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A REVIEW ON ROLE OF GLUTEAL MUSCLE STRENGTHENING IN CHRONIC LOW BACK PAIN IN YOUNG ADULTS

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A B S T R A C T :

Chronic low back pain (CLBP) is a major cause of disability worldwide and is increasingly prevalent among young adults, leading to reduced quality of life, academic disruption, and decreased physical activity. The gluteal muscles, particularly the gluteus maximus and gluteus medius, play a critical role in maintaining pelvic stability, postural alignment, and efficient lumbopelvic mechanics. Weakness or dysfunction of these muscles has been strongly associated with altered biomechanics, compensatory trunk patterns, and increased lumbar loading, which contribute to the persistence of CLBP. This literature review consolidates evidence from randomized controlled trials, systematic reviews, and observational studies to evaluate the role of gluteal strengthening in the management of CLBP. The findings indicate that targeted strengthening exercises such as bridges, clamshells, hip thrusts, and resisted abductions significantly reduce pain, improve functional ability, and enhance long-term musculoskeletal health when incorporated into rehabilitation programs. Additionally, electromyographic and functional studies reveal abnormal activation patterns and weakness of gluteal muscles in CLBP patients, further supporting the importance of gluteal-focused interventions. The review concludes that integrating gluteal strengthening into physiotherapy protocols provides a holistic, non-invasive, and effective approach for symptom reduction, functional restoration, and prevention of recurrence in young adults with CLBP.

Keywords: Chronic low back pain; Gluteus maximus; Gluteus medius; Gluteal strengthening; Pelvic stability; Rehabilitation; Physiotherapy; Young adults

INTRODUCTION

Low back pain (LBP) is one of the most common musculoskeletal disorders affecting individuals across various age groups and is a leading cause of disability worldwide. LBP is often multifactorial, recent evidence has emphasized the significance of hip and pelvic muscle function, particularly the gluteal muscles, in maintaining spinal stability and functional movement. The gluteus Medius and gluteus maximus play critical roles in pelvic control and force transfer between the trunk and lower limbs, and their dysfunction has been associated with altered movement patterns and increased lumbar spine stress. (1,2) Low back pain is one of the most common musculoskeletal complaints experienced globally and represents a significant source of physical limitation and reduced quality of life. It affects individuals across all age groups and occupational backgrounds, often interfering with daily activities, work productivity, and
functional independence. The underlying causes of low back pain are typically multifactorial, involving mechanical, postural, muscular, and sometimes psychosocial components. (4)
The key anatomical structures involved in spinal health and lower body movement, the gluteal muscles specifically the gluteus maximus, gluteus Medius, and gluteus minimums play a critical role. These muscles are primarily responsible for hip extension, abduction, and external rotation, and they contribute significantly to pelvic alignment and lower limb stabilization during dynamic activities. Proper function of the gluteal muscles is essential for maintaining postural balance and ensuring efficient transfer of forces between the upper and lower body. (5)The gluteal muscle group comprising the gluteus maximus, gluteus medius, and gluteus minimus—plays an essential biomechanical and stabilizing role in maintaining lumbopelvic integrity and reducing the risk of low back pain (LBP). These muscles are not only key to movements of the hip, such as extension, abduction, and external/internal rotation, but also act as critical stabilizers during dynamic weight-bearing activities such as walking, running, stair climbing, and transitions from sitting to standing.The gluteus maximus, the largest and most powerful of the gluteal muscles, functions primarily in hip extension and external rotation. It provides force during movements like standing up, climbing, and lifting, and contributes to trunk stabilization by anchoring the pelvis and supporting the thoracolumbar fascia. This reduces compensatory overuse of the lumbar spine, thereby lowering the mechanical stress placed on lumbar structures during forward bending and lifting.The gluteus medius, located on the lateral side of the hip, is critical for lateral pelvic stability, especially during single-leg stance phases of gait. Dysfunction or weakness of this muscle often results in Trendelenburg gait, where the pelvis drops on the non-weight-bearing side, causing compensatory trunk shift and abnormal spine loading. Over time, this leads to uneven stress on the lumbar vertebrae, paraspinal muscles, and intervertebral discs,

contributing to or exacerbating LBP symptoms.The gluteus minimus, though smaller, assists both the gluteus medius in abduction and internal rotation of the hip and helps stabilize the femoral head in the acetabulum during gait. It provides fine motor control and synergistic function to maintain smooth, coordinated lower limb movement and pelvic positioning.(13)Dysfunction or weakness in the gluteal region can lead to compensatory movement patterns, reduced pelvic control, and increased mechanical stress on the lumbar spine. This altered biomechanics is frequently observed in individuals with low back pain and is considered a contributing factor to both the development and persistence of symptoms. (6)Chronic low back pain (CLBP)back pain persisting for more than 12 weeks affects a significant portion of the global population.While epidemiologic research often emphasizes middle-aged and older adults, CLBP also occurs frequently in younger individuals, including those aged 18-35 compromising quality of life academic and work productivity, and physical activity participation. Given that early onset CLBP can lead to prolonged disability and health care utilization early identification and targeted management strategies are essential.EMG studies have demonstrated that CLBP is associated with altered patterns of gluteus medius activation, especially during hip movement tasks with and without instructive stabilization.One study showed that providing lumbopelvic stabilization instruction during sidelying hip abduction tasks in both CLBP and asymptomatic participants significantly altered gluteus medius activity, emphasizing the role of motor control training to optimize gluteal recruitment.(7).

OBJECTIVE OF THE STUDY

To Review On Role Of Gluteal Muscle Strengthening In Chronic Low Back Pain In Young Adults

METHODOLOGY

- **Study type:** Literature review
- **Search engines**: google scholar, PubMed, science direct, research gate
- **Search year**: 2016 to 2025

PROCEDURE

Step 1 – Sourcing

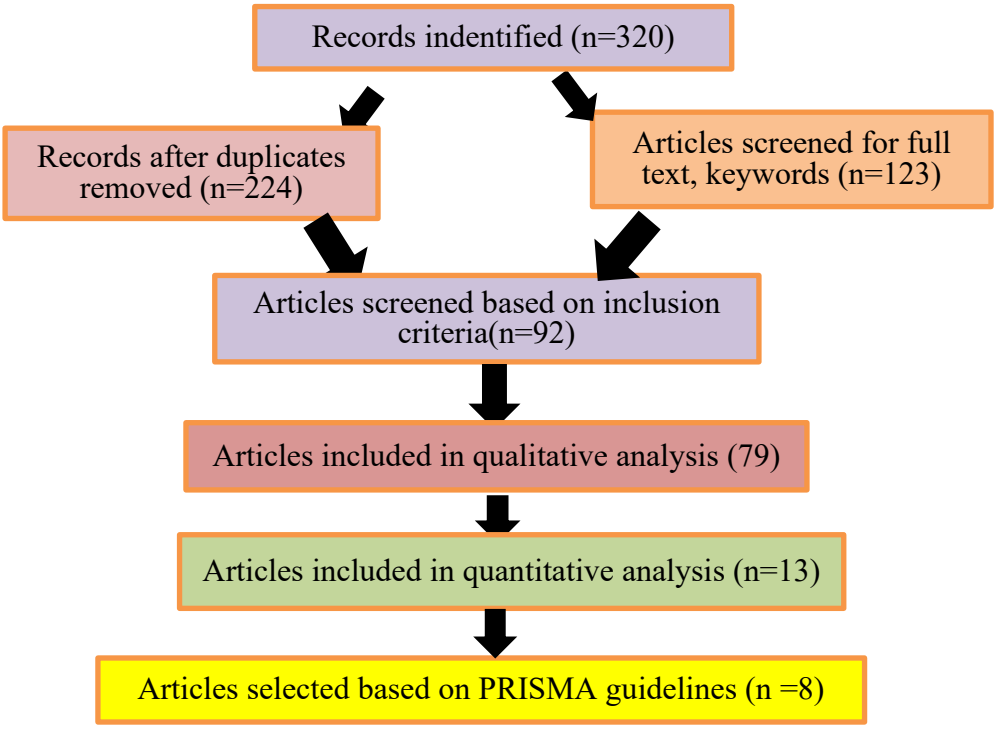
Articles that are reliable and relevant sources to gather evidence on the effectiveness of gluteal muscle strengthening in managing low back pain. Various electronic databases were searched, including PubMed, MEDLINE, Scopus, the Cochrane Library, and Google Scholar. The search strategy included keywords and phrases such as "gluteal muscle strengthening," "gluteus maximus," "gluteus medius," "low back pain," "lumbar pain," "rehabilitation," and "exercise therapy." Boolean operators like AND and OR were used to refine the search. Filters were applied to include only English-language studies published within the last 10–15 years (2010–2025). Priority was given to high-level evidence sources, such as randomized controlled trials (RCTs), systematic reviews, meta-analyses, and cohort studies focusing on adult populations aged 18 to 65 years with non-specific or chronic low back pain

Step 2 – Data Selection

Data selection was carried out by screening the titles and abstracts of identified studies for relevance. Full-text articles were retrieved for those that met the initial criteria. Studies were included if they investigated the role of gluteal muscle strengthening as an intervention in individuals with low back pain and reported outcomes such as pain intensity, functional improvement, or disability scores. Only studies involving adult human participants and describing specific gluteal strengthening protocols were included. Studies were excluded if they focused solely on surgical or pharmacological interventions, involved pediatric or elderly populations outside the target range, were non-English, or were animal or case studies. A systematic approach, such as using a PRISMA flow diagram, was used to track the number of studies included and excluded at each stage.

Step 3 – Data Extraction

Relevant data were extracted systematically from the selected studies using a standardized data extraction table. The extracted information included the author's name, year of publication, study design, sample size, and participant characteristics. Details about the intervention, such as the type of gluteal strengthening exercises used, duration, and frequency, were recorded. Information on control or comparison groups was also noted when applicable. Outcome measures of interest included pain levels (e.g., Visual Analogue Scale, Numeric Pain Rating Scale), disability indices (e.g., Oswestry Disability Index, Roland-Morris Disability Questionnaire), and functional improvements. The main findings of each study were summarized, with attention to both statistical and clinical significance. Additionally, each study's methodological quality was assessed using appropriate tools, such as the PEDRO scale for physiotherapy studies, the Cochrane Risk of Bias tool for RCTs, and the AMSTAR checklist for systematic reviews



LITERATURE REVIEW

Article 1 :Fabio Luciano Arcanjo de Jesus et al (2020) did a systematic review on Addition of specific hip strengthening exercises to conventional rehabilitation therapy for low back pain: a systematic review and meta-analysis to examine the effectiveness of hip strengthening exercises in reducing pain and disability in persons with low back pain they searched for randomized controlled clinical trials on MEDLINE, the Physiotherapy Evidence Database, the Cochrane Central Register of Controlled Trials, LILACS, Scielo and CINAHL from the earliest date available to June 2020. Studies that included hip strengthening exercises for persons with low back pain and included pain and/or disability as an outcome measure were evaluated by two independent reviewers. Mean difference (MD), and 95% confidence interval (CI) were estimated by random effect models and Five studies met the eligibility criteria (309 patients). Four studies included hip strengthening in conjunction with other interventions, while one study evaluated hip strengthening as a standalone intervention. Hip strengthening exercises improved pain (MD -5.4 mm, 95% CI: -8.9 to -1.8 mm), and disability (MD -2.9; 95% CI: -5.6 to -0.1) in persons with low back pain compared to interventions in which hip strengthening was not utilized. The quality of evidence for the pain outcome, was assessed as being moderate. The quality of evidence for the outcome of self-reported disability, was assessed as being and concluded that Addition of specific hip strengthening exercises to conventional rehabilitation therapy may be beneficial for improving pain and disability in persons with low back pain. **Keywords:** Spine; exercise; hip; rehabilitation. **Level of Evidence:**1

Article 2 : Angélica de F Silva et al (2022) did a systematic review on Efficacy of Hip Strengthening on Pain Intensity, Disability, and Strength in Musculoskeletal Conditions of the Trunk and Lower Limbs: A Systematic Review with Meta-Analysis and Grade Recommendations To investigate the efficacy of hip strengthening on pain, disability, and hip abductor strength in musculoskeletal conditions of the trunk and lower limbs, we searched eight databases for randomized controlled trials up to 8 March 2022 with no date or language restrictions. Random-effect models estimated mean differences (MDs) with 95% confidence intervals (CIs), and the quality of evidence was assessed using the GRADE approach. Very low-quality evidence suggested short-term effects (≤3 months) of hip strengthening on pain intensity (MD of 4.1, 95% CI: 2.1 to 6.2; two trials, n = 48 participants) and on hip strength (MD = 3.9 N, 95% CI: 2.8 to 5.1; two trials, n = 48 participants) in patellofemoral pain when compared with no intervention. Uncertain evidence suggested that hip strengthening enhances the short-term effect of the other active interventions on pain intensity and disability in low back pain (MD = -0.6 points, 95% CI: 0.1 to 1.2; five trials, n = 349 participants; MD = 6.2 points, 95% CI: 2.6 to 9.8; six trials, n = 389 participants, respectively). Scarce evidence does not provide reliable evidence of the efficacy of hip strengthening in musculoskeletal conditions of the trunk and lower limbs. **Keywords:** disability; hip strength; hip strengthening; musculoskeletal conditions; pain intensity; rehabilitation. **Level of Evidence:**1

Article 3 : Chun-Kai Tang et al (2024) Effectiveness of gluteal control training in chronic low back pain patients with functional leg length inequality Chronic low back pain (LBP) is a common musculoskeletal disorder and is often accompanied by functional leg length inequality (FLLI). However, little was known about the effects of gluteal muscle control training in patients with LBP and FLLI. This study was designed to investigate the effects of gluteal control training in patients with LBP and FLLI. This is a double-blinded, randomized controlled study design. Forty-eight LBP patients with FLLI were randomized to the gluteal control training (GT) (47.58 ± 9.42 years) or the regular training (RT) (47.38 ± 11.31 years) group and received allocated training for six weeks. The outcome measures were pelvic inclination (PI), ilium anterior tilt difference (IATD), FLLI, visual analogue scale (VAS), patient specific-functional scale (PSFS), Oswestry disability index (ODI), hip control ability, global rating of change scale (GRoC), and lower extremity strength and flexibility. The intervention effects were compared using two-way repeated measures analysis of variance and chi-square tests with $\alpha = 0.05$. The results indicated that the GT group showed greater improvement ($P < 0.01$) in PI (1.03 ± 0.38∘ vs. 1.57 ± 0.51∘), IATD (0.68 ± 0.66∘ vs. 2.31 ±

0.66∘), FLLI (0.3 ± 0.22 vs. 0.59 ± 0.13 cm), VAS (1.41 ± 1.32 vs. 3.38 ± 1.51), hip control ability (2.20 ± 0.45 vs. 0.89 ± 0.74), GRoC at 3rd and 6th week as compared to the RT group. Hip strength and flexibility also improved more in the GT group (P < 0.05conclusion, gluteal control training was more effective in improving low back pain and dysfunctions, and should be integrated in the management plan in patients with LBP and FLLI. **Keywords:** Gluteal control training; Leg length inequality; Low back pain. **Level of Evidence:2**

Article 4: Cooper N Aet al (2026) did a observational study on Prevalence of gluteus medius weakness in people with chronic low back pain compared to healthy controls. Clinical observation suggests that hip abductor weakness is common in patients with low back pain (LBP). The purpose of this study is to describe and compare the prevalence of hip abductor weakness in a clinical population with chronic non-specific LBP and a matched sample without LBP. One hundred fifty subjects with chronic non-specific LBP and a matched cohort of 75 control subjects were recruited. A standardized back and hip physical exam was performed. Specifically, tensor fascia lata, gluteus medius, and gluteus maximus strength were assessed with manual muscle testing. Functional assessment of the hip abductors was performed with assessment for the presence of the Trendelenburg sign. Palpation examination of the back, gluteal and hip region was performed to try and reproduce the subject's pain complaint. Friedman's test or Cochran's Q with post hoc comparisons adjusted for multiple comparisons was used to compare differences between healthy controls and people with chronic low back pain for both the affected and unaffected sides. Mann-Whitney U was used to compare differences in prevalence between groups. Hierarchical linear regression was used to identify predictors of LBP in this sample and found that Gluteus Medius is weaker in people with LBP compared to controls or the unaffected side (Friedman's test, p < 0.001). The Trendelenburg sign is more prevalent in subjects with LBP than controls (Cochran's Q, p < 0.001). There is more palpation tenderness over the gluteal, greater trochanter, and paraspinals in people with low back pain compared to controls (Cochran's Q, p < 0.001). Hierarchical linear regression, with BMI as a covariate, demonstrated that gluteus Medius weakness, low back regional tenderness, and male sex were predictive of LBP. And concluded Gluteus Medius weakness and gluteal muscle tenderness are common symptoms in people with chronic non-specific LBP. Future investigations should validate these findings with quantitative measures as well as investigate the effect of gluteus Medius strengthening in people with LBP *Keywords:* Gluteus Medius; Hip abductor; Low back pain; Muscle pain; Muscle tenderness; Muscular weakness. **Level of Evidence:** 2

Article 5: Nelson-Wong E et al (2017) Gluteus Medius muscle activation patterns as a predictor of low back pain during standing Low back pain is a primary source of disability and economic costs. Altered trunk muscle activation in people with low back pain, specifically agonist/antagonist co-activation, has been previously demonstrated. Prevailing theory considers this muscle activation pattern to be adaptive to low back pain. Muscle activation patterns prior to, and during, the development of low back pain, Participants, without a history of low back pain, stood in a constrained area for 2 h. Continuous surface electromyography was collected from trunk and hip muscles. Participants rated their discomfort level on visual analogue scale every 15 min. Cross-correlation analyses were used to determine co-activation patterns. Blind predictions were made to categorize participants into low back pain and non-low back pain groups, and comparisons made to visual analogue scale scores and found 65% of previously asymptomatic participants developed low back pain during the protocol. Co-activation of the bilateral gluteus Medius muscles was found to be prevalent in the low back pain group (P= .002). 76% of the participants were correctly classified into low back pain and non-low back pain groups based on presence or absence of gluteus Medius co-activation, with sensitivity= .87 and specificity= .50 and concluded Agonist-antagonist co-activation may not be entirely adaptive, and may in fact predispose some individuals to develop low back pain. Muscle activation patterns at the hip may be a useful addition for screening individuals to identify those at risk of developing low back pain during standing. Level of Evidence:1

Article 6: Marshall PW (2017) Gluteus Medius strength, endurance, and co-activation in the development of low back pain during prolonged standing This study measured gluteus Medius (GM) strength and endurance before and after a 2 h prolonged standing task in previously asymptomatic individuals, to compare between individuals who did and did not report pain in the low back. Twenty-four participants without a history of low back pain stood in a constrained area for 2h. Before and after the standing protocol, participant's maximal hip abduction strength (N) and side-bridge endurance (seconds and GM myoelectric fatigue) were measured. Continuous surface EMG was collected from GM during the 2-h protocol for analysis of bilateral co-activation. Pain in the low back was rated every 15 min with a visual analogue scale (VAS). Seventeen of 24 (71%) previously asymptomatic participants developed pain in the low back during the standing protocol. These participants had lower side-bridge endurance (p = .002), and higher gluteus Medius (GM) co-activation (p = .002) compared to participants who did not develop pain in the low back. Hip abduction strength decreased for both groups following prolonged standing, with no between groups' difference. Lower side-bridge endurance and hip abduction strength were significantly associated with higher GM co-activation (adjusted r (2) = .34), but not pain levels. Side-bridge endurance and GM co-activation, but not hip abduction strength, may have utility in identifying participants likely to develop pain in the low back during prolonged standing. The best training program for increasing GM endurance is unclear. Level of Evidence:1

Article 7: **Sadler S et al (2021)** Gluteus Medius muscle activity during gait in people with and without chronic nonspecific low back pain: A case control study, Research investigating differences in gluteus Medius muscle activity in those with and without chronic nonspecific low back pain is both limited and conflicting. Additionally, in these populations the relationship between gluteus Medius muscle activity, foot type, and transversus abdominis muscle thickness is unclear. authors aimed to investigate gluteus Medius muscle activity during gait in those with and without chronic nonspecific low back pain. Secondarily, we aimed to explore the association between gluteus Medius muscle activity, foot type, and transversus abdominis muscle thickness within groups. This case control study recruited 30 people with and 30 people without chronic nonspecific low back pain and matched participants by age (±5 years), sex, and body mass index (±2 BMI units). Gluteus Medius muscle activity was measured with surface electromyography during walking gait; with foot type and transversus abdominis muscle thickness measured with the Foot Posture Index and ultrasound respectively. The Mann-Whitney U test was used to investigate differences in gluteus Medius muscle activity between groups. Spearman rank order correlation was performed to explore the association between gluteus Medius muscle activity, foot type, and transversus abdominis thickness within each group. A linear regression was used to analyse significant correlations (P < 0.05) they found no significant differences in gluteus Medius muscle activity between groups. However, there was a moderate correlation between the Foot Posture Index score and gluteus Medius peak amplitude (P = 0.04) for those with mild to moderate chronic nonspecific low back pain. **Level of Evidence:3**

RESULT:

The existing literature highlights a strong and consistent relationship between gluteal muscle strengthening and the effective management of chronic low back pain (CLBP), particularly in young adults. The gluteal muscle group, consisting primarily of the gluteus maximus and gluteus medius, plays a crucial role in stabilizing the pelvis, maintaining upright posture, and facilitating the smooth transfer of mechanical forces from the lower limbs to the spine. These muscles are actively involved in essential movements such as hip extension, abduction, and external rotation, which are critical for maintaining balance and preventing excessive strain on the lumbar region during daily and athletic activities.

Weakness, delayed activation, or dysfunction of these muscles has been consistently associated with altered biomechanics, such as pelvic drop, excessive lumbar lordosis, or compensatory trunk motions, all of which contribute to abnormal loading of the lumbar spine. These dysfunctional movement patterns can perpetuate or exacerbate existing pain and are often seen in individuals suffering from CLBP. By targeting the gluteal muscles through structured strengthening exercises, many studies have demonstrated measurable reductions in pain levels, improvements in functional abilities such as walking or lifting, and enhanced muscular coordination during movement.

Patients who incorporated gluteal strengthening into their rehabilitation programs not only experienced quicker relief from symptoms but also showed long-term improvements in pelvic stability, postural control, and overall musculoskeletal function. Strengthening interventions, often focusing on exercises like bridges, clamshells, hip thrusts, and resisted abductions, have been particularly effective when combined with other core and lower limb exercises. These programs help correct muscle imbalances, reduce mechanical overload on the spine, and restore efficient lumbopelvic rhythm.

Additionally, observational findings reveal that individuals with CLBP often present with positive signs such as Trendelenburg gait, palpation tenderness over the gluteal region, and reduced side-bridge endurance—all of which are indicators of gluteal weakness. Electromyographic studies further confirm abnormal activation or co-activation patterns of gluteal muscles during prolonged standing or walking in those with low back pain, reinforcing the need for early identification and targeted training.

The review also sheds light on the gap in many traditional rehabilitation protocols, which primarily focus on lumbar spine mobility or core strengthening while often overlooking the influence of surrounding muscle groups like the gluteals. By integrating gluteal-focused exercises into these programs, clinicians can address the root biomechanical contributors of pain more holistically. Ultimately, the strengthening of gluteal muscles not only alleviates current symptoms but also plays a preventive role by minimizing recurrence rates and enhancing movement efficiency in young adults prone to or suffering from chronic low back pain

CONCLUSION

This review highlights the significant impact of gluteal muscle strengthening in the prevention and management of chronic low back pain (CLBP) among young adults. The gluteal muscles—particularly the gluteus maximus and gluteus medius—are fundamental in providing pelvic stability, facilitating efficient movement, and distributing mechanical loads appropriately between the lower limbs and the spine. Weakness or dysfunction in these muscles has been consistently linked to altered movement patterns, poor postural control, and increased lumbar strain, all of which are key contributors to the onset and persistence of CLBP. The evidence from a wide range of clinical and experimental studies clearly supports that targeted gluteal strengthening not only reduces pain intensity but also improves functional ability, endurance, and overall musculoskeletal health. However, these muscles are often under-addressed in conventional rehabilitation strategies. This highlights the need for a more comprehensive, muscle-focused approach that includes structured gluteal training as a core component of physiotherapy for CLBP. Strengthening the gluteal region helps correct biomechanical imbalances, reduces the risk of recurrence, and supports long-term functional independence. Therefore, integrating gluteal muscle strengthening into routine therapeutic protocols can offer a more effective, holistic, and sustainable solution for managing chronic low back pain in young adult population.

DISCUSSION

The findings from this review clearly indicate that gluteal muscle strengthening plays a significant role in the management of chronic low back pain (CLBP) in young adults. The gluteus maximus and gluteus medius are central to maintaining pelvic stability, proper posture, and efficient movement mechanics. Their dysfunction often leads to compensatory patterns, such as increased lumbar spine loading and poor postural alignment, which are commonly observed in individuals with CLBP. Strengthening these muscles improves pelvic control, enhances functional movement, and reduces pain by correcting biomechanical imbalances and restoring optimal force distribution through the lumbopelvic region. Despite the increasing body of evidence supporting their importance, gluteal muscles are often under-targeted in conventional rehabilitation programs for low back pain. This gap highlights the need for physiotherapists and clinicians to integrate focused gluteal strengthening exercises as a core element of treatment plans. Furthermore, improvements in muscle endurance, activation patterns, and coordination following gluteal training suggest not only therapeutic benefits but also a potential for long-term prevention of recurrence. Therefore, incorporating gluteal strengthening into physiotherapy protocols offers a practical, non-invasive, and effective approach to improving outcomes in young adults suffering from chronic low back pain.

Chronic low back pain in young adults is often associated with sedentary lifestyles and poor postural habits, leading to gluteal muscle weakness. The gluteus medius and maximus play vital roles in stabilizing the pelvis and supporting the lumbar spine during movement . Weakness in these muscles can result in compensatory patterns that exacerbate low back discomfort.

Evidence supports the efficacy of combining gluteal strengthening with core stabilization exercises. Such integrated approaches have shown greater improvements in pain reduction and functional outcomes compared to core exercises alone . Additionally, gluteal strengthening has been linked to decreased fear-avoidance behaviors and enhanced mental well-being in individuals with CLBP .While the current evidence is promising, further research is needed to determine the optimal protocols for gluteal strengthening, including exercise intensity, frequency, and duration. Future studies should also explore the long-term effects of these interventions and their applicability across diverse populations.

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