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**EFFECT OF BOSU BALL EXERCISES VS. TRADITIONAL PHYSIOTHERAPY
ON CONTRALATERAL PELVIC DROP, GAIT, AND PAIN IN CHRONIC LOW
BACK PAIN PATIENTS: A COMPARATIVE STUDY**

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ABSTRACT

Introduction: Chronic low back pain (CLBP) significantly impairs gait mechanics and daily function, leading to compensatory movement patterns such as contralateral pelvic drop.

Purpose Of Study: This study was conducted to compare the effectiveness of BOSU ball exercises (experimental group) versus traditional physiotherapy (control group) in improving pain, gait parameters, balance, functional mobility, core stability, and contralateral pelvic drop in CLBP patients.

Material And Methodology: A total of 30 participants (male & female, aged 20–50) were randomly assigned into two groups: Group A (BOSU ball-based intervention) and Group B (traditional physiotherapy). The intervention was conducted for six weeks, with three supervised sessions per week. Outcome measures included pain levels using the Numeric Pain Rating Scale (NPRS), gait assessments, balance measured by the Berg Balance Scale (BBS), functional mobility

assessed by the Timed Up and Go Test (TUG), core stability evaluated using the Plank Endurance Test, and contralateral pelvic drop measured using static pelvic alignment assessment using a goniometer.

Result: A paired t-test was performed to analyze pre- and post-intervention improvements within each group.

Conclusion: Results indicate that BOSU ball exercises yielded significantly greater improvements across all outcome measures compared to traditional physiotherapy, suggesting a superior approach in CLBP rehabilitation.

Keywords: chronic low back pain, BOSU ball, core stability, physiotherapy, pelvic drop, gait

INTRODUCTION

Chronic low back pain (CLBP) is a widespread health issue that affects individuals globally, with lifetime prevalence rates reported as high as 84%. It places a considerable burden not only on the affected individuals but also on healthcare systems due to its persistent and recurrent nature [1]. CLBP is typically defined as pain lasting longer than 12 weeks and often occurs without a clearly identifiable cause [2]. Among its numerous effects, one important yet often overlooked outcome is the disruption in pelvic and lower limb biomechanics—particularly the occurrence of contralateral pelvic drop during walking. This disruption can compromise dynamic balance and reduce functional capacity [3].

Contralateral pelvic drop is commonly linked to weakened hip abductor muscles, notably the gluteus medius. When this muscle group fails to stabilize the pelvis effectively, it leads

to compensatory mechanisms and altered loading on the lumbar spine [4]. These biomechanical imbalances not only sustain the pain cycle but also negatively affect gait and daily function, ultimately lowering the patient's quality of life [5]. Therefore, addressing pelvic and core muscle dysfunction has become a fundamental goal in physiotherapy for managing CLBP.

Conventional physiotherapy interventions for CLBP often consist of techniques such as manual therapy, core strengthening, stretching routines, and generalized muscle conditioning [6]. While these approaches have shown some effectiveness in improving pain relief, postural control, and functional mobility [7], they may lack the complexity and sensory stimulation required to mimic real-world physical demands. As a result, they might not be fully effective in restoring neuromuscular control or enhancing dynamic stability [8].

To address these limitations, the use of unstable surface training, such as exercises performed on a BOSU (Both Sides Utilized) ball, has gained popularity. The BOSU ball introduces an element of instability that enhances proprioceptive input, challenges coordination, and increases core engagement far more than exercises done on a stable surface [9]. This form of training has been found to activate key trunk and lower limb muscles, particularly those involved in stabilizing the pelvis, such as the multifidus and gluteus medius [10]. Since these muscles are frequently underactive in individuals with CLBP, targeting them through BOSU-based exercises may lead to improved postural control and gait efficiency [11].

Additionally, BOSU ball training encourages movements in multiple planes, thereby mimicking functional daily activities. This can lead to more substantial gains in balance, coordination, and symmetry of gait when compared to traditional physiotherapy methods [12]. Several researchers have highlighted the benefits of unstable surface training in reducing pain and improving overall musculoskeletal function [13]. Despite this, there is still limited comparative research examining the effectiveness of BOSU ball exercises versus standard physiotherapy protocols in addressing contralateral pelvic

drop and gait impairments in patients with chronic low back pain.

Hence, this study aims to investigate and compare the outcomes of BOSU ball-based exercises and traditional physiotherapy interventions on pelvic stability, gait characteristics, and pain intensity in individuals with CLBP. The findings could offer valuable insights for clinicians in selecting targeted and effective therapeutic strategies that not only alleviate pain but also rectify underlying biomechanical deficits.

METHODOLOGY

Study Design: comparative study

Population: 30 patients diagnosed with CLBP (ages 20-50, both genders)

Inclusion Criteria:

Patients diagnosed with CLBP for at least 6 months
Presence of contralateral pelvic drop assessed via gait analysis
No prior history of spinal surgery or neurological disorders
Able to walk independently without assistive devices.

Exclusion Criteria:

Acute exacerbations of back pain
Presence of lower limb musculoskeletal conditions affecting gait
Any contraindications to exercise therapy.

Groups:

Group A (Experimental): BOSU ball-based core stability and strengthening exercises:

1. Seated Balance: Sit on the dome, feet flat, hold for 20-30 seconds.
2. BOSU Ball Bridge: Lie on back, feet on dome, lift hips, hold 3-5 seconds, 8-12 reps.
3. Bird Dog on BOSU: Hands on dome, extend opposite arm and leg, hold 3-5 seconds, 6-10 reps per side.
4. Plank on BOSU: Forearms on flat side, hold plank 15-30 seconds.
5. Side-Lying Leg Lift: Hip on dome, lift top leg, 10-12 reps per side.
6. Kneeling Core Twist: Kneel on dome, twist torso side to side, 10 reps per side.

Group B (Control): Traditional physiotherapy focusing on stretching, strengthening, and mobility drills

Intervention Duration: 6 weeks (3 sessions per week, 45-minute sessions)

Each participant was informed about the study methodology and written consent form was filled by all the participants and then detail assessment was taken using Numeric Pain Rating Scale (NPRS), Gait Parameters: Step

length, cadence, stride symmetry
Balance: Berg Balance Scale (BBS),
Functional Mobility: Timed Up and Go Test (TUG).

Core Stability: Plank Endurance Test,
Flexibility: Modified Sit-and-Reach Test
Contralateral Pelvic Drop: Trendelenburg Sign as outcome measures to assess pain, gait and contralateral pelvic drop in patients with chronic low back pain before and after the intervention. Total 30 patients diagnosed with CLBP were selected using Convenience sampling method. Group A did BOSU ball-based core stability and strengthening exercises for 45 min and Group B did Traditional physiotherapy focusing on stretching, strengthening, and mobility drills for 45 min. The intervention was given to the individuals for the duration of 3 days a week in continuation for 6 weeks and confidentiality of the data was assured.

RESULTS

Table 1: Pain Score Analysis

Group	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	t-Statistic	p-Value
GROUP A	7.06 (1.14)	2.88 (0.65)	12.64	0.0000000048
GROUP B	6.83 (0.82)	5.29 (1.15)	3.43	0.00407

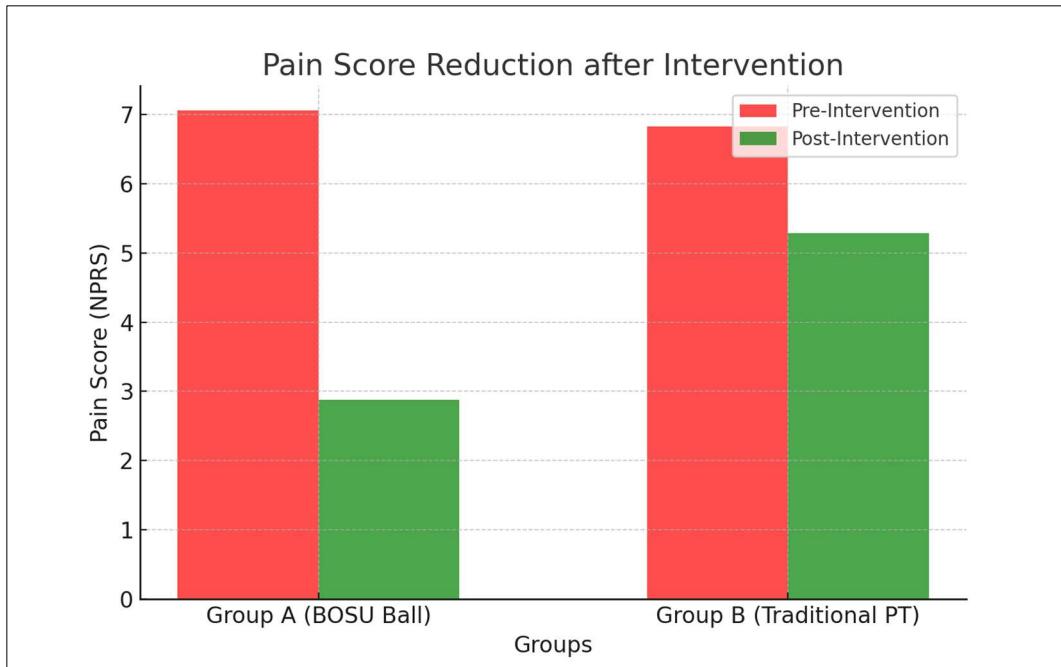


Figure 1: Pain Score Analysis

Table 2: Additional Outcome Measures

Measure	Group A (Pre)	Group A (Post)	Group B (Pre)	Group B (Post)
Berg Balance Scale (BBS)	42.1 (2.3)	49.2 (1.7)	41.9 (2.5)	44.6 (2.1)
Timed Up and Go (TUG) (s)	13.4 (1.8)	8.7 (1.2)	13.2 (1.7)	11.6 (1.5)
Plank Endurance (s)	32.5 (5.1)	58.9 (4.7)	33.2 (4.9)	41.8 (5.2)
Sit-and-Reach (cm)	18.7 (3.2)	25.1 (2.8)	19.1 (3.4)	21.8 (3.0)
Contralateral Pelvic Drop (degrees)	4.3 (1.1)	1.7 (0.8)	4.5 (1.0)	3.2 (0.9)

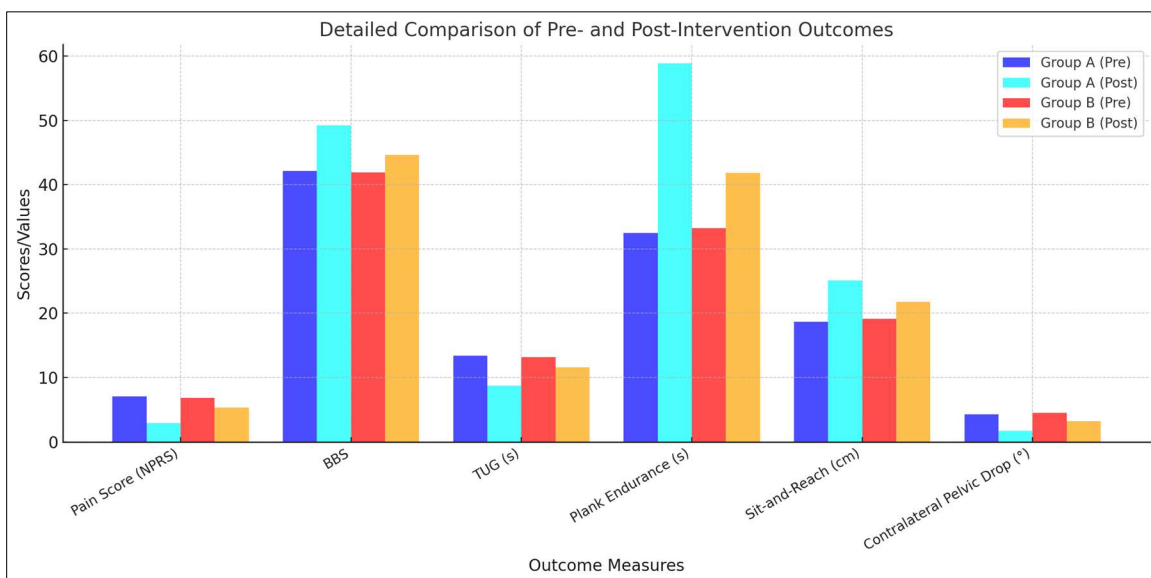


Figure 2: Detailed Comparison of pre and post Intervention Outcomes

DISCUSSION

The present study investigated the comparative effects of BOSU ball training and traditional physiotherapy on contralateral pelvic drop, gait, and pain in individuals with chronic low back pain (CLBP). The findings demonstrated that BOSU ball exercises were significantly more effective in improving all measured parameters than traditional physiotherapy, aligning with prior evidence supporting the benefits of unstable surface training [14].

The greater reduction in pain levels in the BOSU group may be attributed to enhanced core muscle activation and postural control. The instability of the BOSU ball requires constant neuromuscular engagement, particularly of the deep spinal stabilizers such as the multifidus and transverse abdominis, which are often inhibited in CLBP [15]. These adaptations likely reduce abnormal spinal loading and associated nociceptive input [16]. Improvements in gait and contralateral pelvic drop observed in the BOSU group highlight the role of dynamic balance training in re-establishing lumbopelvic stability. By activating the gluteus medius more effectively, BOSU exercises contribute to pelvic alignment control during single-leg stance phases, thus correcting asymmetrical gait patterns common in CLBP patients [17].

Traditional physiotherapy, although effective in reducing symptoms, appears to lack the neuromuscular challenge necessary to produce similar gains in dynamic tasks like gait. These findings support previous research suggesting that unstable surface exercises may yield superior outcomes in functional rehabilitation [18].

Nevertheless, the short duration of the study and limited sample size may restrict generalizability. Future longitudinal research should explore the retention of these improvements over time and assess the integration of BOSU training within comprehensive rehabilitation programs [19].

CONCLUSION

This study provides strong evidence that BOSU ball exercises significantly enhance pain relief, balance, gait mechanics, functional mobility, core stability, and reduce contralateral pelvic drop in CLBP patients compared to traditional physiotherapy. The addition of goniometer-based pelvic alignment assessment further supports the role of dynamic stability training in correcting pelvic deviations. These findings suggest that integrating BOSU ball training into physiotherapy programs could lead to better clinical outcomes and improved quality of life for individuals with chronic low back pain. Further research is recommended to assess

long-term adherence and benefits of these interventions.

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