RELATION BETWEEN PAIN, FUNCTION AND PRESSURE IN PATIENTS WITH CHRONIC NON-SPECIFIC LOW BACK PAIN

Dalia Salah Elshatoury[1]*, Abdelgalil Allam Abdelgalil[1], Mohamed Abdelmegeed[1, 3], Osama Abd-Alzaher[4], Elsadat Saad Soliman[1, 2]

[1]Department of Orthopedic Physical Therapy, Faculty of Physical Therapy, Cairo University, Egypt, [2]Department of Orthopedic Physical Therapy, Faculty of Physical Therapy, Lotus University, Egypt, [3]Department of Allied Health and Kinesiology, Hofstra University, NY, USA, [4]Department of Orthopedic Surgery, Faculty of Medicine, Suez Canal University, Egypt

Abstract

Background: Chronic Nonspecific Low Back Pain (CNSLBP) is a prevalent health issue leading to functional limitations, often accompanied by depressive symptoms and sleep disorders. This condition persists for over three months and is not associated with any identifiable pathological cause.

Materials and Methods: Sixty-six participants (mean age: 38.0 ± 3.84 years) previously diagnosed with CNSLBP for more than three months were recruited from the outpatient clinic of a police authority hospital. Pain intensity was measured using the Visual Analogue Scale (VAS), pain pressure threshold (PPT) was evaluated via pressure algometry, and functional disability was assessed using the Oswestry Disability Index (ODI). An analysis using Pearson's correlation coefficient was conducted to investigate the correlations among these variables.

Results: A significant correlation was found between VAS and ODI scores ($P < 0.05$), indicating that higher pain intensity is linked to greater functional disability. However, no significant correlations were observed between PPT and VAS or ODI scores ($P > 0.05$). Additionally, gender showed no significant association with VAS or PPT scores ($P > 0.05$).

Conclusion: In patients with CNSLBP, pain intensity is strongly associated with functional limitations and interference in daily activities. However, the presence of trigger points or tense muscles does not correlate with pain severity.

Keywords: Nonspecific low back pain, Oswestry Disability Index, Pain pressure threshold, data correlation.

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*Corresponding Author: Dalia Salah Elshatoury, Physical therapist at General Administration for the Presidency of the Medical Services Sector, Ministry of Interior Affairs, Cairo, Egypt

Tel: +201550677823

Correo-e: daliaelelshotoury@gmail.com

Introduction

Nonspecific low back pain (NSLBP) constitutes a significant global health burden, encompassing a heterogeneous constellation of conditions characterized by pain localized in lower torso, lacking a discernible underlying pathology such as malignancy, infection, or fracture [1], [2]. The etiological spectrum of NSLBP is multifaceted, encompassing a myriad of potential contributors including musculoskeletal strain, ligamentous injury, intervertebral disc pathology, and facet joint dysfunction. However, in a substantial proportion of cases, the precise pathophysiological mechanisms remain elusive, complicating definitive diagnosis and necessitating a comprehensive, multidimensional approach to management [3].

The perceived intensity of pain serves as a cardinal determinant of the overall disease burden associated with NSLBP. A robust positive correlation exists between pain intensity and the magnitude of functional limitations experienced by affected individuals. Elevated pain perception is frequently associated with a cascade of adverse consequences, including significant restrictions in activities of daily living (ADLs), diminished occupational productivity, and substantial curtailment of social participation. The profound impact of severe back pain on an individual's capacity for engagement in meaningful life roles can precipitate a vicious cycle of deconditioning, psychological distress, and social isolation [4, 7].

The Visual Analog Scale (VAS) represents a widely employed and psychometrically sound instrument for quantifying the subjective experience of pain intensity. This unidimensional scaling technique typically involves a 10-cm line anchored by verbal descriptors at each extremity, such as "no pain" and "worst imaginable pain." The participant was requested to mark a point on the line that corresponds to their current pain perception, with the distance from the "no pain" anchor serving as a continuous numerical representation of pain intensity. The VAS offers a convenient and readily interpretable method for assessing pain severity across diverse clinical settings [5, 8-9].

The Oswestry Disability Index (ODI) constitutes a self-administered questionnaire specifically designed to assess the functional limitations imposed by low back pain. This comprehensive instrument encompasses ten domains of daily life, including pain intensity, personal care, lifting, walking, sitting, standing, sleeping, social life, traveling, and work. Each domain is rated on a 0-5 Likert scale, with higher scores signifying greater functional impairment. The ODI has demonstrated robust psychometric properties and provides a valuable tool for quantifying the impact of NSLBP on an individual's overall quality of life [8, 10-11].

Pain Pressure Threshold (PPT) represents a quantitative measure of an individual's sensitivity to mechanical pressure. This assessment typically involves the application of increasing pressure to a designated anatomical region using a calibrated algometer until the participant reports the sensation of pain. The magnitude of pressure required to elicit a pain response serves as a metric of pain sensitivity. PPT assessment can provide valuable insights into the spatial distribution of pain sensitivity, identifying regions of heightened or diminished sensitivity that may inform targeted therapeutic interventions [4, 7-12].

The subjective experience of pain intensity exerts a profound influence on an individual's overall quality of life. Chronic pain, including NSLBP, can precipitate a cascade of adverse psychological consequences, including anxiety, depression, and social withdrawal. Sleep disturbances, disruptions to occupational and familial roles, and significant curtailment of leisure activities are frequently reported by individuals living with persistent back pain. Moreover, chronic pain can erode self-esteem, foster feelings of hopelessness, and contribute to a pervasive sense of diminished well-being [13].

Since NSLBP presents a complex clinical challenge characterized by an intricate interplay between pain intensity, functional limitations, and overall quality of life. A robust positive correlation exists between the perceived intensity of pain and the magnitude of functional disability, as evidenced by validated instruments such as the ODI. These functional limitations, in turn, exert a profound impact on an individual's psychological well-being, social participation, and overall quality of life. A comprehensive understanding of these interconnected factors is essential for the development of effective and patient-centered treatment strategies that address the multifaceted sequelae of NSLBP [3].

Despite the extensive research on CNSLBP, inconsistencies remain regarding the relationship between pain intensity, functional disability, and pain pressure threshold. While some studies have reported a strong correlation between these variables, others have found weak or non-significant associations. Additionally, most existing studies have focused on specific subgroups (e.g., elderly patients or athletes), limiting the applicability of findings to the general population. Furthermore, little research has been conducted on how individual factors, such as gender and BMI, influence these relationships. Given these gaps, this study aimed to provide a clearer understanding of the associations among pain intensity, functional disability, and pain pressure threshold in a diverse patient population. Therefore, the aim of this study was to examine the relationships between pain intensity, functional limitations, and pain pressure threshold in patients with CNSLBP.

Materials and Methods

Study design

This study was conducted using a cross-sectional observational design aimed at investigating the relationships between pain intensity, functional disability, and pain pressure threshold in patients with CNSLBP. Data was collected from patients meeting the inclusion criteria at the outpatient clinic of a police authority hospital between April 2022 and April 2023 after obtaining the ethical committee approval of the faculty of Physical Therapy, Cairo University (approval number: P.T.REC/012/003773). The study included 66 patients aged 25–45 years diagnosed with CNSLBP for more than three months. CNSLBP was characterized as a persistent or intermittent dull ache in the lower back, with or without radiation to the buttocks or thighs, lasting at least three months and scoring a minimum of 30 mm on a 100 mm VAS.

Patients were ruled out if they had spinal pathologies such as fractures, tumours, inflammatory diseases, nerve root compromise, disk herniation, spondylolisthesis with neurological involvement, or spinal canal stenosis. Additional exclusion criteria included BMI greater than 25 or the presence of other pathological conditions.

Sample size calculation

The required sample size was determined using Cohen's d = 0.40, with a statistical power of 80% (α = 0.05). The calculation was conducted using G*Power software (version 3.1.9.7; Franz Faul, Universität Kiel, Germany). It was assumed that individuals had not received any treatment for low back pain for at least one month before data collection. Additionally, it was assumed that there would be no statistically significant correlation between the assessed variables.

Ethical considerations

The study received approval from the Institutional Review Board (IRB) of the Faculty of Physical Therapy at Cairo University (approval number: P.T.REC/012/003773). All procedures adhered to the ethical principles outlined in the Helsinki Declaration of 1975 for research involving human participants.

Measurement tools

Prior to participation, the study objectives were explained to each subject, and informed consent was obtained. Pain levels were assessed using the VAS, functional impairment was evaluated via the ODI, and PPT was measured using a pressure algometer (PA).

For pain assessment, participants marked their pain level on the VAS line. The recorded distance from zero was measured with a ruler and rounded to the nearest whole number. Functional impairment was determined by summing the scores from the ODI questionnaire.

Pain pressure threshold was measured using a digital pressure algometer (model: Algometer Force Dial, Wagner Instruments, P.O.B. 1217, Greenwich, CT 06836, USA) (Figure. 1a). This device features a 1-cm diameter rigid disk connected to a calibrated dial gauge (kg/cm²), which was applied perpendicularly to muscular trigger points (MTrPs) to quantify soft tissue tenderness (Figure. 1b) [14]

Figure 1. (A) Pressure algometer used in the study, **(B)** Application perpendicular to the trigger point.

Statistical analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS), version 27 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were applied to summarize findings. Quantitative data were reported as mean ± standard deviation (SD), while categorical variables were expressed as frequency (%). The Shapiro-Wilk test assessed data normality. Pearson's correlation coefficient was calculated to determine relationships between study variables, with correlation strength classified as follows: 0–0.19: Very weak, 0.2–0.39: Weak, 0.4–0.69: Moderate, 0.7–0.89: High, and 0.9–1.00: Very strong [14].

Results

The study included 66 participants, comprising 42 females (64%) and 24 males (36%). The mean age was 38.0 ± 3.84 years, with a mean body mass index (BMI) of 26.68 ± 2.96 kg/m². The average weight was 72.03 ± 8.65 kg, and the mean height was 164.45 ± 8.22 cm.

A significant direct correlation was found between VAS and ODI scores based on Pearson's correlation coefficient. Additionally, BMI, VAS, and ODI were all significantly correlated ($p < 0.05$). However, no significant relationships were observed between VAS scores and age or between ODI and PPT ($p > 0.05$) (Table 1). There were no statistically significant differences in ODI scores, VAS, or PPT between male and female participants ($p > 0.05$) (Table 2).

Discussion

This study aimed to clarify the associations between clinical factors in individuals with CNSLBP. Investigating correlations between outcome measures was a crucial step in understanding how these variables interacted in musculoskeletal disorders.

Despite VAS and PA assessing aspects of pain, no correlation was observed between PPT and any study variable, including pain scores. While PA quantified tenderness, VAS provided a subjective pain rating, suggesting that these two measures might not have been directly linked. The absence of a correlation might have been due to the limited sample size or the possibility that repeated PPT testing had led to patient desensitization, thus affecting results.

The findings of this study aligned with previous research which indicated a strong correlation between pain intensity and functional disability in patients with CNSLBP. However, unlike studies such as Fritz JM.et al [12] who reported a significant relationship between pain pressure threshold (PPT) and pain intensity, our study found no such correlation.

This discrepancy might have been due to differences in sample size and population characteristics, variations in assessment techniques, particularly in how PPT was measured, the presence of individual pain perception variations among participants. Future studies should have investigated whether psychological factors or other biomechanical aspects contributed to the inconsistencies between pain intensity and PPT findings.

A study by Gergek et al. [15] evaluated treatment effects on lower back pain and found a direct relationship between VAS and functional disability, indicated that as pain intensity decreased, functional capacity improved.

Consistent with prior research, our findings reinforced the strong positive correlation between pain intensity (VAS) and functional disability (ODI) in CNSLBP patients. Higher perceived pain levels were associated with greater limitations in daily activities, including self-care, occupational tasks, and social participation [2, 9].

Conversely, an inverse relationship often existed between pain intensity (VAS) and Pain Pressure Threshold (PPT) [12]. PPT measured an individual's sensitivity to pain, with lower PPT values indicating increased sensitivity. Studies have shown that individuals with higher pain intensity (higher VAS scores) tended to have had a lower PPT values, suggesting that increased pain sensitivity might have contributed to higher levels of perceived pain [19]. This finding highlighted the intricate relationship between pain perception and

Table 1. Pearson's Correlation Coefficient (r) for the Study Variables.

Variables	VAS	Pain pressure	ODI
Age	0.25	0.05	0.09
BMI	**0.42***	0.09	**0.62***
VAS	--	0.08	**0.49***
Pain pressure- threshold	0.1	---	0.13

*Significant at $p \leq 0.05$ (two-tailed)

Table 2. Comparison of Measurements Between Males and Females.

Data	Males		Females		t-test	p-value
	Mean	SD	Mean	SD		
VAS	2.23	1.89	2.55	2.01	1.5	0.39
Pain pressure	3.68	0.78	3.22	0.89	1.69	0.42
ODI	28.67	2.41	30.06	6.35	4.88	0.23

sensitivity in individuals with CNSLBP.

Study Limitations

There are certain constraints associated with the present study. The findings' generalizability to broader populations may be restricted by the relatively small sample size. In addition, the study did not completely account for the subjective nature of pain perception, which may vary as a result of psychological and environmental factors.

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Author contributions

DE: Collection of data, investigation, resources, visualization. ESS: supervision, project administration, writing- review and editing. MA: Conceptualization, methodology, formal analysis, data curation, writing- original draft. OA: Critical revision of the article, final approval of the article. AA: formal analysis, supervision, writing- review and editing

Conflict of interest

Authors declare no conflict of interest.

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