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Characteristic of the neutrophil-to-lymphocyte ratio (NLR) in patients with chronic low back pain

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Abstract

Background: Chronic low back pain (LBP) constitutes a worldwide public health issue that substantially impacts a considerable segment of the adult demographic. The Neutrophil-to-Lymphocyte Ratio (NLR) is recognized as a significant inflammatory biomarker for multiple health conditions, including musculoskeletal disorders like low back pain (LBP). **Objective**: The assessment of NLR in patients with LBP has aimed to identify a potential biomarker for elucidating the mechanisms underlying inflammation and chronic pain. **Methods:** This research is a cross-sectional analytical study. All samples in this study underwent a complete blood cell count examination. The neutrophil-to-lymphocyte ratio is calculated by dividing the neutrophil count by the lymphocyte count in routine blood test results. Statistical tests were conducted using SPSS software. **Results:** This study involved 31 participants. The analysis of the NLR indicated that 77.4% of participants were categorized as moderate, whereas 22.6% were classified as high. Furthermore, 18 individuals (58.06%) reported experiencing moderate pain (NPRS 4-6), while 13 individuals (41.94%) indicated severe pain (NPRS 7-10). **Conclusion:** This study found 77.4% of subjects had moderate NLR. Despite moderate to severe pain, their systemic inflammatory response had not fully established, as shown by a lack of NLR increase.

Keywords: Neutrophil-to-Lymphocyte Ratio (NLR); Chronic Low Back Pain (LBP); Inflammatory responses.

Cite This Article

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INTRODUCTION

Low Back Pain (LBP) refers to discomfort or acute pain localized in the fifth lumbar and sacral vertebrae (L5-S1). The discomfort is experienced in the lumbar region and is typically accompanied by pain radiating down the leg at the dermatome level. The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience linked to or potentially resulting in tissue damage. Low back pain is a prevalent musculoskeletal ailment experienced by people. It frequently interrupts everyday tasks, causes impairment, and leads to diminished productivity. Low back discomfort may result from nerve issues, muscular irritation, or osseous diseases. Pain persisting after three months is termed persistent low back pain (LBP) (2).

Chronic low back pain (LBP) constitutes a worldwide public health issue that substantially impacts a considerable segment of the adult demographic. Research indicates that the incidence of low back pain (LBP) in developed nations varies between 59% and 80% (3). It is anticipated that 60-80% of persons will have some kind of low back pain in their lives, with around 20% of these cases progressing to chronic low back pain (4). A thorough review indicates that the prevalence of persistent low back pain escalates with age, typically rising from the third decade of life to approximately 60 years old. Moreover, women are disproportionately impacted compared to men. Variations in the prevalence of chronic low back pain among regions have been recorded. A study from Russia indicated that characteristics associated with low back pain, such as chronic back pain and neck discomfort, were markedly elevated in the elderly population (5).

Healthcare professionals are particularly susceptible to getting persistent low back pain. Research reveals that around 70% of healthcare personnel suffer from chronic low back pain, attributed to their physically demanding roles that require extended standing, lifting, and bending (6). These findings highlight the necessity for alterations in work activity patterns and preventive strategies to mitigate the effects of chronic low back pain on healthcare workers. Alongside occupational considerations, lifestyle and social determinants, such as educational attainment, stress levels, and behavioral patterns, greatly influence the occurrence of chronic low back pain. A systematic analysis of chronic low back pain indicates that lifestyle variables, including physical inactivity, obesity, and smoking, significantly contribute to the advancement of low back pain. This underscores the necessity for a multifaceted approach to the prevention and treatment of low back pain (LBP) treatments (7).

Chronic low back pain may originate from multiple causes, including degenerative disc disease, disc herniation, muscular strain, and psychological variables such as stress and anxiety (8,9). A significant role in the etiology of chronic low back pain is central sensitization, marked by heightened sensitivity to stimuli, which constitutes the fundamental pathophysiology of chronic pain syndromes, including low back pain (10). Psychosocial difficulties, including employment insecurity and mental health issues stemming from chronic pain, are commonly seen in people with chronic low back pain, complicating pain management and rehabilitation (11,12). This encounter underscores the necessity for a holistic approach to comprehending the diverse elements leading to LBP.

Inflammatory biomarkers have been investigated for their involvement in the pathophysiology of low back pain (LBP). Research has demonstrated a link between inflammatory diseases and low back pain (LBP). Patients diagnosed with sacroiliitis exhibit increased levels of inflammatory biomarkers, underscoring the significance of inflammation in chronic pain (13). Additional research indicates that the

inflammatory response significantly contributes to the persistence of pain, especially in degenerative disorders like intervertebral disc degeneration, where elevated levels of inflammatory mediators are detected in deteriorating disc tissue (10). In contrast, whereas certain studies indicate a robust association between inflammation and pain severity in acute tissue damage, this relationship seems to vary in chronic pain. Individuals with chronic low back pain (LBP) have diminished sensitivity to variations in inflammatory markers, such as high-sensitivity CRP, indicating that their pain may be more significantly affected by behavioral and psychological factors rather than solely by inflammation (14)

The Neutrophil-to-Lymphocyte Ratio (NLR) is recognized as a significant inflammatory biomarker for multiple health conditions, including musculoskeletal disorders like low back pain (LBP). The neutrophil-to-lymphocyte ratio (NLR), derived from the ratio of neutrophils to lymphocytes in peripheral blood, offers additional insights into the inflammatory characteristics of patients with low back pain (LBP). An elevated NLR correlates with heightened inflammation and has been suggested as a valuable biomarker for evaluating the inflammatory status linked to chronic low back pain (10,15,16). This is especially pertinent to nociceptive pain, characterized by central nervous system sensitization resulting from persistent inflammation that influences pain pathways in the absence of clear pathology (15). Karakonstantis and colleagues. Multiple factors have been recognized as potential causes for a false-positive elevation in NLR, including age, exogenous steroid use, endogenous sex hormones, active hematologic disorders like leukemia, cytotoxic chemotherapy, granulocyte colony-stimulating factor (G-CSF), and acquired immunodeficiency syndrome (AIDS) (16).

Chronic low back pain (CLBP) is acknowledged as a significant public health issue that adversely affects individuals' physical and mental well-being, thereby diminishing their quality of life. The psychological factors related to chronic pain are significant and warrant attention. Tetik and Paşahan (2020) highlighted the correlation between chronic low back pain and mental health issues, such as job insecurity and emotional distress (11). The assessment of NLR in patients with LBP has garnered interest as a potential biomarker for elucidating the mechanisms underlying inflammation and chronic pain. NLR assessment is a non-invasive test that offers clinicians insights into a patient's inflammatory status. An increased NLR functions as a prognostic marker, offering insights into disease severity and informing treatment strategy selection. For instance, when a patient exhibits an elevated NLR, the physician may prioritize anti-inflammatory strategies or therapies designed to reduce systemic inflammation in order to manage symptoms more effectively (17,18).

METHODS

This research is a cross-sectional analytical study. An analysis was conducted on 31 participants diagnosed with low back pain between June to October 2025. The sample includes chronic lower back pain, excluding those with chronic inflammatory diseases affecting other body parts, such as brain infections, head trauma, lung infections, digestive system infections, urinary tract infections, as well as tumors, malignancies, and HIV/AIDS. The sample technique employs a total sampling procedure. All samples in this study underwent a complete blood cell count examination. The neutrophil-to-lymphocyte ratio is calculated by dividing the neutrophil count by the lymphocyte count in routine blood test results. This neutrophil to lymphocyte ratio (NLR) marker has multiple clinical interpretations. Forget et al. (2017) conducted prior research that assessed the categories of this NLR. The research established that NLR values below 0.78 are classified as low NLR, values ranging from 0.78 to 3.53 are considered normal

NLR, and values exceeding 3.53 are categorized as high NLR (19). Pain assessment utilized the Numeric Pain Scale instrument, categorizing pain levels as follows: NPRS 1-3 indicates mild pain, 4-6 denotes moderate pain, and 7-10 represents severe pain. Statistical tests were conducted using SPSS software. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Faculty of Medicine and Health Sciences, Universitas Jambi (No. 2353/UN21.8/PT.01.04/2025).

RESULTS

A total of 31 participants were involved in this study. The analysis of gender distribution revealed that a significant majority of the participants were women, totaling 23 individuals (74.2%), while the male participants comprised 8 individuals (25.81%). The participants had an average age of 58.23 years, accompanied by a standard deviation of 10.24 years. The findings indicated that the intensity of pain reported by the participants fell within the moderate to severe range. A significant portion of participants, totaling 18 individuals (58.06%), indicated experiencing pain classified as moderate, whereas 13 individuals (41.94%) reported pain in the severe category. The examination of the Neutrophil-Lymphocyte Ratio (NLR) revealed that 77.4% of participants fell within the moderate category, while 22.6% were classified in the high category. Table 1 presents the characteristics of the study.

Table 1. Characteristic of the Neutrophil-to-Lymphocyte Ratio (NLR) in patients with Chronic Low Back Pain.

Variable	N
Age (years±sd)	58.23 ±10.24
Gender, (%)	
Male	8 (25.8)
Female	23 (74.2)
NPRS (%)	
Moderate	18 (58.1)
Severe	13 (41.9)
Leukocyt (mean±sd)	9.039±2315
Neutrophyl (mean±sd)	5798.4±2135
Lymphocyt (mean±sd)	2357±792
Neutrophyl Limphocyt Ratio (NLR) (%)	
Moderate	24 (77.4)
High	7 (22.6)

DISCUSSION

The research indicated that a significant proportion of individuals with LBP were women. Additionally, age variables revealed that individuals suffering from LBP were primarily late adults, with a mean age of 58.23±10.24 years. men experiencing this condition more frequently than men across various age groups (20). The chronicity of this pain, defined as persisting for more than three months, raises concerns particularly for older women, who face—alongside chronic pain—an increased risk of psychological comorbidities such as anxiety and depression (21,22). Additionally, the prevalence of CLBP is found to escalate with age, with data suggesting that older adults

exhibit rates as high as 68% in the last year, particularly among women aged 60 and older (23)

A complete blood count analysis offered an overview of the patient's systemic inflammatory response, emphasizing leukocytes, neutrophils, lymphocytes, and particularly the neutrophil-lymphocyte ratio (NLR). The mean leukocyte count of 9039/mm3 fell within the normal range, albeit at the upper limit, suggesting that the participants generally did not display a severe inflammatory response. The mean neutrophil count (5798.4/mm3) exceeds that of lymphocytes (2357/mm3), indicating a nuanced equilibrium within the immune system. In chronic pain or specific inflammatory conditions, elevated neutrophil counts are frequently linked to acute or persistent inflammation, whereas lower lymphocyte levels may indicate immune suppression or chronic stress (24)

Neutrophyl Leucocyte Ratio is acknowledged in medical literature as a straightforward and predictive indicator of systemic inflammation. An elevated NLR indicates a shift in immune equilibrium characterized by an increase in neutrophils and a reduction in immune regulation, specifically lymphocytes, frequently observed in numerous chronic diseases and malignancies. The observation that a significant proportion of participants (77.4%) categorized as having moderate NLR is noteworthy. This indicates that despite experiencing considerable pain (moderate to severe), their systemic inflammatory response had not yet fully developed, as evidenced by a lack of a significant increase in NLR. Research by Tertemiz and Tepe investigates the relationship between NLR and chronic LBP, suggesting that chronic pain conditions, including LBP, may be influenced by central sensitization mechanisms that reflect systemic inflammatory responses (10).

Participants exhibiting a high NLR (22.6%) represent a subgroup within the sample characterized by a markedly enhanced systemic inflammatory response. (25) The findings indicate a possible correlation between subjectively reported pain severity (NPRS) and objectively measured systemic inflammation (NLR). Further research could examine the hypothesis that participants with a high NLR are significantly more likely to experience severe pain compared to those with a moderate NLR. A positive correlation may indicate that NLR serves as a non-invasive biomarker for evaluating the severity of inflammation-mediated pain.

CONCLUSIONS

Chronic low back pain suggests central sensitization pathways that reflect systemic inflammatory responses may influence chronic pain problems. This study found 77.4% of subjects had moderate NLR. Despite moderate to severe pain, their systemic inflammatory response had not fully established, as shown by a lack of NLR increase.

CONFLICT OF INTEREST

The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

This study used artificial intelligence (AI) tools and methodologies in the following capacities in manuscript writing support in language refinement (improving the grammar, sentence structure, and readability of the manuscript). We confirm that all AI-assisted processes were

critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

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