To Compare the Effectiveness of One Leg Sqaut and Lunges on Gluteus Medius Muscle Strength and Dynamic Balance in Normal Healthy Individuals

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***Abstract*—This study aimed to compare the effectiveness of one-leg squats and lunges on gluteus medius strength and dynamic balance in healthy individuals aged 18–25 years. A total of 52 participants were randomly assigned to two groups and trained for four weeks. Gluteus medius strength was assessed using a hand-held dynamometer, and dynamic balance was measured using the Y-Balance Test. Both exercises significantly improved strength and balance, but one-leg squats showed greater improvement in gluteus medius strength, while lunges resulted in better dynamic balance. These findings highlight the exercise-specific benefits for lower-limb function.**

***Index Terms*—Gluteus medius, One-leg squat, Lunges, Dynamic balance, Strength, Y-Balance Test**

I. INTRODUCTION

The gluteus medius (GM) muscle plays a crucial role in stabilizing the pelvis in the frontal plane throughout walking and other functional tasks [1,2]. Weakness or dysfunction of this primary hip abductor is linked to several lower-extremity injuries and gait abnormalities[3,4,5,6,7,8]. Because of its significant contribution to postural control and movement efficiency, developing specific GM conditioning guidelines is essential for rehabilitation professionals and strength specialists. Anatomically, the GM is a broad, fan-shaped muscle with anterior, middle, and posterior fibers, inserting onto the greater trochanter [9,10], though its tendon morphology remains debated [11]. Functionally, it assists in hip abduction, rotational control, and prevention of Trendelenburg gait[12,1]. The GM also contributes substantially to medio-lateral stability, especially when responding to disturbances during walking [13]. Adequate hip abductor strength is necessary to support pelvic alignment, and deficits may arise from medical conditions [15–17]or lifestyle-related postural habits [19,20].

II. AIMS AND OBJECTIVES

A. AIMS

This study compares the effects of lunges and one-legged squats on dynamic balance and gluteus medius muscular strength in healthy, average adults.

B. Objectives

To find out the effect of one leg squat exercise on strength of gluteus medius muscle.

¬ To find out the effect of one leg squat exercise on dynamic balance.

¬ To find out the effect of lunges on strength of gluteus medius muscle.

¬ To find out the effect of lunges on dynamic balance.

¬ To compare the effect of one leg squat and lunges on the strength of gluteus medius muscle.

¬ To compare the effect of one leg squat and lunges in the dynamic balance.

III. METHDOLOGY

The present comparative study was conducted at Parul University, where subjects were selected based on predefined inclusion and exclusion criteria. A total of 60 healthy individuals aged 18–25 years with normal BMI and willingness to participate were recruited. Both males and females were included. Participants with neurological, neuromuscular,

hormonal, visual, vestibular, or recent lower-limb injuries, as well as unwilling or physically challenged individuals, were excluded. Using a random sampling method (chit system), the sample was equally divided into two groups: One-Leg Squat (n=30) and Lunges (n=30).The study duration was one year, with an intervention period of four weeks, conducted five days per week. Tools used included a hand-held lower limb dynamometer, Y-Balance Test instrument, mat, pen, and recording sheets. Outcome measures comprised gluteus medius muscle strength and dynamic balance. Strength was assessed using a hand-held dynamometer with participants positioned in side-lying, performing maximal hip abduction against resistance. Dynamic balance was measured using the Y-Balance Test in three directions: anterior, posteromedial, and posterolateral. Participants performed practice and test trials barefoot, with strict criteria for valid attempts.

Ethical clearance was obtained from the Parul University Institutional Ethics Committee, and informed consent was secured from all participants prior to study initiation.

IV. PROCEDURE

Participants were selected from Parul University based on the inclusion and exclusion criteria. Before starting the study, detailed information about the research was provided, and informed consent was obtained. Eligible subjects were randomly allocated into two equal groups (Group A and Group B) using the chit method. Baseline evaluation included measurement of gluteus medius strength using a hand-held dynamometer and dynamic balance using the Y-Balance Test. Pre- and post-intervention outcomes were recorded for both groups.

Group A – One-Leg Squat Training

Participants in Group A performed one-leg squat exercises for four weeks, five days per week. Each session included warm-up, main exercises (unilateral wall squat and lateral step-down), and cool-down. All exercises were performed for three repetitions with 30-second rest between repetitions and a 3-minute rest between exercises. Total daily session duration was 25–30 minutes.

Group B – Lunges Training

Participants in Group B received lunge exercises following the same four-week protocol. Sessions included warm-up, walking lunges, side lunges, and cool-down. Rest intervals and total duration matched Group A.

Following the four-week intervention, post-tests for muscle strength and dynamic balance were performed.

A. Statistical Analysis

Data were analysed using SPSS Version 20. Pre–post comparisons were performed using the Wilcoxon Signed-Rank Test, and intergroup comparisons using the Mann–Whitney U Test. A p-value < 0.05 was considered statistically significant.

V. RESULTS

Age and Gender Distribution

The study included participants aged 18–25 years, distributed across Group A (n=24) and Group B (n=28). Age distribution was fairly balanced, with the majority in the 22–23 years category (Group A: 8; Group B: 11). Gender distribution showed a predominance of males in Group A (62%) and females in Group B (57%) (Tables 1–2, Graphs 1–2).

Effect of Intervention on Gluteus Medius Strength (HHD)Both groups showed significant improvements in gluteus medius muscle strength following the intervention.

- Group A: Right-side HHD increased from 11.1±2.51 to 18.27±1.7, and left-side HHD from 12.10±2.0 to 19.83±1.7 (p=0.01).
- Group B: Right-side HHD increased from 10.28±2.5 to 14.98±2.3, and left-side HHD from 10.14±2.30 to 15.87±2.47 (p=0.01) (Tables 3–8, Graphs 3–8).

Effect of Intervention on Dynamic Balance (YBT**)** Dynamic balance, assessed by the Y-Balance Test, also improved significantly in both groups.

- Group A: Right YBT improved from 79.95±4.95 to 87.36±2.64, left YBT from 76.19±5.94 to 83.58±4.6 (p=0.01).
- Group B: Right YBT improved from 79.14±5.60 to 86.25±4.65, left YBT from 76.32±6.64 to 87.37±4.05 (p=0.01) (Tables 5–10, Graphs 5–10).

Comparison Between Groups

post-intervention comparisons between groups revealed that Group A showed greater improvement in HHD for both right (7.62±1.89 vs 4.69±1.85) and

left sides (7.72±1.84 vs 5.73±1.69) compared to Group B (p=0.01). YBT comparisons indicated significant improvements in both groups, with slightly higher gains in Group B for the left side (11.05±3.55 vs 7.39±3.22) (Tables 11–14, Graphs 11–14)

VI. DISCUSSION

This study compared the effects of one-leg squats (Group A) and lunges (Group B) on gluteus medius strength and dynamic balance in healthy individuals. Muscle strength was assessed using a hand-held dynamometer and balance via the Y-Balance Test. Post-intervention, both groups showed significant improvements in gluteus medius strength and dynamic balance. Group A (one-leg squat) demonstrated greater gains in muscle strength, while Group B (lunges) showed greater improvement in dynamic balance. These findings align with previous research highlighting the role of hip abductor strengthening in enhancing balance and functional performance.

VII. CONCLUSION

One-leg squats and lunges both effectively improve gluteus medius strength and dynamic balance. One-leg squats are more effective for enhancing muscle strength, whereas lunges are more effective for improving dynamic balance.

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