**Association between chronic pain and sleep and the quality of life in elderly community members**

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**Disclosure statement**

The authors report no conflict of interest.

**ABSTRACT**

**Aims of the study:** Chronic pain and poor sleep quality are biopsychosocial changes that are associated with human aging and have a bidirectional correlation. The objective was to evaluate the association between chronic pain and quality of sleep and quality of life of elderly people.

**Methods:** This was a cross-sectional study with a correlational quantitative approach on the association of chronic pain with the quality of sleep and quality of life of elderly people in the community. The evaluation was carried out using sociodemographic, clinical and anthropometric questionnaires, Pittsburgh Sleep Quality Index, visual analogue scale, cognitive impairment, quality of life, and functional mobility. Descriptive statistical analysis was performed. The means between the groups were compared using the Student's t-test for independent samples, using the Spearman correlation coefficient (ρ) to test the associations and one-way analysis of variance to compare the means between the three age groups.

**Results:** This study included 131 elderly people, predominantly female (87%), with an average age of 68 ± 7 years, low income per capita (84.8% ≤2 MW), and low education (86.3% ≤3 years of study). The elderly with a history of chronic pain had worse quality of sleep and quality of life than those without chronic pain. There was a moderate (ρ = 0.590) and significant (p <0.01) positive correlation between sleep quality and chronic pain intensity, and a moderate (ρ = -0.57) and significant (p <0.01) correlation between quality of life and the intensity of chronic pain.

**Conclusion:** Elderly people with chronic pain have worse quality of sleep and quality of life than those without chronic pain. We also found that the greater the number of chronic diseases, the worse the quality of sleep and quality of life.

**Trial Registration:** Registro Brasileiro de Ensaios Clínicos (REBEC) Identifier: RBR-3cqzfy

**Keywords:** Elderly; sleep; chronic pain; quality of life.

**What’s known**

Chronic pain and poor sleep quality are biopsychosocial changes that are associated with human aging and have a bidirectional correlation.

**What’s new**

Elderly with a history of chronic pain have worse quality of sleep and quality of life. There is a good correlation between chronic pain and quality of sleep and quality of life, and the greater the intensity of pain, the worse the quality of sleep and life of the elderly. The greater the number of comorbidities, the more compromised the quality of sleep and the quality of life of the elderly.

**Main body of manuscript**

**Introduction**

Pain is a physical and emotional sign of bodily harm that largely interferes with a subject’s behaviour, while sleep, which is influenced by behaviour, is necessary to maintain homeostasis and optimise the functions of different physiological systems. Humans need pain and sleep to survive, so chronic deficiencies in the systems that regulate pain and/or sleep can negatively impact health and quality of life1,2.

The aging process generates quantitative and qualitative interferences in sleep, causing a reduction in the ability to sleep, which may also be associated with comorbidities and not only with age. These changes can cause several diseases and cause social and economic problems1-3.

Chronic pain and poor sleep quality are biopsychosocial changes that are often associated with human aging and have a two-way correlation; that is, pain impairs sleep quality and sleep deprivation increases pain1,4. These changes correspond to public health problems that have a significant functional and social impact on aging, increasing the morbidity and mortality of the elderly and negatively influencing their quality of life4,5.

Pain raises the state of cortical alertness and can alter the architecture of sleep, in addition to causing discomfort, discouragement, functional dependence, and interfering with activities of daily living6. The association between poor sleep quality and chronic pain may be relevant to functional changes in the central nervous system, especially in the thalamus, as it is related to both the painful sensations and the control of the sleep-wake cycle7,8. The older the age and number of chronic diseases, the more likely it is that sleep quality will be compromised9.

There is a high and progressive prevalence of chronic pain in people over 60 years old (51%–67%)9,10, and this remains the main cause of complaints among elderly people in hospitals and outpatient clinics11,12. However, many elderly people and their families believe that pain is part of the natural aging process and, as a result, start to omit the subject, trying to minimise the number of procedures, medications, and the side effects of their possible treatments12-14. Thus, studying the relationship between chronic pain and the quality of sleep and quality of life of the elderly can generate information that will support health services in planning appropriate strategies regarding prevention, early diagnosis, and adequate treatment for the elderly.

Therefore, the present study aimed to test the hypothesis that there is an association between chronic pain and the quality of sleep and quality of life of the elderly in the community. In addition, we expected that the elderly with a history of chronic pain would have lower quality of sleep and quality of life than those without chronic pain, and that the older the elderly with chronic pain, the worse their functional mobility and their quality of sleep and life would be.

**Materials and methods**

**Study design and subjects**

This was a cross-sectional study with a correlational quantitative approach on the association between chronic pain and the quality of sleep and quality of life of elderly people in the community. The present study was based on data from a clinical trial (registered in ensaiosclinicos.gov.br with identifier: RBR-3cqzfy) that analyses the impact of a home exercise program on the quality of sleep and the quality of life of elderly people in the community. The aforementioned clinical trial was developed by researchers linked to the study and research group on quality of life and healthy aging (QUALES) of the Universidade do Estado da Bahia (BA), Brazil. The design and conduct of this study followed the rules of the Reporting of Observational Studies in Epidemiology (STROBE).

Data was collected from July to December 2015, with the approval by the Ethics Committee of the Escola Bahiana de Medicina e Saúde Pública - EBMSP, with CAAE: 39072514.6.0000.5544. All study participants provided written informed consent for participation in the study. The recruitment of the research subjects took place through radio, social media, neighbourhood associations, churches, and groups of senior citizens meeting in the city hall of Senhor do Bonfim-Ba. The study sample was composed of elderly people from the community, and the inclusion criteria were as follows: both genders, being 60 years old or older, and having poor sleep quality. Participants with cognitive impairment identified via the Mini Mental State Examination (MMSE) were excluded15.

**Assessments**

Through individual interviews, data related to sociodemographic and anthropometric characteristics, self-reported morbidities, presence of multimorbidity (≥2 chronic diseases), a history of chronic pain, and functional mobility were collected and the following assessment instruments were used: MMSE 15, Visual Analogue Scale (VAS)16, Pittsburgh Sleep Quality Index (PSQI)17, and the World Health Organization Quality of Life Group-Old (WHOQOL-OLD)18.

Regarding anthropometric variables, weight was verified using a Welmy® anthropometric scale with a capacity of 150 kg arranged on a flat surface. The elderly were instructed to wear light clothes and were asked to climb barefoot and with empty pockets to the centre of the base of the scale, with the body erect and weight evenly distributed between the two feet, arms at the sides, and looking forward. Height (in meters) was measured with a vertical stadiometer attached to the scale, with the participant standing with his back to the device, legs and feet parallel, arms at the sides, and palms facing the body. Body mass index (BMI) was determined by the ratio of body mass in kilogrammes divided by height in meters squared.

Sleep quality was assessed using the PSQI validated in Brazil17, an instrument with established reliability and validity that provides an assessment of the subjective quality of sleep through a questionnaire, containing 19 items, which evaluates the subjective quality of sleep in the previous month. The questions are organised into seven components, with each component having specific scores ranging from 0 to 3. The scores of the seven components are summed to give an overall score ranging from 0 to 21, with scores ranging from 0 to 4 indicating good quality of sleep, 5 to 10 indicating poor quality, and above 10 indicating sleep disorder. The components are organised as follows: subjective quality of sleep, sleep latency, sleep duration, habitual sleep efficiency, sleep disorders, use of sleeping medication, daytime sleepiness, and disturbances during the day17.

Chronic pain is characterised as pain that has persisted for more than 3 months, manifests itself continuously or recurrently, and is able to cause prolonged disability and dependence in the activities of daily life of the elderly. Pain perception was measured using VAS, in which the elderly assessed pain on a scale of 0 to 10, with 0 indicating no pain and 10 being the worst pain16. Participants were dichotomized into two groups (group with no history of chronic pain and the group with a history of chronic pain), and the group with history of chronic pain was subdivided according to the intensity of pain, with 0–3 points categorized as mild pain, 4–6 points categorized as moderate pain, and 7–10 points categorized as severe pain16. The WHOQOL-OLD was used to assess quality of life, which contains six facets of four items each and assessed with Likert scale of 1 to 5 points: Facet I – “Sensory Functioning”; Facet II – “Autonomy”; Facet III – “Past, Present and Future Activities”; Facet IV – “Social Participation”; Facet V – “Death and Dying”; Facet VI – “Intimacy”. Each facet can have scores ranging from 4 to 20, and the scores of these six facets can be combined to produce a “global” score for quality of life in the elderly18.

Cognitive impairment was assessed through MMSE, which consists of questions covering five dimensions: concentration, language/praxis, orientation, memory, and attention, with a maximum score of 30 points. The cutoff points adopted were 20 points for illiterates, 25 points for elderly people with 1–4 years of education, 26.5 points for elderly people with 5–8 years of education, 28 points for those with 9–11 years of education, and 29 points for those with >11 years of education15.

Functional mobility was assessed using the Timed Up-and-Go (TUG) test, a simple test that assesses the speed of execution in getting up from a chair with arms, walking 3 meters ahead, turning, walking back, and sitting on the chair again. Execution time of <10 seconds suggests a totally free and independent subject; those who perform the test between 10 and 19 seconds are considered independent, whereas those who take 20 to 29 seconds to perform the test are in the "gray zone", i.e., they demonstrate difficulties in performing tasks of daily living and have limited functional capacity. Those with an execution time score of ≥30 seconds tend to be totally dependent on others for many basic and instrumental activities of daily living19.

**Statistical analysis**

The data were tested for normality by means of histogram analysis, mean and median, standard deviation, asymmetry, and kurtosis, and confirmed using the Kolmogorov–Smirnov normality test. Before the correlation analysis, linearity between the variables and the homoscedasticity of the sample was tested. Next, the data were subjected to descriptive analysis by means of absolute and percentage frequencies for categorical variables, and measures of central tendency and dispersion for numerical variables. The differences between the two groups of participants (with and without history of chronic pain) were analysed using the Student's t-test for independent samples for numerical variables, and the Pearson's chi-squared test for categorical variables.

In the correlation analysis, considering that the variables did not meet all criteria for the use of parametric tests, Spearman's correlation coefficient (ρ) was used to analyse the association of chronic pain intensity levels with the global PSQI score and the WHOQOL-OLD global score, and these correlations were presented using a box plot.

The Spearman correlation coefficient (ρ) was also used for the analysing correlation between the number of chronic diseases and the quality of sleep and quality of life.

To compare sleep quality, quality of life, and functional mobility between the three age groups of the elderly (60–69, 70–79, and ≥80 years) with chronic pain, one-way analysis of variance was used (one-way ANOVA).

For the decision criteria, a significance level of 5% (p <0.05) was adopted and the statistical procedures were analysed and processed using the IBM SPSS Statistical software for Windows®, version 21 (Armonk, NY: IBM Corp).

**Results**

Initially, 191 potential participants were recruited from the community. However, 28 refused to participate in the study and 32 did not meet the eligibility criteria. Therefore, only 131 elderly people were finally included in the study. A summary of the flow of participants over the course of the study is shown in Figure 1.

The sample was predominantly composed of females (87%), with an average age of 68 ± 7 years, with low education (86.3% with ≤3 years of education), low per capita income (84.8% ≤2 MW), and mostly living with family members (67.9%). Regarding the clinical characteristics, 51 elderlies (39%) have chronic pain, of which 12 (23.6%) reported mild pain, 31 (60.8%) reported moderate pain and 8 (15.6%) reported severe pain. Chronic diseases were identified in 70 elderly people (53.4%), and of these elderly people with chronic disease, the most reported diseases were anxiety (58.8%), arthrosis (37.4%), arterial hypertension (33.6%), and diabetes (26%) of the elderly. The prevalence of multimorbidity (≥ 2 morbidities) was 40.5%.

Table 1 shows the comparison of sociodemographic and clinical characteristics between the two groups. A statistically significant difference was found only between variables related to chronic disease and functional mobility (TUG). The elderly with history of chronic pain had a higher number of chronic diseases and lesser functional mobility than those without history of chronic pain.

Figure 2 shows the correlation between the quality of sleep using the global PSQI score and the intensity of chronic pain using the VAS, showing a moderate (ρ = 0.590) and significant (p <0.01) positive correlation between sleep quality and the intensity of chronic pain. The increase in pain intensity was associated with a decline in sleep quality, represented by an increase in the PSQI score.

The correlation between the number of self-reported chronic diseases and sleep quality was positive, moderate (ρ = 0.42), and statistically significant (p <0.01), whereas the correlation between the number of chronic diseases and quality of life, was negative, strong (ρ = -0.78), and statistically significant (p <0.01). This demonstrates that the greater the number of chronic diseases in the elderly, the worse the quality of sleep and the quality of life.

The correlation between quality of life, assessed using the WHOQOL-OLD global score, and pain intensity, assessed using the VAS, was moderate, negative (ρ = -0.57), and statistically significant difference (p <0.01) (Figure 3). The increase in pain intensity was associated with a reduction in the WHOQOL-OLD score.

When dividing the elderly with history of chronic pain into three age groups (60–69, 70–79, and ≥80 years) and making a comparative analysis of sleep quality, quality of life, number of morbidities, and mobility, it appears that the older the elderly, the worse their sleep quality, quality of life, and functional mobility, but the number of morbidities did not change significantly with age (Table 2).

Table 3 shows a comparison between the elderly with and without history of chronic pain in relation to the components of the PSQI. The elderly with chronic pain presented worse quality of sleep than those without chronic pain, which was statistically significant in all components of the PSQI evaluation.

On comparing the quality of life between the two groups using the WHOQOL-OLD facets, it appears that the elderly with chronic pain had a worse quality of life than those without chronic pain (p <0.05), as shown in Table 4.

**Discussion**

This study demonstrated that the elderly with chronic pain have worse quality of sleep and life than those without chronic pain. Furthermore, there is a positive, moderate, and significant correlation between pain intensity and sleep quality between the two groups. Moreover, a negative, moderate, and significant correlation exists between pain intensity and quality of life, and that the greater the intensity of pain, the worse the quality of sleep and quality of life of the elderly.

In the sample of the present study, there was a predominance of females (87%), reflecting the greater longevity of women, an aspect already highlighted in literature14,20. This feminisation of old age is justified by the fact that women have a lower mortality rate than men due to external causes, low prevalence of smoking and alcohol consumption, in addition to being more self-care practitioners20,21. However, epidemiological studies have shown that chronic pain disorders have a considerably higher prevalence in women than in men22,23. The reasons for this gender difference have not yet been fully elucidated. However, epidemiological studies suggest some hypotheses: women are more likely the ones who seek health services and are more willing than men to report pain24; biological factors related to the action of oestrogen and progesterone24,25; cognitive and emotional characteristics such as stress, depression, and catastrophization (believing that something is worse than it really is), have also been referred to as factors that contribute to different pain reactions between the two genders26.

Our sample had a mean age of 70 ± 8 years, which is consistent with population-based studies25-27, reinforcing the external validity of the present study. The majority of the elderly have a low level of education (69.4% with ≤3 years of study), reflecting the country's socioeconomic inequality. Additionally, a low per capita income was identified (84.8% ≤ 2 minimum wages), as found in studies of epidemiological profile conducted in Brazilian cities26,27 and a strong and negative correlation between the number of chronic diseases and quality of life, demonstrating that the greater the number of chronic diseases, the worse the quality of life of the elderly, corroborating previous studies28,29.

Regarding the main outcome of this study, when analysing the association between chronic pain and sleep quality, our results demonstrate that the increase in pain intensity is associated with worsening sleep quality and that the elderly with chronic pain had worse sleep quality than to those without chronic pain. This corroborates with other studies, which collectively have accepted the idea that the relationship between pain and sleep is bidirectional, with pain interrupting sleep and sleep deprivation or disturbance increasing pain; one influencing the other and making it difficult to dissociate in clinical practice30-33. However, some of the more recent studies have shown a direction of the association between sleep and pain, suggesting that sleep disorders are more significant predictors of pain than in the opposite direction34-37. Therefore, the bidirectional association seems to be stronger in the sense that sleep interferes with pain than the opposite mechanism.

In the present study, we found that, among the elderly with a history of chronic pain, sleep quality, quality of life, and functional mobility worsened with advancing age, in line with previous studies. These studies have shown that pain or physical discomfort in the elderly leads to changes in sleep patterns that tend to progress with age; with advancing age, there may be an increase in the number of diseases and a gradual decline in the functions of organic systems, which can reduce physical capacity and emotional suffering with depressive symptoms, accelerate the aging process, and interfere with the quality of sleep and quality of life of the elderly38-41.

There was a positive correlation between the number of chronic diseases and quality of sleep and a strong negative correlation between the number of chronic diseases and quality of life: the higher the number of self-reported chronic diseases, the worse the quality of sleep and the quality of life of the elderly. Sleep disorders can negatively impact chronic diseases, as poor sleep is associated with psychosocial symptoms such as depression and anxiety, in addition to causing an increased response to physiological stress and contributing to the systemic inflammatory process, enabling the development or worsening of diseases and the intensification of pain and declining quality of life42,43.

In the present study, we found that there was a moderate negative correlation between quality of life and pain intensity, and that the elderly with chronic pain had a worse quality of life than the elderly without chronic pain. Cross-sectional studies have reported a negative correlation between chronic pain and aspects of quality of life44-46. Such relationships were found in both chronic pain cohorts and population-based studies47,48. In addition, systematic reviews confirmed evidence of a link between pain and poor quality of life48,49. One systematic review reported a lack of evidence for relationship between quality of life and pain intensity49. However, our study found a negative relationship between quality of life and pain intensity. Thus, quality of life was negatively associated with the presence and intensity of pain in the elderly population.

The results of the present study strengthen the hypothesis that sleep quality and pain have a two-way and reciprocal relationship, which allows us to discuss some clinical implementations. Health professionals who participate in the treatment of patients with chronic pain and/or chronic illness, in addition to using interventions that alleviate symptoms, should also pay attention to the assessment and treatment of sleep disorders, since only secondary attention is often given to these disorders50. The findings of the present study are in line with previous recommendations51,52, suggesting that sleep assessment should be routinely addressed in the management of patients with chronic pain and/or chronic disease in terms of assessment, monitoring, and definition of therapeutic strategies. Therefore, a multidisciplinary approach is often necessary to obtain more comprehensive results regarding elderly care.

Some limitations of this study must be acknowledged. The first is related to the use of a cross-sectional design, not allowing an examination of the temporal association between the variables; therefore, the associations between chronic pain and the quality of sleep and the quality of life of the elderly should be interpreted with caution. Even though we know that the studied variables have a bidirectional relationship53, they do not allow causal inference. Although we used validated questionnaires, another limitation was the use of self-reported measures, increasing the possibility of measurement errors, recall bias, and the desire effect, which can lead to overestimation of problems54. Future studies with the application of objective methods such as polysomnography and the use of longitudinal methodology to evaluate variables at some points over time, are necessary to better capture and understand the causality between the variables studied.

**Conclusion**

These results corroborate our hypothesis that the elderly with a history of chronic pain have worse quality of sleep and quality of life than those without a history of chronic pain, and that there is a correlation between chronic pain and quality of sleep and quality of life, and the greater the intensity of pain, the worse the quality of sleep and life of the elderly. We also found that the greater the number of chronic diseases, the worse the quality of sleep and quality of life, and the older the elderly with chronic pain, the worse their quality of sleep, functional mobility, and quality of life.

In view of the above, our results reflect the need for an adequate investigation and treatment of sleep disorders in the elderly with chronic pain and chronic pain in the elderly with sleep disorders in clinical practice.

**Tables**

**Table 1.** Sociodemographic and clinical characteristics of the elderlies according to chronic pain.

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **History of chronic pain (n = 51)** | **No history of chronic pain (n = 80)** | **p** |
| Gender (n (%) female) | 45 (88.3) | 69 (86.3) | ns |
| Age (mean ± SD) | 70 ± 7 | 69.9 ± 7 | ns |
| Education (n (%) ≤ 3 years of study) | 45 (88.4) | 68 (85) | ns |
| Per capita monthly income  (n (%) ≤ 2) | 44 (86.4) | 71 (88.8) | ns |
| Household arrangement (n (%) lives with family members) | 35 (64.9) | 54 (70.2) | ns |
| BMI (mean ± SD) | 27.2 ± 4.5 | 27.3 ± 4.1 | ns |
| Chronic disease (n (%) have it) | 40 (78.5) | 30 (37.5) | <0.01 |
| TUG in seconds (mean ± SD) | 9.0 ± 2.0 | 7.9 ± 1.9 | <0.01 |

Note: SD = standard deviation; ns = not significant; BMI = body mass index; TUG = Timed Up and Go test.

**Table 2.** Comparison of sleep quality, quality of life, number of comorbidities and functional mobility between the three age groups of elderly with chronic pain.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **60 to 69 years**  **(n = 26)** | **70 to 79 years**  **(n = 18)** | **≥ 80 years**  **(n = 10)** | **p** |
| PSQI | 11.19 ± 1.9 | 12.73 ± 1.5 | 13.83 ± 1.1 | <0.01 |
| WHOQOL-OLD | 84.04 ± 9.8 | 80.9 ± 8.3 | 73.5 ± 5.1 | ns |
| Number of comorbidities  (n (% ≥ 2)) | 18 (69.6%) | 13 (72.5%) | 7 (70%) | ns |
| TUG (seconds) | 8.53 ± 1.7 | 10.35 ± 2.1 | 12.01 ± 1.6 | <0.01 |

**Note:** PSQI = Pittsburgh Sleep Quality Score; WHOQOL-OLD = World Health Organization Quality of Life Group-old; TUG = Timed Up and Go test; ns = not significant.

**Table 3.** Pittsburgh Sleep Quality Score among the elderly with and without chronic pain.

|  |  |  |  |
| --- | --- | --- | --- |
| **Components** | **History of chronic pain (n = 54)** | **No history of chronic pain (n = 77)** | **p** |
| Subjective sleep quality | 1.08 ± 0.9 | 2.07 ± 0.8 | < 0.01 |
| Sleep latency | 1.27 ± 0.9 | 2.15 ± 0.9 | < 0.01 |
| Sleep duration | 1.69 ± 0.8 | 2.24 ± 0.7 | < 0.01 |
| Usual sleep efficiency | 1.79 ± 0.8 | 2.0 ± 0.9 | < 0.04 |
| Sleep disorders | 1.99 ± 0.8 | 2.39 ± 0.7 | < 0.01 |
| Use of sleeping medication | 0.26 ± 0.2 | 0.54 ± 0.6 | < 0.01 |
| Dysfunction during the day | 1.47 ± 0.7 | 1.8 ± 0.6 | < 0.01 |
| Global score | 9.57 ± 2.7 | 12.7 ± 2.7 | < 0.01 |

**Note:** PSQI = Pittsburgh Sleep Quality Score; ns = not significant.

**Table 4.** WHOQOL-OLD facets between the elderly with and without chronic pain.

|  |  |  |  |
| --- | --- | --- | --- |
| **Facets** | **History of chronic pain (n = 54)** | **No history of chronic pain (n = 77)** | **p** |
| Sensory functioning | 15.2 ± 3.6 | 16.7 ± 2.1 | < 0.01 |
| Autonomy | 12.9 ± 3.3 | 15.2 ± 1.9 | < 0.01 |
| Past, present and future activities | 14.6 ± 3.2 | 15.7 ± 1.8 | 0.01 |
| Social participation | 14.5 ± 3 | 15.9 ± 1.8 | < 0.01 |
| Death and dying | 12.1 ± 4.9 | 14.9 ± 2 | < 0.01 |
| Intimacy | 14.5 ± 3.4 | 15.6 ± 1.8 | 0.02 |
| Global score | 84 ± 16 | 94.1 ± 8.2 | < 0.01 |

**Note:** WHOQOL-OLD = World Health Organization Quality of Life Group-old

**Figures**

Recruited elderlies

(n = 191)

Assessment 1 (n = 163)

Evaluation of sociodemographic data, self-reported morbidities and application of the Mini Mental State Examination

Excluded:

Declined participation (n = 8)

Excluded:

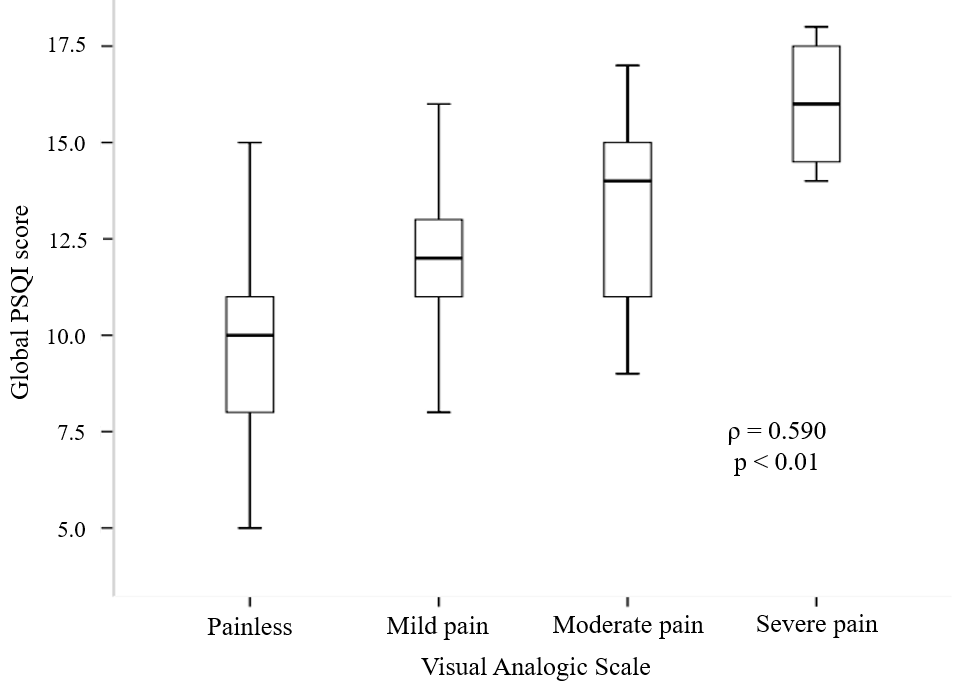
Did not meet the eligibility criteria (n = 32)

Assessment 2 (n = 51)

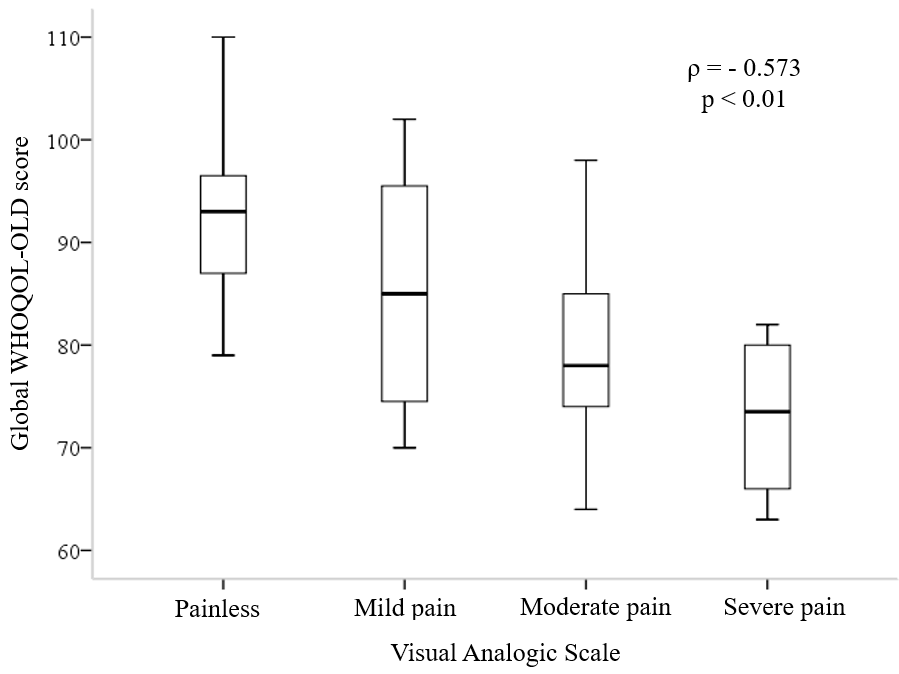
Anthropometric assessment, application of the Visual Numerical Scale and the Pittsburgh Sleep Quality Index

Data analysis (n = 131)

**Figure 1.** Flow diagram of the study.



**Figure 2.** Correlation of the global PSQI score with the intensity of chronic pain.



**Figure 3.** Correlation of the WHOQOL-OLD global score with the intensity of chronic pain.

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