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Sri Lanka Journal of Physiotherapy and Rehabilitation Sciences

Original article

Relationship between pain intensity, sleep quality, and functional disability among patients with non-specific chronic low back pain: A multicentre cross-sectional study at two tertiary care hospitals in Colombo, Sri Lanka

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Received on 28 Oct 2025
Accepted on 24 Feb 2026

ABSTRACT

Background & Aim: Low back pain represents a significant global public health concern, with approximately 90% of cases classified as non-specific. Understanding the interrelationships between pain intensity, sleep quality, and functional disability is crucial for developing comprehensive management strategies for patients with non-specific chronic low back pain (NSCLBP). This study aimed to examine the relationship among pain intensity, sleep quality, and functional disability in patients with NSCLBP attending selected government hospitals in the Colombo district.

Methods: A descriptive cross-sectional study was conducted among 148 patients with NSCLBP (mean age 51.97 ± 13.40 years) attending rheumatology and rehabilitation clinics at the National Hospital Sri Lanka and Colombo South Teaching Hospital. Demographic data were collected using a semi-structured questionnaire. Pain intensity was assessed using the Short-Form McGill Pain Questionnaire-2 (SF-MPQ-2), sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and functional disability with the Roland-Morris Low Back Pain and Disability Questionnaire (RMQ). Descriptive statistics and Pearson's correlation coefficient were used for statistical analysis.

Results: The majority of participants (88.5%) reported poor sleep quality, with sleep latency identified as a major concern. A significant weak positive correlation was found between pain intensity and poor sleep quality ($r=0.303$, $p<0.001$). Pain intensity was also weakly positively correlated with functional disability ($r=0.388$, $p<0.001$). Additionally, sleep quality demonstrated a significant, though weak, positive correlation with functional disability ($r=0.187$, $p=0.023$).

Conclusions & Recommendations: Significant interrelationships were identified among pain intensity, sleep quality, and functional disability in patients with NSCLBP. The high prevalence of poor sleep quality and its associations with pain severity and functional limitations underscore the importance of holistic management approaches addressing pain control, sleep quality, and functional rehabilitation to enhance overall patient well-being.

Keywords: *non-specific chronic low back pain, pain intensity, sleep quality, functional disability*

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Introduction

Low back pain (LBP) is among the most prevalent health conditions worldwide, affecting all age groups, with a particularly significant impact on adults (1). Globally, LBP is as the leading cause of disability and stands sixth in overall disease burden (2). Non-specific chronic low back pain (NSCLBP), defined as low back pain persisting for twelve weeks or longer without identifiable pathology such as fractures, tumours, inflammatory disorders, or radicular syndromes, accounts for the vast majority of LBP cases in primary care settings (1,3).

The global burden of NSCLBP continues to rise, with the South Asian region reporting age-standardised prevalence rates of 11.1% among males and 9.2% among females (2). Age-specific prevalence peaks between 35 and 89 years, with over 10% of individuals affected at any given time (4). This trend is particularly concerning in low and middle-income countries such as Sri Lanka, where informal employment is widespread and opportunities for job modification are limited (5).

Non-specific chronic low back pain is multifaceted, with pain intensity, sleep quality, and functional disability emerging as critical interconnected components that significantly influence patient outcomes. Pain intensity, defined as the magnitude of experienced pain (7), substantially affects patients' functional capacity and ability to perform activities of daily living (8). Sleep quality, characterized as one's satisfaction with the sleep experience, including aspects of sleep initiation, maintenance, quantity, and refreshment upon awakening (9) maintains a bidirectional relationship with chronic pain. Individuals with NSCLBP frequently experience difficulties achieving restful sleep, creating a detrimental cycle wherein pain disrupts sleep patterns while poor sleep quality intensifies pain sensitivity (10). Sleep deprivation, particularly sleeping less than eight hours nightly, may cause impairment in long-term sleep patterns (8).

Functional disability, defined as acquired difficulty in performing basic everyday tasks or more complex activities necessary for independent living (11), represents a crucial outcome measure in NSCLBP management. International expert panels have recommended measuring physical functioning as a core outcome domain in all clinical trials for NSCLBP (12). Factors involved in the development and chronification of LBP include biological, psychological, social and environmental influences (13).

While the individual associations between pain, sleep, and disability are recognized in global literature, their specific interaction within the unique socio-economic landscape of Sri Lanka remains poorly understood. Some studies have examined risk factors for chronic LBP in specific occupational populations in Sri Lanka. (14) In the Sri Lankan public healthcare sector, chronic low back pain management traditionally follows a bio-medical model, focusing primarily on physical pain relief. This study aims to provide the evidence needed to move local treatment beyond just physical pain toward a 'bio-psychosocial' approach that considers the whole patient and contributing valuable insights to guide clinical practice and improve patient outcomes within the Sri Lankan healthcare context.

Methods

Study design and participants

The study was a descriptive cross-sectional study and conducted in two rheumatology and rehabilitation clinics of the National Hospital of Sri Lanka (NHSL) and the rheumatology clinic of Colombo South Teaching Hospital (CSTH) from 24th of October 2022 to the 18th of November 2022. The targeted population included male and female

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patients aged 18 years or above, who were diagnosed as having non-specific chronic low back pain and followed up at rheumatology and rehabilitation clinics. Patients with spinal surgery within the preceding six months, patients diagnosed with a sleep disorder (obstructive sleep apnoea, insomnia) and mental health conditions (depression according to the medical report); and rotating night shift workers, patients undertaking sleep treatment or using psychiatric medications were excluded.

Ethical consideration

Ethical approval was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo, Sri Lanka (UCP/AL/18/423) and from the National Hospital of Sri Lanka and of Colombo South Teaching Hospital, Sri Lanka. Informed written consent was obtained from all the participants prior to the data collection.

Data collection

A total of 148 participants were recruited using a convenience sampling method from patients attending the two rheumatology and rehabilitation clinics of the National Hospital of Sri Lanka and Colombo South Teaching Hospital, based on clinical records. Informed written consent was obtained for the study participation.

Socio-demographic data were recorded using an interviewer administered semi-structured questionnaire. Pain intensity was measured using the Short Form McGill-2 Pain Questionnaire (SF-MPQ -2). It consists of 22 different descriptors of pain, and each item is rated based on a 0-10 scale with 0 equal to no pain and 10 equal to the worst pain ever during the past week. The total score is calculated by summing 22 individual scores. SF-MPQ-2 comprises of four parts including Continuous (throbbing pain, cramping pain, gnawing pain, aching pain, heavy pain, tender), Intermittent (shooting pain, stabbing pain, sharp pain, splitting pain, electric-shock pain, piercing), Neuropathic (hot-burning pain, cold-freezing pain, pain caused by light touch, itching, tingling or "pins and needles", numbness), and Affective (tiring-exhausting, sickening, fearful, punishing-cruel) subscales.

Quality of sleep was measured using the Pittsburgh Sleep Quality Index (PSQI). This is a self-administered questionnaire consisting of 19 individual items which generate seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component is scored from 0 to 3, yielding a Global PSQI score ranging from 0 to 21. The additional five questions intended for a bed partner or roommate were not administered, as they are not used in the calculation of the Global PSQI score and were not applicable to the clinic-based data collection setting. Participants were categorized into two groups based on their Global PSQI scores: those scoring 5 or greater were identified as having 'poor' sleep quality, while those scoring below 5 were classified as having 'good' sleep quality. This threshold is based on the original psychometric validation of the PSQI, which demonstrated high sensitivity and specificity in distinguishing between good and poor sleepers.

Roland-Morris Low Back Pain and Disability Questionnaire (RMQ) used to assess the functional disability which greater levels of disability are reflected by higher numbers on a 24-point scale. This instrument consists of 24 yes or no items representing common daily activities limited by low back pain. Participants were asked to tick only the items that described them on the day of the assessment. The total score is calculated by summing the 'yes' responses, ranging from 0 (no disability) to 24 (maximum disability). The RMQ was selected for its high reliability and sensitivity to change in clinical settings. Higher scores indicate greater levels of functional impairment. All three questionnaires were translated to Sinhala and Tamil. The translated questionnaires were pilot tested

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before being administered to the study participants.

Statistical analysis

The data were analysed by SPSS version 25.0 software. Data analysis was conducted using the descriptive method to describe the pain intensity, sleep quality, and functional disability. These variables were treated as continuous data. The normality of the data was tested with Shapiro Wilk test. The descriptive statistics including mean, standard deviations, minimum value, and maximum value were used to summarise the continuous data. Frequencies were used for the analysis of categorical variables. Independence t test was used to determine the pain intensity with gender and employment status, to determine the sleep quality with gender and employment status, and to determine the functional disability with gender and employment status. Pearson correlation test was used to determine the pain intensity with age, sleep quality with age, and functional disability with age and to assess the relationship among pain intensity, sleep quality, and functional disability.

Results

Demographic and clinical characteristics

The study sample consisted of 148 participants (n=148) with 13.5% (n=20) males and 86.5% (n=128) females. The mean age of the sample was 51.97 (standard deviation [SD] =13.40) years with an age range of 21–76 years.

Pain intensity

The mean SF-MPQ-2 pain score was 61.00 (SD=21.50). Among the subscales, continuous pain had the highest mean item score (3.81), whereas the neuropathic pain subscale demonstrated the lowest mean item score (2.19).

Sleep quality

A global sleep quality score was calculated by summing the seven individual component scores of the PSQI. The global score ranges from 0 to 21, with higher scores indicating poorer sleep quality. This overall score provides a comprehensive assessment of sleep quality by incorporating multiple sleep-related factors. Participants were categorized into two groups based on their Global PSQI scores (Figure 1). The majority of participants (88.5%, n=131) were identified as having poor sleep quality, while only 11.5% (n=17) reported good sleep quality. The mean Global PSQI score for the entire sample was 8.11 (SD=2.94), which exceeds the cut-off threshold, indicating a high prevalence of sleep disturbances among patients with NSCLBP.

Table 1. Descriptive statistics of socio-demographics

Characteristic		No. (n=148)	Percentage (%)
Gender	Male	20	13.5
	Female	128	86.5
Age (Years)	Mean (SD)	51.97 (13.40)	-
	Range	21–76	-

SD: standard deviation

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Table 2. Pain intensity levels among study participants

Pain Subscale (SF-MPQ-2)	Number of Items	Total Mean Score (SD)	Item Mean Score (0-10 Scale)
Continuous pain	6	22.86 (9.38)	3.81
Intermittent pain	6	14.16 (7.95)	2.36
Neuropathic pain	6	13.14 (7.68)	2.19
Affective pain	4	10.84 (7.45)	2.71

SF-MPQ-2: short form McGill-2 pain questionnaire, SD: standard deviation

Table 3. Descriptive statistics of sleep quality among study participants

		Mean (SD)	Min	Max
PSQI Global Score		8.11 (2.94)	4	15
Sleep Quality Components Scores	Subjective sleep quality	1.38 (0.63)	1	3
	Sleep latency	1.62 (0.97)	0	3
	Sleep duration	1.38 (0.88)	0	3
	Sleep disturbance	1.38 (0.58)	0	2
	Habitual sleep efficiency	0.16 (0.43)	0	2
	Use of sleep medications	0.19 (0.61)	0	3
	Daytime dysfunction	0.92 (0.71)	0	3

PSQI: Pittsburgh Sleep Quality Index, SD: standard deviation

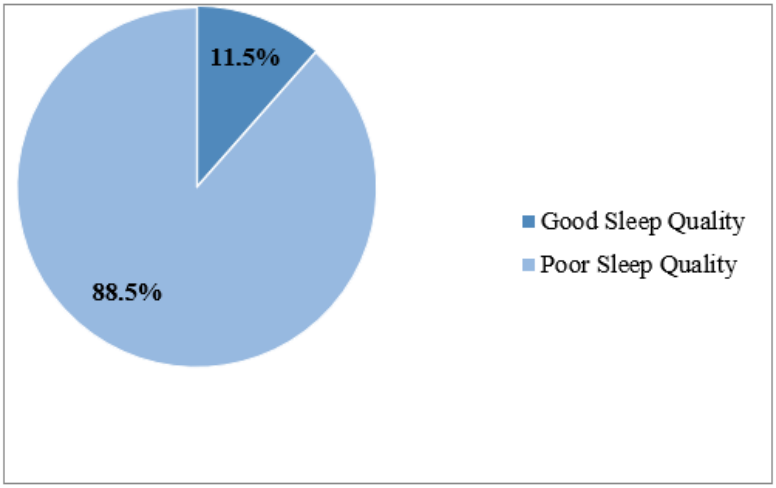

Figure 1 - Global PSQI scores of participants

Subjective sleep quality, assessed through PSQI, evaluates participants' self-perceived overall sleep quality over the past month. This component is scored on a 0-3 scale, where 0 represents very good sleep quality and 3 indicates very poor sleep quality. The study findings revealed that 70.3% of participants rated their subjective sleep quality as "fairly good," while 21.6% reported "fairly bad" and 8.1% indicated "very bad" sleep quality. Notably, this relatively positive self-perception contrasts with the global PSQI scores, where 88.5% of participants demonstrated objectively poor sleep quality when all seven components were assessed comprehensively.

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This discrepancy suggests that while patients may subjectively perceive their sleep as adequate, objective measures including sleep latency, sleep efficiency, sleep duration and other PSQI components, reveal more substantial sleep disturbances among the NSCLBP population (Table 4).

Functional disability

The study participants demonstrated a mean RMQ score of 13.51 (SD=4.80), indicating moderate functional disability among patients with NSCLBP. The minimum RMQ score recorded was 2, while the maximum score was 22, reflecting substantial variability in functional limitations across the study population.

Relationship between pain intensity and sleep quality among patients with NSCLBP

Results showed a weak positive correlation (r=0.303) with a statistically significant level of association ($p<0.01$) between the SF-McGill-2 pain questionnaire total score and the Pittsburgh Sleep Quality Index global score, which indicates that poor sleep quality is associated with severe pain.

Continuous pain, intermittent pain, affective pain sub scales of SF-McGill-2 pain questionnaire were shown statistically significant ($p<0.01$) positive relationships between the global score of Pittsburgh Sleep Quality Index. No statistically significant correlation was observed between neuropathic pain intensity and the Pittsburgh Sleep Quality Index global score ($p>0.01$), suggesting that neuropathic symptoms were not a primary driver of sleep quality in this study population (Table 5).

Table 4. Descriptive statistics of subjective sleep quality among study participants

Response	Component Score	No. (n=148)	Percentage (%)
Very good	0	0	0
Fairly good	1	104	70.3
Fairly bad	2	32	21.6
Very bad	3	12	8.1

Data were presented as frequency (n) and percentages (%)

Table 5. Correlation, p-value for each item of the SF-McGill-2 pain questionnaire pain intensity scores with global score of PSQI

Items	Global score of PSQI	
	Correlation coefficient (r)	*p* value
SF-Mcgill-2 Pain total score	0.303	0.000*
SF-Mcgill-2 Continuous pain score	0.432	0.000*
SF-Mcgill-2 Intermittent pain score	0.237	0.004*
SF-Mcgill-2 Neuropathic pain score	-0.167	0.043**
SF-Mcgill-2 Affective pain score	0.250	0.002*

PSQI: Pittsburgh Sleep Quality Index

**Statistically significant at p<0.01, **Statistically significant at p<0.05*

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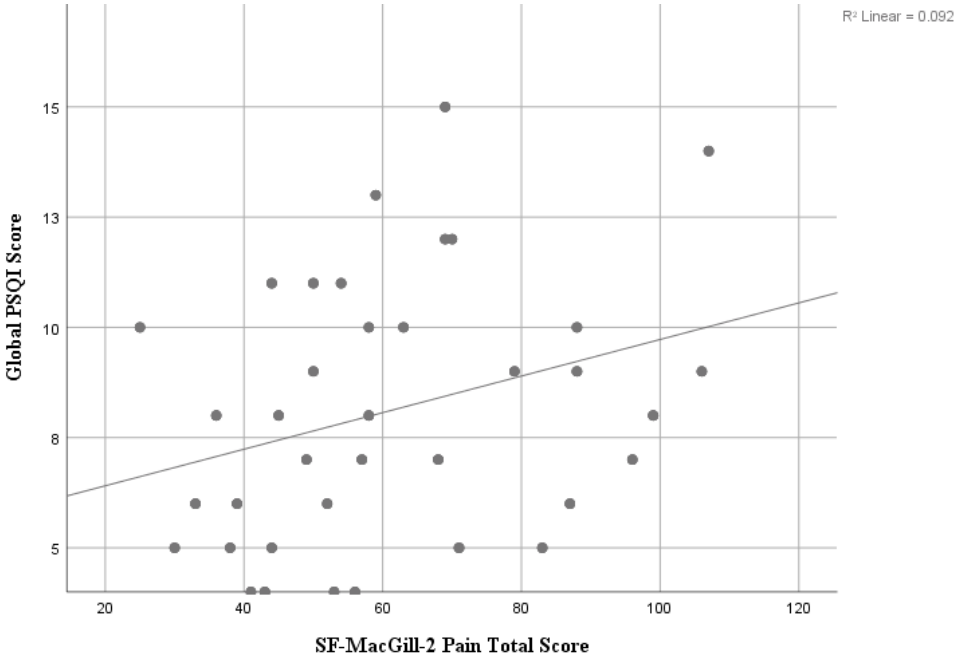

Figure 2. Correlation coefficients for each of the scales of SF-McGill-2 pain total score with sleep quality (Global PSQI)

Correlation coefficients for each of the items of PSQI with pain intensity (SF-McGill-2 pain score)

The relationship between pain intensity (SF-MPQ-2 score) and the individual components of the PSQI was examined, with p-values calculated for each component. The results demonstrated significant associations between pain intensity and several aspects of sleep. Subjective sleep quality was highly significantly correlated with pain intensity ($p < 0.01$). Sleep latency and sleep duration, however, did not differ significantly based on pain intensity ($p > 0.05$). Sleep disturbances were significantly associated with pain intensity ($p < 0.01$), while habitual sleep efficiency showed no significant variation ($p > 0.05$). The use of sleep medications demonstrated a significant correlation with pain intensity ($p < 0.05$). Finally, daytime dysfunction exhibited a highly significant association with pain intensity ($p < 0.001$) (Table 6).

Relationship between pain intensity and functional disability among patients with NSCLBP

Results showed weak positive correlation ($r=0.388$) with a statistically significant level of association ($p<0.01$) between the two scores.

The continuous, intermittent, and affective pain subscales of the SF-MPQ-2 all demonstrated statistically significant ($p<0.01$) positive relationships with the RMQ score. In contrast, the neuropathic pain subscale did not show a statistically significant relationship ($p>0.05$) with the RMQ score (Table 7).

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Table 6. Correlation p-value for each item of PSQI with pain intensity (SF-McGill-2 total pain score)

Items	SF-McGill-2 total pain score	
	Correlation coefficient (r)	*p* value
Subjective sleep quality	0.474	0.000*
Sleep latency	0.145	0.080
Sleep duration	-0.147	0.074
Sleep disturbance	0.383	0.000*
Habitual sleep efficiency	0.133	0.107
Use of sleep medications	-0.183	0.026**
Daytime dysfunction	0.345	0.000*

PSQI: Pittsburgh Sleep Quality Index

**Statistically significant at p<0.01, **Statistically significant at p<0.05*

Table 7. Correlation, p-value for each item of the SF-McGill-2 pain questionnaire pain intensity scores with RMQ score

Items	RMQ Score	
	Correlation coefficient (r)	*p* value
SF-Mcgill-2 Pain total score	0.388	<0.01*
SF-Mcgill-2 Continuous pain score	0.378	<0.01*
SF-Mcgill-2 Intermittent pain score	0.303	<0.01*
SF-Mcgill-2 Neuropathic pain score	0.007	0.933
SF-Mcgill-2 Affective pain score	0.312	<0.01*

RMQ: Roland-Morris low back pain and disability questionnaire

**Statistically significant at p<0.01*

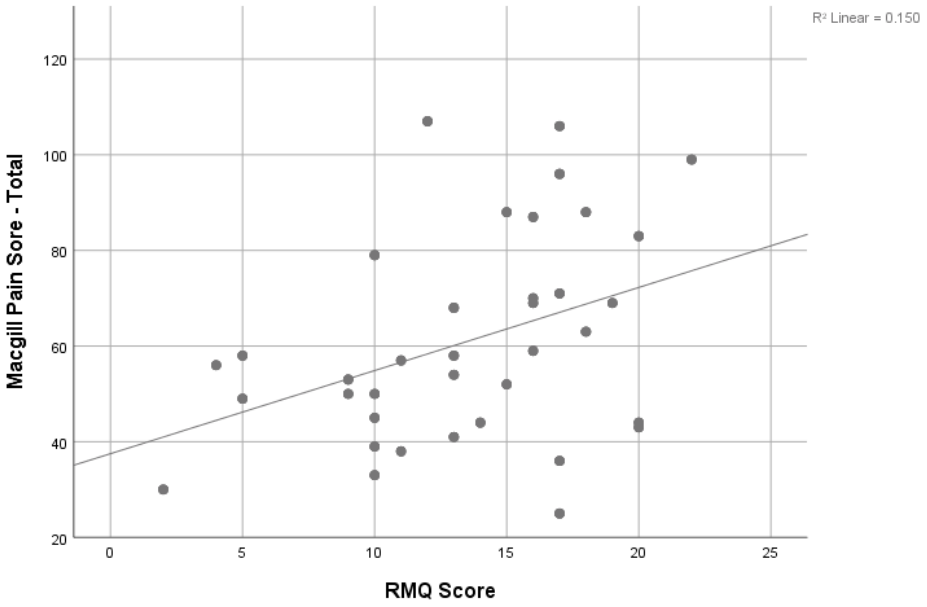

Figure 3. Correlation coefficients for each of the scales of SF-McGill-2 pain total score with sleep quality (Global PSQI)

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Relationship between sleep quality and functional disability among patients with chronic low back pain

Based on scoring interpretations, higher global PSQI scores indicate poorer sleep quality, while higher RMQ scores reflect greater functional disability. The results showed a weak but statistically significant positive correlation between global PSQI and RMQ scores ($r = 0.187$, $p < 0.01$), suggesting that poorer sleep quality is associated with higher functional disability.

Four components of sleep quality—subjective sleep quality, sleep duration, sleep disturbances, and use of sleep medications—demonstrated statistically significant positive correlations with RMQ scores ($p < 0.01$) (Table 8).

Table 8. Correlation, p-value for each item of the PSQI pain questionnaire pain intensity scores with RMQ score

Items	RMQ Score	
	Correlation coefficient (r)	*p* value
Global score of PSQI	0.187	0.023*
Subjective sleep quality	0.223	0.007**
Sleep latency	0.077	0.352
Sleep duration	-0.175	0.034*
Sleep disturbance	0.336	0.000**
Habitual sleep efficiency	0.012	0.886
Use of sleep medications	0.246	0.003**
Daytime dysfunction	0.068	0.413

RMQ: Roland-Morris low back pain and disability questionnaire, PSQI: Pittsburgh Sleep Quality Index
**Statistically significant at p<0.05, **Statistically significant at p<0.01*

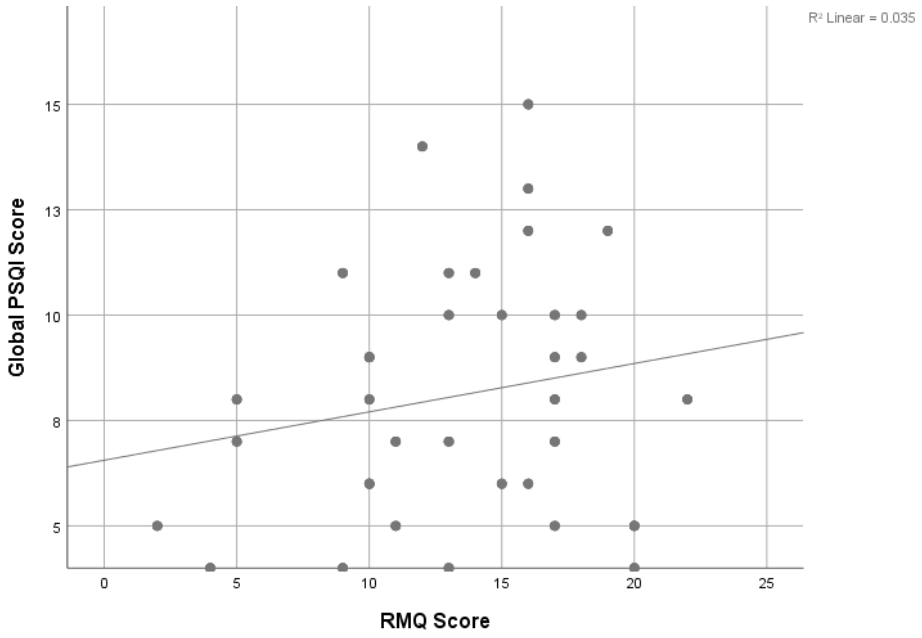

Figure 4. Correlation coefficients for each of the scales of global PSQI score with RMQ score

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Discussion

This descriptive cross-sectional study investigated the relationship between pain intensity, sleep quality, and functional disability in 148 patients with non-specific chronic low back pain attending selected government hospitals in the Colombo district. The findings demonstrated significant relationship among these variables, providing valuable insights into the complex nature of NSCLBP and its impact on patient well-being.

The study found a high prevalence of poor sleep quality, with 88.5% of participants reporting sleep disturbances as measured by the Pittsburgh Sleep Quality Index (PSQI). Sleep latency was the most affected component, with a mean score of 1.62 (SD=0.97), and 40.5% of participants reported only 5-6 hours of sleep nightly. These findings are consistent with previous research, including study (15), which reported that over 70% of low back pain patients experience sleep disturbances, and study (8), which found a mean PSQI score of 10.9 among chronic low back pain patients versus 4.7 in healthy controls. In the present study, the mean PSQI score of 8.11 (SD=2.94) further highlights the substantial sleep impairment in this patient population.

A weak positive correlation was observed between pain intensity and sleep quality ($r=0.303$, $p<0.001$), demonstrating that pain intensity associates with poor sleep quality. This relationship is consistent with findings by (15), who reported a correlation coefficient of -0.57 between pain intensity and sleep quality, and (16), who found a correlation of -0.65. The present study revealed that not only total pain scores but also specific pain dimensions including continuous, intermittent, and affective pain significantly influenced sleep quality, suggesting that multiple aspects of pain contribute to sleep disturbances in NSCLBP patients.

The relationship between pain intensity and functional disability demonstrated a weak positive correlation ($r=0.388$, $p<0.001$), indicating that pain levels associate with functional limitations. These findings are consistent with (17), who confirmed that pain level was significantly associated with low back pain-related disability. The study by (18) supported these findings using the International Classification of Functioning framework, demonstrating the multidimensional relationship between pain and functional disability. Gender emerged as a significant factor influencing pain intensity, with women reporting higher pain scores than men across total, continuous, intermittent, and affective subscales, consistent with findings by (19), who reported mean pain intensity scores of 5.6 for women versus 4.9 for men.

Furthermore, sleep quality exhibited a weak positive correlation with functional disability ($r=0.187$, $p=0.023$), This finding aligns with studies by (20) and (21), who demonstrated that poor sleep quality was associated with increased functional disability, including difficulty with activities of daily living and decreased social participation.

These findings hold significant implications for the Sri Lankan healthcare landscape. Currently, management of chronic low back pain in the Sri Lankan public sector predominantly follows a traditional bio-medical model focused on physical pain relief. To improve local healthcare services, this evidence supports a transition toward a "bio-psychosocial" care approach in Sri Lankan clinics, which considers the whole patient rather than focusing solely on the anatomical source of pain. A critical component of this shift involves implementing routine sleep screening using standardized tools like the PSQI. This is essential because 70.3% of patients subjectively perceive their sleep as "fairly good" despite objective scores indicating significant impairment. Furthermore, the moderate association found between continuous pain and disability ($r=0.378$, $p<0.001$) emphasizes the urgent need for targeted, structured rehabilitation programs in government hospitals that specifically address pain-related functional limitations.

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Conclusions

This study demonstrates that among NSCLBP patients in the Colombo district, pain intensity, sleep quality, and functional disability are significantly interrelated. The findings highlight the need for multifaceted approaches, including functional rehabilitation, sleep quality education, and pain management. To improve patient outcomes, the implementation of structured rehabilitation programs and future longitudinal research are recommended.

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Author Declarations

Competing interests: None.

Funding: The study was fully self-funded by the investigator.

Acknowledgements: We acknowledge the directors and consultants of the National Hospital of Sri Lanka, Colombo Hospital and Colombo South Teaching Hospital for permitting to carry out this study. We would like to thank the Research Stream of the Department of Allied Health Sciences, Faculty of Medicine, University of Colombo, for the guidance provided throughout the research project. We would like to thank all the participants of this study for their immense support.

Author contributions: KKV Chandula contributed to conceptualisation, formal analysis, investigation, and writing of the original draft, while CMA Anthony contributed through supervision and writing – review and editing.

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