**RESEARCH PAPER**

# Awareness of Kinetic Chain Dysfunction associated with Low back pain among Physiotherapy students

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**ABSTRACT**

**Background**
Low back pain (LBP) is one of the most prevalent musculoskeletal problems affecting physiotherapy students, who are routinely exposed to prolonged sitting, postural strain, and clinical handling tasks. These factors can contribute to kinetic chain dysfunction—an imbalance or restriction in the interconnected joints and muscles that support coordinated movement. Early recognition of such dysfunction is essential for prevention and for fostering better clinical understanding among future physiotherapists.

**Materials and Methodology**
A cross-sectional survey was conducted among 202 physiotherapy students aged 18–25 years from Krishna College of Physiotherapy, Karad. Participants with spinal deformities, fractures, or congenital abnormalities were excluded. Data were collected using a structured Google-Form questionnaire that recorded demographic details, history of LBP, and awareness-related items on kinetic chain dysfunction. Pain-related disability was measured using the Oswestry Disability Index (ODI), and the level of awareness was assessed through a 5-point Likert Awareness Scale 21. The study followed ethical approval protocols and maintained participant confidentiality. Data were analysed descriptively to determine frequency and percentage distributions.

**Results**
A high prevalence of low back pain was observed, with 82.7% of respondents currently experiencing pain. Pain intensity was mainly mild to very mild, though functional limitations were noted in activities such as sitting (62.9%), standing (78.7%), and lifting (over 70%). Regarding awareness, 34.1% of students were moderately aware and 20.3% highly aware of kinetic chain dysfunction, while 29.7% reported minimal awareness. Although most students (around 80%) maintained normal social participation, more than half reported occasional sleep disturbances due to pain, indicating early kinetic chain imbalance despite good theoretical knowledge.

**Conclusion**
Low back pain is highly prevalent among physiotherapy students, and many demonstrate only moderate awareness of its biomechanical links with kinetic chain dysfunction. The coexistence of mild functional disability and limited awareness highlights the need to reinforce kinetic-chain-based education, ergonomic training, and preventive movement screening within physiotherapy curricula. Early intervention and self-application of postural and core-stability principles may help reduce long-term musculoskeletal problems and enhance clinical proficiency.

**Keywords**: *Kinetic chain biomechanics, awareness of movement system dysfunction, Oswestry disability index, musculoskeletal health, impairments.*
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## INTRODUCTION

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders worldwide and a major contributor to functional limitation and disability[1]. It affects individuals across different age groups and occupations, leading to reduced productivity and quality of life[2]. Physiotherapy students represent a particularly vulnerable group due to the physical and postural demands of their academic and clinical training[3]. Prolonged sitting during lectures, repetitive lifting, patient handling, and sustained therapeutic postures place continuous stress on the musculoskeletal system, increasing the risk of

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cumulative strain and movement-related dysfunctions[4,5]. Early onset of LBP in this population is concerning, as it may negatively influence learning capacity, clinical performance, and long-term professional health[6].

The concept of the kinetic chain offers a comprehensive framework for understanding the biomechanical basis of low back pain. The kinetic chain refers to the integrated functioning of joints, muscles, and neural structures that work together to produce coordinated movement and stability[7]. Dysfunction at any segment of this chain—such as the hip, pelvis, knee, or foot—can disrupt force transmission and increase mechanical loading on the lumbar spine[8]. Muscular weakness, pelvic misalignment, restricted hip mobility, or altered lower-limb mechanics have been shown to contribute to excessive lumbar stress and pain[9,13]. Therefore, assessment of LBP should extend beyond the spine to include evaluation of interdependent body segments[14].

Evidence increasingly supports that LBP is not merely a localized spinal condition but a complex biomechanical and neuromuscular disorder[12]. Altered coordination between the lumbar spine and adjacent segments, particularly during functional activities such as sitting, standing, and transitional movements, has been documented in individuals with LBP[13]. Impaired spinal control and segmental instability arising from deficits in muscular coordination further contribute to recurrent pain and dysfunction[12,14]. These findings emphasize the importance of adopting a holistic, system-based approach in physiotherapy education and clinical practice[17,18].

Despite the clinical relevance of kinetic chain principles, awareness of kinetic chain dysfunction among physiotherapy students appears to be limited. Lifestyle factors such as prolonged sitting, sedentary behaviour, academic stress, and inadequate sleep further increase susceptibility to LBP[10,19,20]. Inadequate awareness of biomechanical interrelationships may hinder early recognition and self-management of movement dysfunctions. Therefore, assessing the level of awareness regarding kinetic chain dysfunction in relation to low back pain is essential to identify knowledge gaps and support preventive, education-based strategies among future physiotherapists. Increasing awareness of kinetic chain dysfunction will not only improve students' self-care practices but also enhance their clinical reasoning, enabling them to deliver more holistic and effective rehabilitation to future patients.

## STUDY AIM

To determine the prevalence of low back pain and assess the level of awareness of kinetic chain dysfunction among physiotherapy students.

## MATERIALS AND METHODS

This cross-sectional survey study included a total of 202 physiotherapy students from Krishna College of Physiotherapy, Karad. The study population comprised undergraduate and postgraduate students of both genders, aged 18–25 years. Students who reported experiencing low back pain and who remained in a sitting posture for more than three hours per day were considered eligible for participation.

Participants were selected using a simple random sampling technique. A list of eligible students was obtained from the institutional academic registry, and participants were selected using a computer-generated random number sequence to ensure equal probability of selection and to minimize selection bias. Only students who voluntarily consented to participate were included in the study. Students with a history of spinal fracture, structural spinal deformities, congenital spinal abnormalities, or those aged below 18 years or above 25 years were excluded, as these conditions could confound the assessment of low back pain related to kinetic chain dysfunction.

The study was initiated after obtaining approval from the Institutional Protocol and Ethics Committee, and ethical principles outlined in the Declaration of Helsinki were strictly followed. All participants were informed about the study objectives and procedures, and written informed consent was obtained prior to data collection. Participant confidentiality and anonymity were maintained throughout the study.

The sample size was calculated using the formula $\mathbf{n = 4pq/L^2}$, where $n$ represents the required sample size, $p$ (45.1%) denotes the estimated prevalence of low back pain among physiotherapy students based on previous literature[1], $q = 100 - p$, and $L$ represents the allowable margin of error (7%). Based on this calculation, a minimum sample size of **202 participants** was obtained.

Data were collected using a structured, self-administered questionnaire developed in Google Forms and distributed through the WhatsApp platform. The questionnaire consisted of sections on demographic characteristics, history of low back pain, and awareness related to kinetic chain dysfunction. Functional disability due to low back pain was assessed using the Oswestry Disability Index (ODI), a validated and widely used outcome measure.

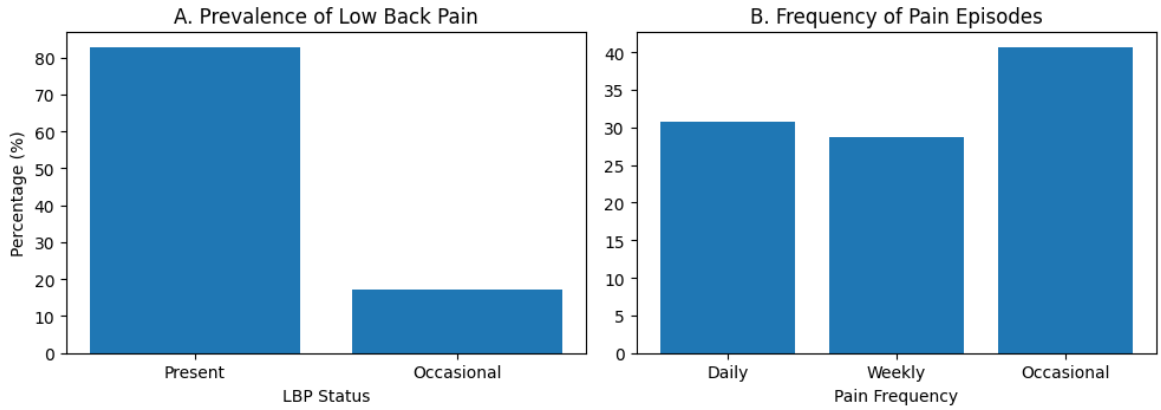
### Awareness Assessment Tool

Awareness regarding kinetic chain dysfunction was assessed using a self-designed awareness questionnaire based on relevant literature and clinical concepts of kinetic chain biomechanics. The questionnaire comprised multiple items assessing knowledge and awareness related to kinetic chain dysfunction and its association with low back pain. Responses were recorded using a 5-point Likert scale, ranging from *not at all aware (1)* to *extremely aware (5)*. Higher scores indicated a greater level of awareness. Content validity of the questionnaire was established through review by experts in physiotherapy, and necessary modifications were made to improve clarity and relevance of the items.

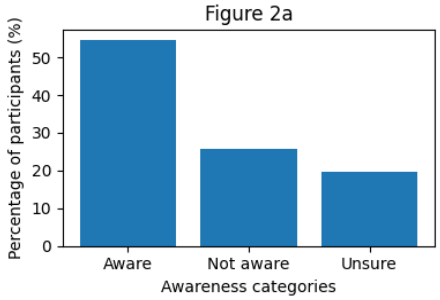
The collected data were entered into a spreadsheet and analyzed using descriptive statistical methods, including frequencies and percentages.

## RESULT

Figure 1: Distribution of Low Back Pain among Physiotherapy Students (n=202)




As shown in Figure 1A and 1B, the majority of physiotherapy students reported current low back pain, with occasional pain episodes being most common. As shown in Figure 1A, the majority of participants reported 82.7% currently experiencing low back pain, while 17.3% reported experiencing pain occasionally. No participants reported absence of low back pain. Figure 1B demostrated the frequency of low back pain, where 40.6% of participants reported occasional pain, 30.7% reported daily pain, and 28.7% reported weekly episodes of low back pain.



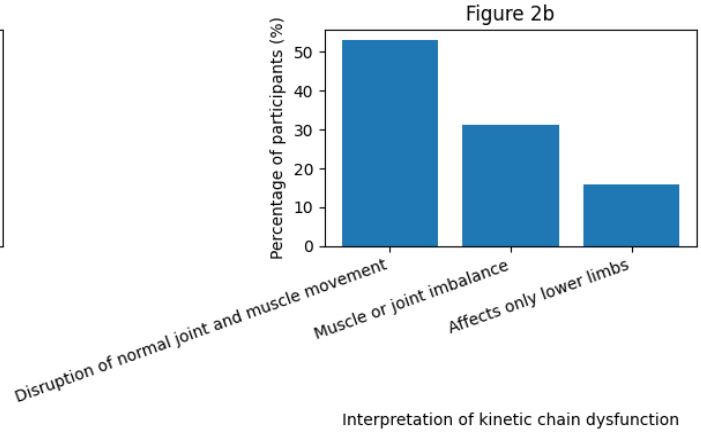




Figure 2 presents the distribution of participants based on awareness and understanding of kinetic chain dysfunction. As shown in Figure 2a, more than half of the participants were aware of the association between low back pain and kinetic chain dysfunction. 54.5% of participants reported being aware of the association, 25.7% reported lack of awareness, and 19.8% were unsure. Figure 2b demonstrates the meaning of kinetic chain dysfunction, 53.0% identified it as a disruption in normal movement patterns of joints and muscles, 31.2% identified it as an imbalance in muscles or joints, and 15.8% reported that it affects only the lower limbs.

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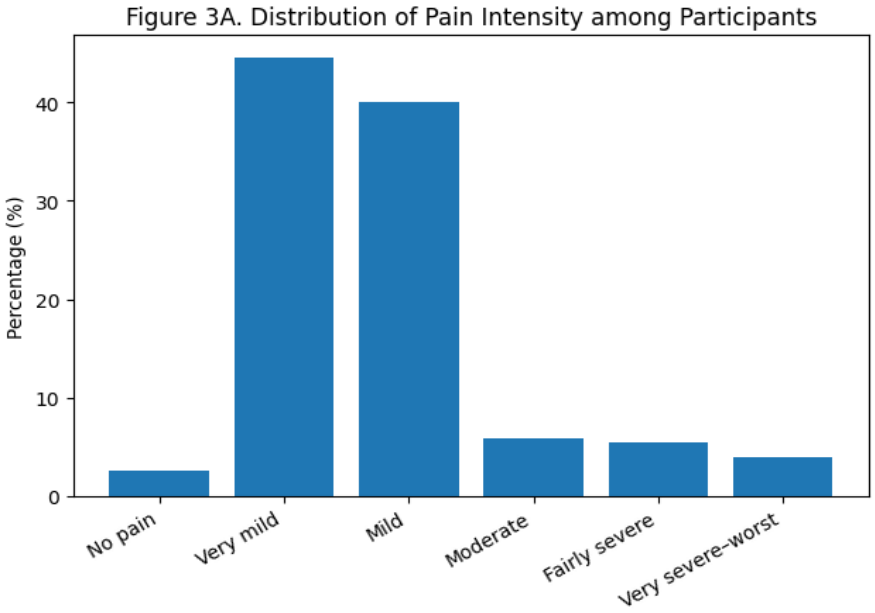
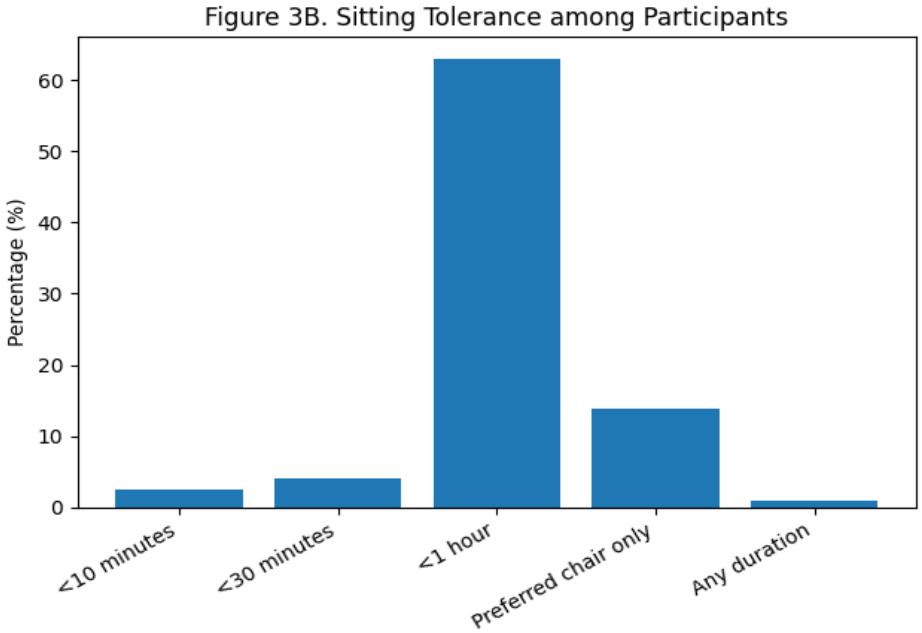



Pain intensity among participants are presented in Figure 3A. As shown in Figure 3A, the majority of participants reported very mild pain (44.6%), followed by mild pain (40.1%). A smaller proportion experienced moderate pain (5.9%), fairly severe pain (5.4%), and very severe to worst pain (approximately 4%), while 2.5% of participants reported no pain.




Functional assessment of sitting tolerance (Figure 3B) demonstrated that 62.9% of participants were unable to sit comfortably for more than one hour. Additionally, 13.9% reported being comfortable only when seated in a preferred chair, whereas 4.0% were unable to sit beyond 30 minutes and 2.5% experienced discomfort within 10 minutes. Only 1.0% of participants reported being able to sit comfortably for any duration.

Figure 4: Overall Awareness of Kinetic Chain Dysfunction Associated with Low Back Pain

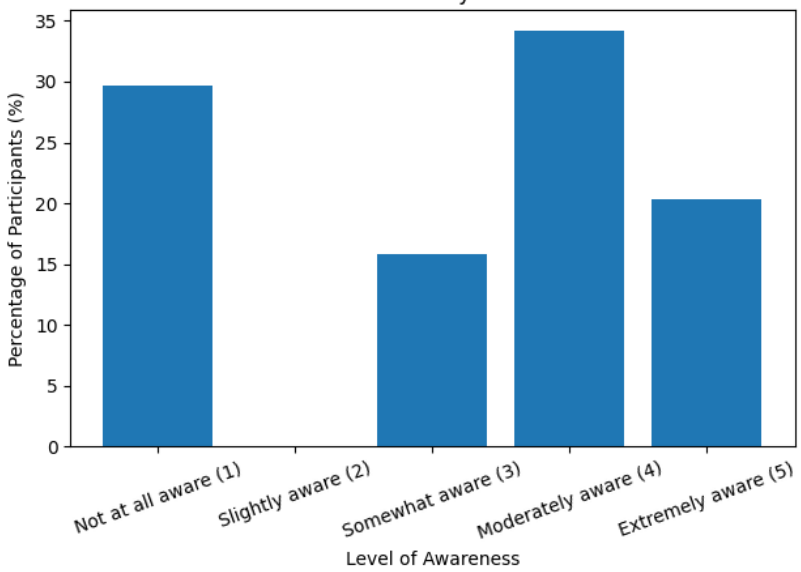



Figure 4 illustrates the overall distribution of awareness levels regarding kinetic chain dysfunction associated with low back pain among physiotherapy students using a Likert scale. Among the participants, 29.70% reported being not at all aware, while none of the students reported being slightly aware. A total of 15.84% of participants were somewhat aware of kinetic chain dysfunction. The highest proportion of students demonstrated moderate awareness (34.15%), followed by 20.29% who reported being extremely aware. These findings indicate a varied level of awareness among physiotherapy students, with the majority exhibiting moderate to high awareness of kinetic chain dysfunction in relation to low back pain.

## DISCUSSION

The present study examined awareness of kinetic chain dysfunction in relation to low back pain (LBP) among physiotherapy students, revealing a critical interplay between conceptual knowledge and functional outcomes. While students demonstrated variable awareness of kinetic chain principles, those with lower awareness were more likely to experience higher functional limitation, as reflected in their Oswestry Disability Index (ODI) scores. Conversely, participants with moderate awareness often reported persistent, though less severe, symptoms, indicating that partial understanding alone may not suffice to prevent or manage LBP effectively.

The prevalence of low back pain in this cohort aligns with prior research attributing musculoskeletal symptoms to prolonged sitting, repetitive physical demands, and sustained postural loading during academic and clinical training[2–4]. Biomechanically, these exposures stress interconnected segments of the kinetic chain, and compensatory movement patterns or postural adaptations—if unrecognized—may contribute to continued discomfort despite the absence of overt structural pathology.

Awareness of kinetic chain dysfunction was observed to be fragmented, reflecting partial understanding of intersegmental coordination. Earlier studies similarly report that healthcare students often comprehend isolated joint mechanics but underestimate force transmission across multiple body segments[8]. Such gaps in knowledge likely hinder early identification of dysfunctions in areas remote from the lumbar spine, thereby exacerbating functional limitations.

Functional difficulties during activities like prolonged sitting, standing, and lifting highlight the practical consequences of insufficient awareness. Reduced muscular endurance, delayed stabilization, and impaired segmental coordination—well-documented in individuals with LBP[3,13]—underscore that knowledge must be coupled with applied neuromuscular control. The coexistence of functional limitation despite theoretical awareness emphasizes a disconnect between understanding and implementation, reinforcing the need for experiential, application-oriented learning.

Lifestyle factors, including sedentary behaviour, limited postural variation, and academic stress, further compound kinetic chain inefficiency.

This suggests that awareness alone is insufficient; it must be paired with behavioural modification and ergonomically informed strategies to mitigate functional impairment[10,19].

Collectively, these findings indicate a clear association: **lower awareness is linked to higher functional limitation, and moderate awareness corresponds to persistence of symptoms**. Strengthening the connection between knowledge and functional application is essential to reduce LBP prevalence, enhance self-management, and prepare students for competent clinical practice. Integrating kinetic chain–based assessment, movement education, and posture-specific interventions into

physiotherapy curricula is therefore imperative for fostering both student health and professional readiness.

**STRENGTH OF THE STUDY**

1. First-of-its-kind focus on kinetic chain dysfunction awareness among physiotherapy students within the local academic context.
2. Adequate sample size (n=202) representing both undergraduate and postgraduate students, providing comprehensive insights.
3. Use of validated tools such as the Oswestry Disability Index (ODI) and a structured Likert Awareness Scale to measure pain intensity and awareness objectively.
4. Balanced gender representation allowing for broader generalizability within the physiotherapy student population.
5. Integration of both subjective and functional parameters (pain, activity limitations, and awareness), offering a holistic understanding of LBP impact.

**FUTURE RECOMMENDATIONS**

- Conduct multi-centre longitudinal studies to establish causal links between kinetic chain dysfunction and LBP among physiotherapy students.
- Include objective clinical assessments (e.g., strength testing, movement screening, postural analysis) alongside self-reported questionnaires.
- Integrate kinetic chain-based movement education and ergonomic modules into the physiotherapy curriculum to promote self-application.
- Encourage preventive workshops and awareness campaigns focusing on postural control, functional training, and spine health.
- Explore the psychological and lifestyle factors influencing LBP to design holistic wellness interventions for physiotherapy students.

**LIMITATIONS OF THE STUDY**

- Cross-sectional design limits the ability to establish a cause-and-effect relationship between kinetic chain dysfunction and LBP.
- Self-reported data may be influenced by response bias or subjective interpretation of pain and awareness.
- The study population was limited to a single institution, restricting the generalizability of results across different educational or cultural contexts.
- Lack of objective biomechanical assessments (such as EMG or gait analysis) may limit the precision of identifying actual dysfunction patterns.
- Confounding factors such as physical activity levels, psychological stress, or ergonomic variations were not extensively controlled.

**CONCLUSION**

The study concludes that low back pain is highly prevalent among physiotherapy students, with the majority experiencing mild to moderate pain that impacts daily function. Importantly, the findings reveal a direct link between awareness and functional limitation: **students with lower awareness exhibited greater functional impairment, while those with moderate awareness experienced persistent symptoms**, highlighting a critical gap between theoretical knowledge and practical application.

Dysfunction across interconnected segments—hips, pelvis, and lower limbs—plays a pivotal role in the onset and persistence of LBP. This underlines the need for physiotherapy education to emphasize kinetic chain integration, ergonomic posture, and movement efficiency as core components of both academic and clinical training.

By fostering self-awareness, preventive exercise, and postural re-education, students can reduce their own functional limitations and improve musculoskeletal resilience. Strengthening the translation of knowledge into applied practice is essential not only to reduce the burden of low back pain but also to develop a generation of physiotherapists who are competent in assessing, preventing, and managing kinetic chain dysfunction in clinical settings.

**Ethics Statement**

The study received approval from the Institutional Ethical Committee of XXX, Karad (Protocol Number 376/2024-2025).

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**Conflict of interest**

The authors declare that they have no conflicts of interest related to this article.

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