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Determinants of Sleep Disturbances Among Patients with Moderate Disability Due to Chronic Lower Back Pain

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Abstract

Aims & Objective: The purpose of this study is to identify the predictors of poor sleep among patients with moderate disability due to chronic lower back pain and to evaluate the potential gender differences in this relationship. **Methodology:** A Cross-sectional study with a convenience sample was conducted on subjects who were ≥ 18 years of age and reported CLBP. The Pearson correlation test was used to investigate the relationship between sleep quality, gender, pain severity, and disability. **Results:** 387 CLBP patients were recruited, out of which 43.9% ($n = 171$) were female and 56.1% ($n = 217$) were male. Sleep quality and gender were shown to have a significant relationship ($r = -0.33$, $p = 0.05$) with females exhibiting lower scores on the Pittsburgh Sleep Quality Index, indicating better sleep quality. Similarly, pain intensity ($r = 0.99$, $p = 0.05$) and disability ($r = 0.98$, $p = 0.05$) were positively associated with sleep quality. **Conclusions:** Significant relations between sleep disturbance, gender, physical activity, and pain intensity have been found.

Key Words: Chronic Low Back Pain, Sleep Quality, Pain Intensity, Disability, Gender.

Introduction

Chronic low back pain (CLBP) is a common and debilitating ailment that affects a significant proportion of the world's population. CLBP has a worldwide incidence of over 20%, according to current estimates, and it is linked with severe morbidity, poor quality of life, and high costs for medical care (Lim, 2020). While the reasons for CLBP are complicated and multifaceted, evidence suggests that sleep disruptions may play an important role in the development and maintenance of this disorder.

Sleep problems, such as difficulty falling asleep, maintenance of sleep, or waking up feeling tired, are typical complaints among CLBP patients, affecting up to 80% of the population (van de Water, Eadie, & Hurley, 2011). Sleep disruptions have a well-documented influence on CLBP patients' quality of life, pain severity, and psychological well-being, making them an important part of their therapeutic care (Kelly et al., 2011). Several factors have been identified as potential predictors of poor sleep quality in patients with CLBP, including demographic, clinical, and psychological variables.

Demographic variables, such as age and gender, have been shown to influence sleep quality, with older age and female gender being associated with worse sleep outcomes (Alsaadi, McAuley, Hush, & Maher, 2011). Clinical variables, such as pain intensity, pain duration, and disability, have also been linked to poor sleep quality in CLBP patients (Chang et al., 2021). These factors may contribute to the complex interplay between pain and sleep disturbances, as chronic pain may disrupt patients' sleep patterns, and poor sleep quality may, in turn, exacerbate their pain experience.

Furthermore, psychological factors, such as depression, anxiety, and pain catastrophizing, have been identified as important predictors of sleep disturbances in this population (Manning et al., 2022). For example, individuals with high levels of pain catastrophizing tend to magnify the negative aspects of their pain experience and have difficulty disengaging from pain-related thoughts, which may interfere with their sleep quality (Klyne et al., 2020). Additionally, sleep disturbances may impair patients' cognitive functioning, including attention, memory, and decision-making, further exacerbating their pain-related disability (Tang, Goodchild, Hester, & Salkovskis, 2012).

While there has been an increasing recognition of the bidirectional relationship between chronic lower back pain (CLBP) and sleep disturbances, a meticulous analysis delineating the gender distinctions within this association remains largely absent from existing literature. This gap is particularly noticeable in studies focusing on CLBP patients grappling with a moderate level of disability, a demographic that necessitates focused attention given the unique challenges they face.

Previous endeavors in this field have hinted at a heightened susceptibility among women to experience sleep disturbances, a phenomenon speculated to be grounded in gender-divergent pathways of pain perception, hormonal regulation, and coping strategies (Boer, Höhle, Rosenblum, & Fietze, 2023). Despite these initial inklings, the landscape of knowledge remains fragmented with inconclusive evidence.

Therefore, the aim of our study is to investigate the interaction between gender differences and the factors influencing sleep quality in patients with CLBP-induced moderate disability. This

investigation addresses a clear gap in the existing literature by focusing on the complex effects of CLBP-induced moderate disability on the sleep quality of individuals of various genders, an aspect that, to our understanding, remains unexplored. The main objective of this study is to discern the primary determinants of poor sleep and to explore any gender-based variations in the association between these predictors and sleep disturbances in patients with CLBP-induced moderate disability.

This research will offer crucial insights into the determinants of sleep disturbances among patients with moderate disability due to chronic lower back pain (CLBP), the development of more targeted and effective interventions for this population. By identifying the key predictors of poor sleep quality in this demographic and exploring the role of gender differences in these dynamics, our study stands to enhance both the quality of life and clinical outcomes for this patient group.

Methodology

The current study recruited patients aged more than 18 years who reported chronic lower back pain (CLBP) at the outpatient physiotherapy clinic at the Centre for Physiotherapy and Rehabilitation Sciences, Jamia Millia Islamia, New Delhi, India. Inclusion criteria for recruitment were patients diagnosed with CLBP (duration of pain >12 weeks) and who had moderate disability (Oswestry Disability Index score of 20-40). Patients were excluded if they had severe disability, undergone back surgery within the past year, diagnoses of inflammatory diseases such as rheumatoid arthritis or ankylosing spondylitis, neurological conditions affecting lower limb function including severe neuropathy or neurological deficits, a history of spinal fracture or malignancy, received steroid injections or other invasive treatments for back pain within the last three months, or were pregnant, due to the potential for pregnancy-related back pain and the impact of pregnancy on sleep patterns and disability levels.

The study adhered to the principles outlined in the Declaration of Helsinki and received ethical approval from the university's ethics committee (21/3/163/JMI/IEC/2018). Recruitment of patients with chronic lower back pain (CLBP) was achieved through community outreach and the Outpatient clinic, utilizing methods such as word of mouth,

posters, and banners, after which screening was conducted. All patients were thoroughly informed about the study's aims and objectives, and the researchers conducted detailed examinations to verify adherence to the inclusion and exclusion criteria. Patients were encouraged to ask any questions they had, ensuring clarity, and understanding. Upon determining eligibility, both oral and written informed consent were obtained from the subjects. A total of 387 participants were recruited ensuring a robust sample size for the study.

Participants were asked to complete a self-report questionnaire that gathered information on demographic and clinical characteristics such as age, gender, education, employment status, marital status, duration of pain, intensity of pain, and pain-related disability. To evaluate sleep quality over the preceding month, the Pittsburgh Sleep Quality Index (PSQI) was employed. The PSQI, with its 19 items, covers various aspects of sleep, including latency, duration, efficiency, overall quality, and daytime dysfunction, and is recognized for its validity and reliability across different populations, including those with chronic lower back pain (CLBP) (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006). Additionally, the Insomnia Severity Index (ISI), a widely used tool for screening and assessing insomnia, was utilized. This seven-item questionnaire focuses on difficulties with sleep initiation, maintenance, and early morning awakening over the last two weeks, offering insights into the severity and impact of insomnia (Bastien, Vallières, & Morin, 2001). Due to its strong internal consistency and established concurrent validity with other sleep measures, the ISI has proven to be an effective tool for evaluating insomnia in patients with chronic pain (Blais, Gendron, Mimeault, & Morin, 1997).

Result:

The study population consisted of a total of $N = 387$ patients. Gender distribution revealed that 43.9% ($n = 170$) were female, while 56.1% ($n = 217$) were male. Regarding marital status, 56.8% ($n = 220$) reported being unmarried, while 43.2% ($n = 167$) were married. Majority of the patients had completed higher secondary education, accounting for 45.5% ($n = 176$). Other education categories included no formal education (20.4%, $n = 79$), graduate (25.6%, $n = 99$), and postgraduate

(8.5%, $n = 33$). Among the patients, 88.4% ($n = 342$) were nonsmokers, while 11.6% ($n = 45$) were smokers. Most of the patients (95.1%, $n = 368$) reported to be non-alcoholics while 4.9% ($n = 19$) indicated alcohol consumption. In terms of coffee consumption, 61.8% ($n = 239$) reported not consuming coffee, whereas 38.2% ($n = 148$) reported consuming coffee. 20.4% ($n = 79$) reported to be non-tea consumers, while 79.6% ($n = 308$) reported tea consumption. Only 19.4% ($n = 75$) reported being physically active whereas 80.6% ($n = 312$) reported being physically inactive.

The average patients' age is around 37.01 ± 12.7 years, and an average BMI of 23.83 ± 2.7 . The mean Numeric Pain Rating Scale (NPRS) score is approximately 4.27, with a standard deviation of 2.8, suggesting mild pain levels. The Insomnia Severity Index (ISI) reveals an average score of approximately 8.11 ± 4.5 , implying mild insomnia symptoms among the patients. Finally, the PSQI shows an average score of approximately 11.17 ± 6.3 , suggesting a moderate level of sleep disturbances among the patients.

The correlation analysis revealed that Gender had a significant negative correlation with PSQI ($r = -0.33$, $p = 0.00$). The negative correlation with Gender indicates that being female is associated with lower PSQI scores, which signifies better sleep quality.

Similarly, PSQI was significantly correlated with NPRS ($r = 0.99$, $p = 0.00$), ODI ($r = 0.99$, $p = 0.00$), and ISI ($r = 0.95$, $p = 0.00$), indicating strong positive relationships. The positive correlations with NPRS, ODI, and ISI imply that higher scores on these measures, which denote greater pain, disability, and insomnia respectively, are associated with higher PSQI scores, indicating poorer sleep quality.

However, the data revealed that there were no significant relationships between sleep quality, as measured by PSQI, and variables such as marital status ($r = 0.01$, $p = 0.46$), body mass index (BMI) ($r = -0.04$, $p = 0.23$), or physical activity levels ($r = -0.07$, $p = 0.10$). This suggests that, within this sample, these factors did not significantly influence the quality of sleep experienced by the individuals. (Table 1)

We used multiple linear regression to test whether age, gender, marital status, BMI, physical activity, pain, and the insomnia severity significantly

predicted the sleep quality as measured by global PSQI scores. The overall regression was found to be statistically significant, with an R-squared value of 0.98, $F(7, 39) = 2768.85$, $p < .00$, indicating that the model explains 98% of the variance in the PSQI scores.

Among the predictors, gender ($\beta = -0.016$, $t = -2.068$, $p = 0.039$), physical activity ($\beta = -0.018$, $t = -2.512$, $p = 0.012$), NPRS score ($\beta = 0.692$, $t = 13.521$,

$p < .0001$), and ISI score ($\beta = -0.152$, $t = -5.454$, $p < .0001$) were found to have statistically significant relationships with the dependent variable, PSQI score. (Table 4)

However, BMI ($\beta = -0.016$, $t = -2.094$, $p = 0.037$), marital status ($\beta = 0.007$, $t = 0.922$, $p = 0.357$), and ODI ($\beta = 0.440$, $t = 8.114$, $p < .0001$) were not found to have significant associations with the dependent variable. (Table 2)

Table 1: Pearson correlation analysis examining the relationship of Pittsburgh Sleep Quality Index Global Score with the gender, BMI, marital status, physical activity, Oswestry disability index, numeric pain rating scale Score and insomnia severity index Scores.

	PSQI	Gender	Marital status	BMI	Physical Activity	NPRS	ODI
Gender	-.329 .000*						
Marital status	.005 .464	-.046 .184					
BMI	-.039 .225	-.016 .380	.289 .000*				
Physical Activity	-.065 .102	-.027 .298	-.101 .024*	-.067 .095			
NPRS	.988 .000*	-.320 .000*	.002 .481	-.026 .305	-.046 .185		
ODI	.985 .000*	-.317 .000*	-.005 .463	-.035 .244	-.046 .185	.990 .000*	
ISI	.945 .000*	-.310 .000*	.000 .497	-.048 .173	-.029 .286	.961 .000*	966 .000*

BMI: Body Mass Index; NPRS: Numeric Pain Rating Scale; ODI: Oswestry disability index ;ISI: Insomnia Severity Index; PSQI: Pittsburgh Sleep Quality Index,

Table 2: The regression analysis examining the relationship between the predictor variables with Pittsburgh Sleep Quality Index Global Score.

Model	Unstandardized Beta	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	1.252	.480		2.607	.010
Gender	-.196	.095	-.016	-2.068	.039
Marital Status	.087	.094	.007	.922	.357
BMI	-.037	.018	-.016	-2.094	.037
Physical activity	-.285	.114	-.018	-2.512	.012
NPRS	1.564	.116	.692	13.521	.000
ODI	.311	.038	.440	8.114	.000
ISI	-.209	.038	-.152	-5.454	.000

BMI: Body Mass Index; NPRS: Numeric Pain Rating Scale; ODI: Oswestry disability index ;ISI: Insomnia Severity Index

Discussion

The present study aimed to investigate the interplay between gender differences and factors influencing sleep quality in CLBP patients encountering moderate disability. The primary

finding of our research indicates a notable relationship between gender and PSQI scores. Specifically, our findings imply that females who have chronic low back pain (CLBP) and moderate

disability were likely to have better sleep quality compared to males in similar circumstances.

A study found that chronic low back pain patients have frequent sleep interruptions, as measured by the Pittsburgh Sleep Quality Index (Sezgin et al., 2015). This observation supports our research findings, providing additional evidence for the established connection between CLBP and disrupted sleep. In this study, it was further observed that women with CLBP demonstrated inferior sleep quality, particularly in aspects such as the time taken to fall asleep, disruptions during sleep, and impaired functioning during the day, in comparison to men (Sezgin et al., 2015). The discovery, notwithstanding its divergence from the findings of our study, highlights the complex nature of gender's influence on sleep quality in individuals with CLBP.

According to the findings, there is a link between sleep quality and pain severity (Boer et al., 2023). The researchers offered evidence to support the idea that an increase in pain intensity is accompanied by an increase in sleep interruptions, emphasizing the interrelated nature of pain and sleep disruptions. Furthermore, a significant relationship was found between decreased functional ability and poor sleep quality in people with CLBP (Boer et al., 2023). The link emphasizes the broad impact of persistent low back pain on an individual's general well-being.

This discovery is consistent with our study findings, which indicate that sleep quality has a considerable influence on pain perception in people with CLBP, with gender differences. Given the potential impact of sleep disruptions on inflammatory markers and the noticeable deterioration in self-reported physical health status, it is reasonable to speculate that the observed gender-specific disparities in sleep quality may contribute to divergent pain experiences and thresholds among male and female CLBP patients.

The findings of our study, which imply a possible link between females with moderate disability from CLBP and better sleep quality, could indicate the presence of enhanced coping mechanisms or distinct physiological responses to long-term pain. These findings emphasize the intricate link between gender and sleep disorders, emphasizing the need for more gender-specific study.

Another finding of our study was that physical activity was a strong predictor of sleep quality, with higher levels of physical activity related to better sleep quality. This is consistent with previous studies that have highlighted the positive effects of physical activity on sleep outcomes (Kredlow et al., 2015; Dolezal et al., 2017). Promoting regular physical exercise among patients with moderate disability from CLBP has the potential to enhance not only their physical well-being but also their sleep quality.

Additionally, pain intensity was found to be a significant predictor of poor sleep and higher pain levels were associated with worse sleep quality, supporting existing research on the bidirectional relationship between pain and sleep disturbances (Finan, Goodin, & Smith, 2013; Smith et al., 2019). Managing pain effectively through appropriate pain management strategies and interventions may be crucial in improving sleep outcomes for these patients. In contrast, another study found that sleep disruptions affect pain responses differently based on gender: disrupted sleep increased secondary hyperalgesia in males and amplified temporal summation in females (Smith et al., 2019). Collectively, these studies emphasize that gender plays a significant role in sleep and pain dynamics, suggesting the need for tailored approaches in treatment and research.

Poor sleep quality and duration can increase the risk of pain conditions by two- to three-fold, according to a systematic review (Duo et al., 2023). This supports our result that pain levels of patients' moderate disability from CLBP differ by gender and are influenced by sleep quality. Since sleep disruptions can increase inflammatory markers and lower self-reported physical health status (Duo et al., 2023), gender-specific sleep quality differences may contribute to different pain experiences and thresholds in male and female CLBP patients. In relation to our study, females with CLBP may be more resistant to its negative effects due to their better sleep quality, which may explain part of their pain variability.

We can better comprehend the findings of our study considering the meta-analysis's significant association between sleep and pain (Afolalu, Ramlee, & Tang, 2018). It emphasizes the relevance of sleep as a controllable aspect of pain management, advocating for more holistic, sleep-

inclusive pain management, particularly in patients with moderate disability from CLBP.

Limitation of the Study

It is important to note that this study has certain limitations. Firstly, the study design was cross-sectional, which limits the ability to establish causality between the variables. Future longitudinal studies would provide more robust evidence regarding the relationships observed. Additionally, the study relied on self-reported measures, which are subject to recall bias and may not accurately reflect objective measures of sleep quality, pain, and disability. Lastly, the study focused on a specific population of CLBP patients with moderate disability, and the findings may not be generalizable to other chronic pain conditions or individuals with different levels of disability.

Further research is warranted to explore additional predictors of poor sleep in CLBP patients, including psychological factors, comorbidities, and

treatment-related variables. Understanding the complex interplay between gender, sleep disturbances, pain, and disability in CLBP conditions is crucial for developing targeted interventions to improve sleep quality and overall well-being in affected individuals.

Conclusion

The current study found the prevalence of sleep disturbances in CLBP patients. Pain intensity, physical activity and insomnia were significantly associated with sleep disturbances. Further research is required to determine the factors that might be associated with sleep disturbance and insomnia in CLBP patients. It seems that the relationships among sleep disturbance and pain suggest that an indirect pathway exists between these variables, but further research is required to extensively investigate this issue.

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