP, associated with impacts on quality of life, should alert the medical community to the importance of investigating the presence of sleep alterations in these patients. Previous research suggests that adequate pain management improves sleep quality by up to 14%[18] and the association of other therapies, pharmacological or not, should be used for the treatment of both conditions.

Limitations

Studies that correlate sleep disturbances - measured by the MSQ questionnaire - and pain intensity are scarce. It must also be remembered that the use of cross-sectional data limits the ability to establish temporal relationships and make causal inferences about pain, sleep and quality of life. However, major works in this field have shown that these relationships are probably reciprocal and consequential of each other.

CONCLUSION

The sleep assessment in this research identified a high prevalence of severe sleep disturbances, especially in patients with moderate and severe pain. The frequency of this disturbance was also higher in patients with anxiety, depression or both anxiety and depression compared to patients who did not have these psychiatric disorders. The results of the multivariate analysis identified that the pain and vitality items, both from the SF-36 instrument, presented protective factors for the presence of sleep disturbances, thus indicating that the better the quality of life, the lower the chances of the patient having a sleep disorder. Bearing in mind that pain is an important factor for the well-being of individuals, early identification of sleep disturbances in patients with CP is necessary, in order to achieve early intervention and better future outcomes.

AUTHORS' CONTRIBUTIONS

Michelle dos Santos Severino Costa
Data Collection, Conceptualization, Resource Management, Project Management, Research, Methodology, Writing - Preparation of the Original, Validation, Visualization

Caroline Carvalho Mageste
Data Collection, Conceptualization, Research, Methodology, Writing - Preparation of the Original, Validation

Dierisson Souza Simão
Statistical Analysis, Data Collection, Conceptualization, Project Management, Software, Visualization

Renato Santiago Gomez
Conceptualization, Resource Management, Project Management, Research, Writing - Review and Editing, Supervision, Validation

REFERENCES

1. Ong KS, Keng SB. The biological, social, and psychological relationship between depression and chronic pain. Cranio. 2003;21(4):286-94.
2. Cáceres-Matos R, Gil-García E, Barrientos-Trigo S, Porcel-Gálvez AM, Cabrera-León A. Consequences of chronic non-cancer pain in adulthood. Scoping review. Rev Saude Publica. 2020;54:39.
3. Zanuto EAC, Lima MCS, Araújo RG, Silva EP, Anzolin CC, Araujo MYC, Codongnol JS, Christofaro DGD, Fernandes RA. Distúrbios do sono em adultos de uma cidade do estado de São Paulo. Rev Bras Epidemiol. 2015;18(1):42-53.
4. Smith BH, Elliott AM, Chambers WA, Smith WC, Hannaford PC, Penny K. The impact of chronic pain in the community. Fam Pract. 2001;18(3):292-9.
5. Andersen ML, Araujo P, Frange C, Tufik S. Sleep disturbance and pain. Chest. 2018;154(5):1249-59.
6. Smith MT, Haythornthwaite JA. How do sleep disturbance and chronic pain inter-relate? Insights from the longitudinal and cognitive-behavioral clinical trials literature. Sleep Med Rev. 2004;8(2):119-32.
7. Boakye PA, Olechowski C, Rashiq S, Verrier MJ, Kerr B, Witmans M, Baker G, Joyce A, Dick BD. A Critical Review of Neurobiological Factors Involved in the Interactions Between Chronic Pain, Depression, and Sleep Disruption. Clin J Pain. 2016;32(4):327-36.
8. Smith MT, Edwards RR, McCann UD, Haythornthwaite JA. The effects of sleep deprivation on pain inhibition and spontaneous pain in women. Sleep. 2007;30(4):494-505.
9. Martins MRI, Polvero LO, Rocha CE, Foss MH, Santos Junior R. Uso de questionários para avaliar a multidimensionalidade e a qualidade de vida do fibromiálgico. Rev Bras Reumatol. 2012;52(1):21-6.
10. Zhai L, Zhang H, Zhang D. Sleep duration and depression among adults: a meta-analysis of prospective studies. Depress Anxiety. 2015;32(9):664-70.
11. Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. J Pain. 2013;14(12):1539-52.
12. Mathias JL, Cant ML, Burke ALJ. Sleep disturbances and sleep disorders in adults living with chronic pain: a meta-analysis. Sleep Med. 2018;52:198-210.
13. Call-Schmidt TA, Richardson SJ. Prevalence of sleep disturbance and its relationship to pain in adults with chronic pain. Pain Manag Nurs. 2003;4(3):124-33.
14. Zambelli Z, Halstead EJ, Fidalgo AR, Dimitriou D. Good sleep quality improves the relationship between pain and depression among individuals with chronic pain. Front Psychol. 2021;12:668930.
15. Generaal E, Vogelzangs N, Penninx BW, Dekker J. Insomnia, sleep duration, depressive symptoms, and the onset of chronic multisite musculoskeletal pain. Sleep. 2017;40(1).
16. Dunietz GL, Swanson LM, Jansen EC, Chervin RD, O'Brien LM, Lisabeth LD, Braley TJ. Key insomnia symptoms and incident pain in older adults: direct and mediated pathways through depression and anxiety. Sleep. 2018;41(9):zsy125.
17. Lo CM, Lee PH. Prevalence and impacts of poor sleep on quality of life and associated factors of good sleepers in a sample of older Chinese adults. Health Qual Life Outcomes. 2012;10:72.
18. Karaman S, Karaman T, Dogru S, Onder Y, Citil R, Bulut YE, Tapar H, Sahin A, Arici S, Kaya Z, Suren M. Prevalence of sleep disturbance in chronic pain. Eur Rev Med Pharmacol Sci. 2018;18(17):2475-81.
19. Smith MT, Haythornthwaite JA. How do sleep disturbance and chronic pain inter-relate? Insights from the longitudinal and cognitive-behavioral clinical trials literature. Sleep Med Rev. 2004;8(2):119-32.
20. Wilson KG, Eriksson MY, D'Eon JL, Mikail F, Emery C. Major depression, and insomnia in chronic pain. Clin J Pain. 2002;18(2):77-83.

21. Castro A, Gili M, Aguilar JL, Pélaez R, Roca M. Sueño y depresión en una muestra de pacientes con dolor crónico. Rev Soc Esp Dolor. 2014;21(6):299-306.
22. Ciena AP, Gatto R, Paccini VC, Picanço VV. Influence of pain intensity on the unidimensional scales responses of pain measurement in an elderly and young adults population. Semina Ciências Biológicas e da Saúde. 2009;29(2).
23. Bertolazi AN. Universidade Federal do Rio Grande do Sul Faculdade de Medicina Programa de pós-graduação em Medicina: ciências médicas - Tradução, adaptação cultural e validação de dois instrumentos de avaliação do sono: escala de sonolência de Epworth e Índice de qualidade de sono de Pittsburgh. 2008.
24. Zomer J. Mini Sleep Questionnaire (MSQ) for screening large populations for EDS complaints. Sleep. 1985.
25. Cicconelli RM, Ferraz MB, Santos W, Meinão I, Rodrigues IQM. Tradução para a Língua Portuguesa e avaliação do questionário genérico de avaliação de qualidade de vida SF-36 (Brasil SF-36). Rev Bras Reumatol. 1999;39(3):143-50.
26. Hosmer DW, Lemeshow S, Sturdivant RX. Applied Logistic Regression [Internet]. Wiley; 2013. (Wiley Series in Probability and Statistics). Available from: https://onlinelibrary.wiley.com/doi/book/10.1002/9781118548387.
27. Amtmann D, Bamer AM, Askew R, Jensen MP. Cross-lagged longitudinal analysis of pain intensity and sleep disturbance. Disabil Health J. 2020;13(3):100908.
28. Affleck G, Urrows S, Tennen H, Higgins P, Abeles M. Sequential daily relations of sleep, pain intensity, and attention to pain among women with fibromyalgia. Pain. 1996;68(2-3):363-8.
29. Sun Y, Laksono I, Selvanathan J, Saripella A, Nagappa M, Pham C, Englesakis M, Peng P, Morin CM, Chung F. Prevalence of sleep disturbances in patients with chronic non-cancer pain: a systematic review and meta-analysis. Sleep Med Rev. 2021;57:101467.
30. Keilani M, Crevenna R, Dorner TE. Sleep quality in subjects suffering from chronic pain. Wien Klin Wochenschr. 2018;130(1-2):31-6.
31. Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. J Pain. 2013;14(12):1539-52.
32. Zhang J, Lam SP, Li SX, Tang NL, Yu MWM, Li AM, Wing YK. Insomnia, sleep quality, pain, and somatic symptoms: sex differences and shared genetic components. Pain. 2012;153(3):666-73
33. Foo H, Mason P. Brainstem modulation of pain during sleep and waking. Sleep Med Rev. 2003;7(2):145-54.
34. Coutinho VS, Urban OM, Gebhart FG. Role of glutamate receptors and nitric oxide in the rostral ventromedial medulla in visceral hyperalgesia. Pain. 1998;78(1):59-69.
35. Paulson PE, Casey KL, Morrow TJ. Long-term changes in behavior and regional cerebral blood flow associated with painful peripheral mononeuropathy in the rat. Pain. 2002;95(1):31-40.
36. Tenti M, Raffaeli W, Gremigni P. A narrative review of the assessment of depression in chronic pain. Pain Manag Nurs. 2022;23(2):158-67.
37. Dansie EJ, Turk DC. Assessment of patients with chronic pain. Br J Anaesth. 2013;111(1):19-25.
38. van Hecke O, Torrance N, Smith BH. Chronic pain epidemiology and its clinical relevance. Br J Anaesth. 2013;111(1):13-8.
39. Lee S, Kin JH, Chung JH. The association between sleep quality and quality of life: a population-based study. Sleep Med. 2021;84:121-6.