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EFFECTIVENESS OF GLUTEAL MUSCLE STRENGTHENING EXERCISES ON NON-SPECIFIC LOW BACK PAIN IN EARLY ADULTHOOD POPULATION

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ABSTRACT

BACKGROUND: In India nearly 60% of people have significant back pain at some time in their lives. Low back pain is a symptom rather than a disease, like headache and dizziness, it can have many causes. The most common form of low back pain is non-specific LBP means when the pathoanatomical cause of pain cannot be determined. Gluteal muscle strengthening exercises are used to strengthen and reactivate gluteal muscles, hence decreased load on SI joint results in reduction of low back pain and functional disability.

OBJECTIVE: To evaluate the efficacy testing of gluteal muscle strengthening exercise on non-specific low back pain.

METHODOLOGY: patients with complain of low back pain were aged between 22-34 years of both sexes and observed that further met the inclusion and exclusion criteria recruited for the present pre-experimental research design during specified schedule.

TECHNIQUE: Pre and Post OWDI scores are subjective scoring method for recording the degree of pain and functional disability. The 60 subjects with low back pain included in the study. For 4 weeks, the students having LBP received treatment 5 sessions per week for 40 minutes. After all the interventions were completed, the OWDI scores, Gmax and Gmed strength were measured again. The patients were given 20 minutes hot moist pack for 20 minutes followed by exercises, hip clams, hip abduction, prone glute squeeze, forward lunges, and sideways lunges repeated by both lower limbs.

RESULTS: There is significant improvement in strength and reduction in scores of functional disability scale. At post intervention stage, the average (Mean ± Standard Deviation) of strength of right Gmax (2.45 ±0.84kilogram) and left Gmax (2.33±0.62kilogram), strength of right Gmed (2.20±0.86kilogram) and left Gmed (2.65±0.04kilogram) was improved and functional disability (20.00±0.99percent) in patients was reduced and found to be statistically significant($p<0.001$).

CONCLUSION: On the basis of the results obtained in the present study, it is concluded that gluteal muscle strengthening exercises are effective in improving strength and reducing functional disability in patient having low back pain. There is significant improvement in strength of right and left Gmax and Gmed. There is reduction in the scores of OWDI which shows improvement in functional status of patient having LBP.

KEYWORDS: gluteal activation exercises, modified aneroid sphyganomanometer (MST), oswestry disability index (OWDI), Gmax (gluteus maximus), and Gmed (gluteus medius)

INTRODUCTION

Low back pain is defined as pain perceived anywhere from the lower margin of the rib cage to the lower gluteal fold, with or without referral to the lower extremity[1].

In India nearly 60% of people have significant back pain at some time in their lives which is alarming.[2] Low back pain became one of the biggest problems for public health systems in western world during second half of the 20thcentury and now seems extending worldwide.[1-2]

The lifetime prevalence of low back pain is reported to be as high as 84% and the prevalence of chronic low back pain is about 23% with 11-12% of the population being disabled by low back pain.[2]

Female gender, age, history of spinal trauma, repetitive job, disc degeneration, prolonged static posture, awkward posture, psychosocial factors such as anxiety, depression, job dissatisfaction, working hours, obesity, television viewing, smoking, depression and stress increases the risk of non-specific low back pain.[3] LBP is also categorized into mechanical LBP and secondary LBP by different etiologies. For mechanical or nonspecific LBP, it has no serious underlying pathology or nerve root compromise. It is the tension, soreness or stiffness in the lower back region for which the specific cause of the pain is still unknown. The secondary LBP, occurring in less than 2% of patients, is associated with underlying pathology. They include metastatic cancer, spinal osteomyelitis, epidural abscess, fractures, infection, ankylosing spondylitis and other inflammatory disorders.[4,5]

Many authors have speculated that LBP may occur as a result of excessive stress on the lumbar spine and SI joint due to an exaggerated anterior pelvic tilt posture. [6] The anterior pelvic tilt is postural distortion which is caused by long sitting posture which tightens the hip flexors. This pulls the pelvis down which creates excessive lumbar lordosis in spine which causes strain and pain[7].

Common methods for the clinical assessment of strength are the manual muscle test (MMT) and by hand-held dynamo-meter (HHD). An alternative method is modified sphygmomanometer test (MST). The MST provides objective measures and involves the use of an aneroid sphygmomanometer, a low-cost, portable device widely used by health professionals.[8]

There are various exercises which are prescribed based on different school of thoughts, it includes intensive dynamic back extensor exercises, motor control exercises yoga, aerobics and various relaxation techniques. Exercises focused on the strengthening of weak musculature and stretching of tight musculature.[9] Low back pain can be managed by changing the behavioral habits like prolonged sitting, adaptations of furniture, adding physical activities in daily routine, proper diet.[10]

AIMS

The aim of the study is to analyze the effectiveness of gluteal muscle strengthening exercises on non-specific low back pain in early adulthood.

OBJECTIVES

- To assess the effect of gluteal muscle strengthening exercises on functional disability with low back in patients.
- To assess effect of gluteal muscle strengthening exercises on strength of Gmax with low back pain in patients.
- To assess effect of gluteal muscle strengthening exercises on strength of Gmax with low back pain in patient.

MATERIALS AND METHODS

HYPOTHESIS

- Research hypothesis:

Gluteal muscle strengthening exercises are effective in patients with low back pain.

- Null hypothesis:

Gluteal muscle strengthening exercises are not effective in patients with low back pain.

RESEARCH DESIGN: Experimental study

STUDY SETUP: The study was conducted at Govt medical college Ratlam, Outpatient Department of PMR, Ratlam (Madhya Pradesh).

SAMPLING: Simple random sampling (probability sampling) technique was used.

STUDY TOOLS: Treatment couch, Chair, Paper and pencil, Mat, Aneroid Sphyganomanometer, Rewised oswestry scale

INCLUSION CRITERIA:

- Patient's age group: 22-34 years.
- Gender: males and females.
- Non-specific low back pain.

EXCLUSION CRITERIA:

- Not presenting any oesteo-myoarticular or neurological lesion or dysfunction
- Not undergoing physiotherapy treatment.
- Any fracture or injury to knee, ankle or hip.
- Radiating pain.

SAMPLE SIZE: *60 Patients.*

STUDY DURATION: *3 Months*

TREATMENT DURATION: *4 Weeks*

OUTCOME MEASURES:

- Revised Oswestry Disability Index.
- Gmax muscle strength by MST.
- Gmed muscle strength by MST.

METHOD OF APPLICATION OF TECHNIQUES:

- Moist hot pack used to reduce pain and superficial muscle spasm, and to improve tissue extensibility was applied on lower back for 20 minutes and two times a day.
- LBP patients received five exercises for strengthening of gluteal muscles with frequency: 2 times per day, 5 days a week with 10 Repetitions with 10 sec hold,3 Sets of each exercise with 1-2 min rest period.

1. *HIP CLAMS*

Subjects positioned side lying on the floor, with the knees flexed at 90° and hips flexed at 60° or 30°. Subjects abducted the top knee off of the bottom knee while keeping their heels together and their anterior superior iliac spines facing forward, and then return to the starting position. Repeat with the other side.

2. *PRONE GLUTE SQUEEZE:*

Patient has to lie down in prone position with knees bent and apart from each other, join both the medial malleolus. At the same time ask the patient to squeeze his/her buttocks or contract the gluteal muscles. Hold the position for 5 sec. then relaxes.

3. *SIDE-LYING HIP ABDUCTION:*

Patient were positioned side lying on the floor, in a starting position of full knee extension and neutral hip position. Patient slowly abducted the hip of the top limb, while keeping the knee in extension, the tibia and femur in a neutral transverse plane position, and the bottom limb stationary. patient stopped at 30 of hip abduction and slowly returned to the starting position.

4. *FORWARD LUNGE:*

Lunges were performed in the sagittal plane. Patient should be in standing position with their feet near each other and hands on their hips. Lunges were performed with the dominant limb, keeping the trunk in an upright position, so that the knee and hip of the dominant limb flexed to 90°, lunge forward and repeat this with other side.

5. *SIDEWAYS LUNGE:*

Lunges were performed in frontal plane. pt in standing position with their feet near each other and hands on their hips. Lunges were performed with the dominant limb, keeping the trunk in an upright position, so that the knee and hip of the dominant limb flexed to 90°. Subject lunge sideways and repeat this with other side.

INDEPENDENT VARIABLES

- Gluteal muscle strengthening exercises.

DEPENDENT VARIABLES

- Revised Oswestry Disability Index: It includes ten questions about everyday activities such as pain severity, self-care, ability to lift weights, walking, sitting, standing, sleeping, social life, travelling, and professional work. Each answer was graded according to (a) 0 points, (b) 1 point, (c) 2 points, (d) 3 points, (e) 4 points, (f) 5 points. Then these points were summed up. The maximum no. of points scored 50. The final score was interpreted as: 0%-20% minimum disability,

21%-40% moderate disability, 41%-60% severe disability, 61%-80% crippled,
81%-100% which was bed-bounded
The intraclass correlation coefficient for the test-retest reliability of the questionnaire was 0.877 and 0.943.

- Modified Aneroid sphyganomanometer

The test instrument used in this study was a modified sphyganomanometer. The modification made by altering the position of the air tube and meter so they both are fixed on to the front of the cuff. In conducting the test, the instrument was first pumped up to 20 mmhg and the examiner placed her right or left hand inside the cuff, depending on which limb and movement was tested. A second modification was made, a one-way valve which insecure that no air is released from the cuff after pressure from the test was released. This maintains the needle in the position on the dial, so the accurate readings can be taken. After each test, the pressure within the cuff was released completely before commencing the next test.
The readings obtained are subtracted by 20 mmhg.
Then the readings obtained are converted into kg by using formula developed through linear regression techniques (Pagano and Gauvreau 2000).
Kg = 0.12x sphyganomanometer (mmhg) - 5.53
The intratest reliability coefficients, using the modified sphyganomanometer, ranged between 0.86-0.97.

- Gmax muscle strength by MST:

For hip extension, for Gmax muscle patient position is prone lying, for testing the right leg examiner should stood right side of the subject. Examiners placed the cuff on her right hand and positioned the hand just above the back of the thigh. patient was asked to bend the leg 90^0 and raise the thigh 15°-20° off the table the patient then initiated to extend the hip, the examiner resist the movement by increasing downward force until equilibrium was reached and the pressure exerted by patient is recorded. The patient was allowed to relax for 30-35 sec and the procedure was repeated with contralateral limb.

- Gmed muscle strength by MST:

For hip abduction, Gmed muscle, patient was positioned side lying. For testing the left Gmed the examiner stand on behind the patient at about mid-thigh. Patient shoulder and pelvis should be perpendicular to the table, the patients right leg was bent to 45 while holding the left leg straight on the right one. The examiner should place the cuff on the right hand, now positioned it on the vastus lateralis muscle just above the knee, the pt has to raise the leg 15°-20° straight up and then told to initiate the action by pushing upwards while the examiner resist this by applying the downward pressure until the equilibrium reached. The pressure exerted on the cuff is released and the subject relaxed for 30-35 sec before the second test was performed. The right leg was tested in the same manner.

STATISTICS

Sixty patients with low back pain screened for the study and the collected information for all these samples were entered into the computer database. Prevalence of an outcome variable along with 95% confidence limits was calculated and the responses of frequencies were calculated and analyzed by using various statistical tools.
The strength of left and right sides gluteus maximus and medius muscles, and score (%) of low back pain on OWDI had noted among studied patient with low back pain. This was assumed that the observations recorded for continuous variables had followed a normal distribution and overall assuming the normality of the gathered continuous data.
Therefore, a parametric test, paired t-test used to identify the significance of mean difference of the strength (kilogram) of left and right sides gluteus maximus and gluteus medius muscles, and score (%) of low back pain on OWDI of patients with low back pain between pre and post intervention of gluteal muscle strengthening exercises which further treated as z-test due to large sample (n>30).

RESULTS

Assessment of selected parameters to know the effect of gluteal muscle strengthening exercises on strength of left and right sides gluteus maximus and gluteus medius muscles and low back pain in patients was carried out before (baseline) and after (post) intervention of gluteal muscle strengthening exercises in improving low back pain.

The tables from 1 and 2 summarize the assessment and comparison of the strength of left and right sides gluteus maximus and gluteus medius muscles of patients.

After intervention of gluteal muscle strengthening exercises, the average (Mean ± Standard Deviation) strength of right-side gluteus maximus muscle (11.98±2.14 kilogram) and strength of left side gluteus maximus muscle (10.72±2.04 kilogram) among college students with low back pain found to be significantly higher at post intervention. However, this mean difference of 2.45 kilogram in strength of right-side gluteus maximus muscle and 2.33kilogram in strength of left side gluteus maximus muscle between baseline and post intervention stages among patient found to be statistically strongly significant ($p<0.001$).

After intervention of gluteal muscle strengthening exercises, the average (Mean ± Standard Deviation) strength of right-side gluteus medius muscle (15.37±1.26 kilogram) and strength of left side gluteus medius muscle (14.62±1.40 kilogram) among patients found to be significantly improved at post intervention stage. However, this mean difference of 2.20kilogram in strength of right-side gluteus medius and strength of left sides gluteus medius muscle (11.97±1.04kilogram) muscle among patients found to be statistically strongly significant ($p<0.001$) between baseline and post intervention stages.

The statistical agreement projected that the patients having nonspecific low back pain intervened with gluteal muscle strengthening exercises had more improved and better the strength of left and right sides gluteus maximus muscles.

The table 3 summarizes the assessment and comparison of score percent of revised Oswestry disability index of patients with low back pain.

(After intervention of gluteal muscle strengthening exercises, the average (Mean ± Standard Deviation) score percent of revised OWDI (27.43±4.74 percent) among patients with low back pain found to be significantly reduced at post intervention stage as compared to average score percent of revised OWDI (48.42±4.65 percent) at baseline sampling stage. However, this mean difference of 20.99% measured on revised OWDI between baseline and post intervention stages among with low back pain found to be statistically strongly significant $p<0.001$).

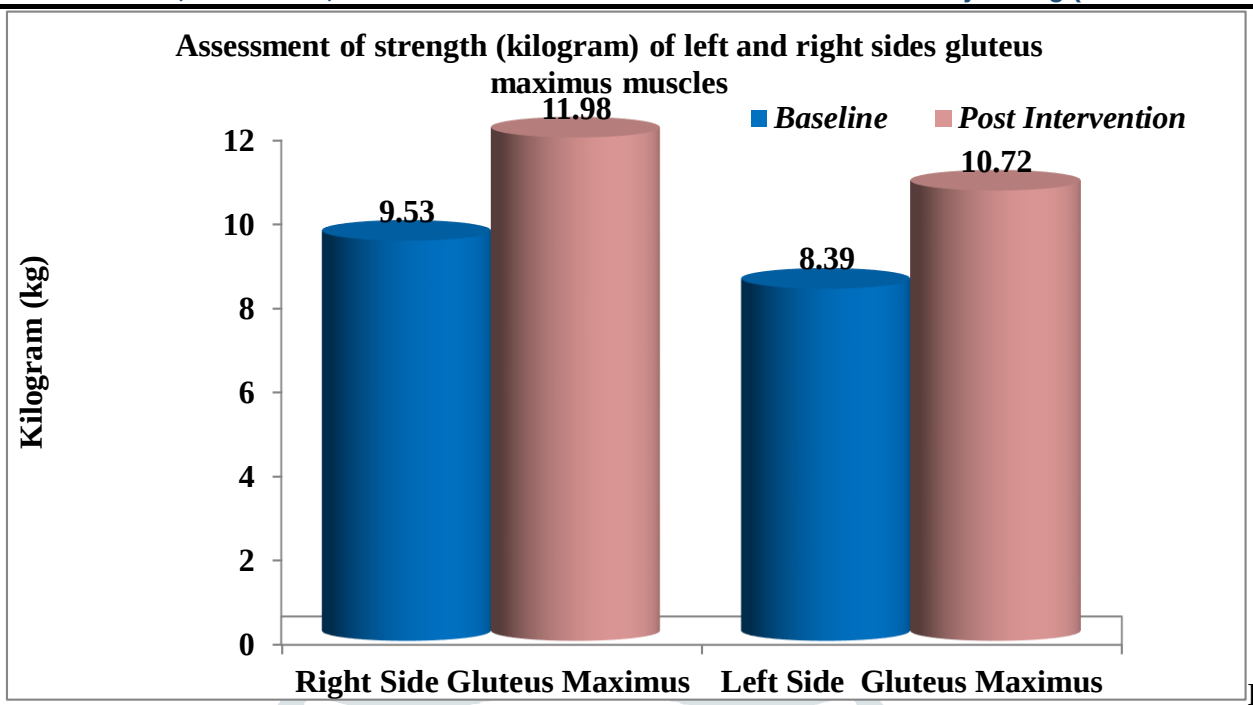
This was concluded statistically that the patients having low back pain suffered from impaired gluteus muscle and disability due to low back pain intervened with gluteal muscle strengthening exercises had more significantly improved strength of left and right sides gluteus maximus and medius muscles, and reduced disability.

Finally, the above all statements, tables, graphical presentations and inferences indicated the rejection of null hypothesis. Therefore, the alternative hypothesis is accepted. The achievement of the entire selected objectives followed with fulfillment of the aim of the proposed research titled **"EFFECTIVENESS OF GLUTEAL MUSCLE STRENGTHENING EXERCISES ON NON-SPECIFIC LOW BACK PAIN IN EARLY ADULTHOOD"**.

Table 1: Comparison of Strength of Gluteus Maximus Muscle Between Baseline and Post Intervention Stages

Variable	Sampling Stage	Scatter: Mean ± SD	Mean Diff	Z-statistic	p-value (LOS)
Right Side Gluteus Maximus (kilogram)	***Baseline***	9.53±2.05	2.45kilogram	51.12	$p<0.001$ #
	Post Intervention	11.98±2.14			
Left Side Gluteus Maximus (kilogram)	***Baseline***	8.39±2.04	2.33kilogram	66.20	$p<0.001$ #
	Post Intervention	10.72±2.04			

The mean differences are highly significant at the 0.001 level of significance. The degrees of freedom are 59.
[SD-Standard Deviation; Mean Diff-Mean Difference; LOS-Level of Significance]

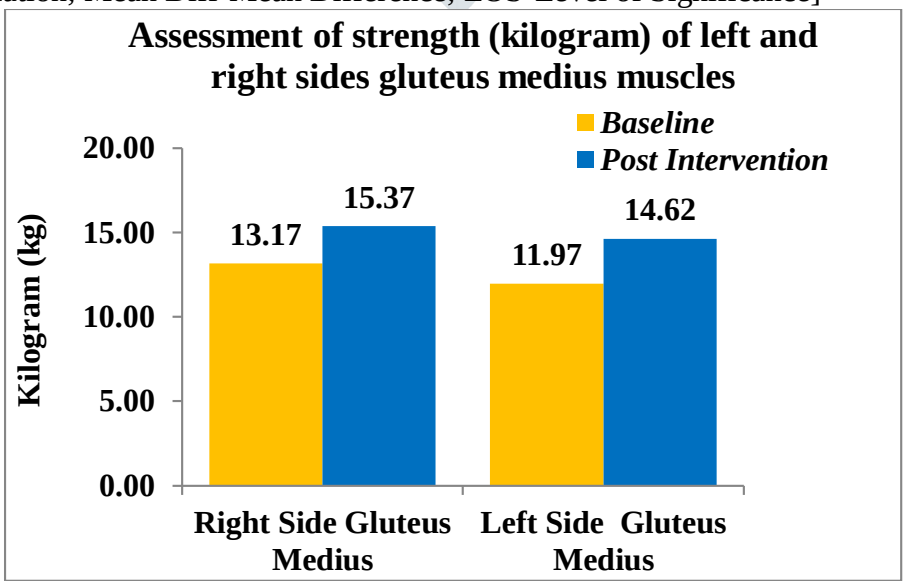


Bar diagram showing the assessment and comparison of the strengths of right and left sides gluteus maximus muscle between baseline and post intervention stages.

TABLE 2 Comparison of Strength of Gluteus Medius Muscle Between Baseline and Post Intervention Stages

Variable	Sampling Stage	Scatter Mean ± SD	Mean Diff	Z-statistic	p-value (LOS)
Right Side Gluteus Medius (kilogram)	*Baseline*	13.17±1.04	2.20 kilogram	17.77	p<0.001 #
	Post Intervention	15.37±1.26			
Left Side Gluteus Medius (kilogram)	*Baseline*	11.97±1.04	2.65 kilogram	19.66	p<0.001 #
	Post Intervention	14.62±1.40			

The mean differences are highly significant at the 0.001 level of significance. The degrees of freedom are 59.
[SD-Standard Deviation; Mean Diff-Mean Difference; LOS-Level of Significance]

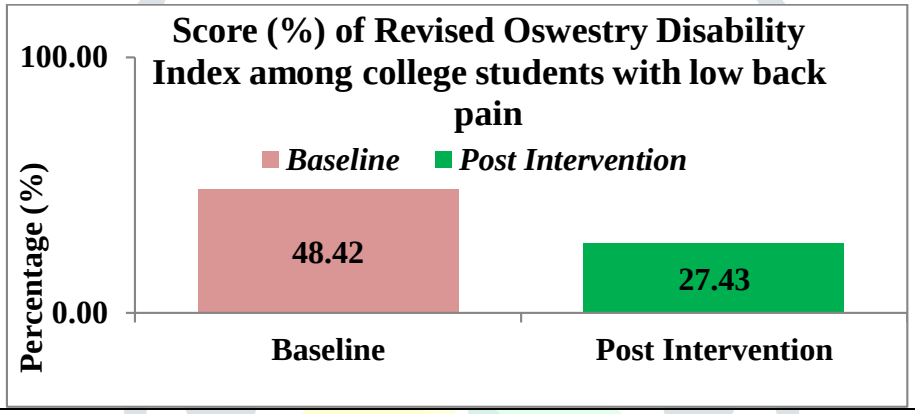


Bar diagram showing the assessment and comparison of the strength of right and left side's gluteus medius muscle between baseline and post intervention stages.

TABLE 3: Comparison of Disability due to Low Back Pain Between Baseline and Post Intervention Stages

Parameter	Sampling Stage & Difference	Scatter (percent) Mean ± SD	Z-statistic	p-value (LOS)
Revised OWDI Score (%)	*Baseline*	48.42±4.65	26.86	p<0.001 #
	Post Intervention	27.43±4.74		
	Mean Difference	20.99 percent		

The mean differences are highly significant at the 0.001 level of significance. The degrees of freedom are 59. [SD-Standard Deviation; Mean Diff-Mean Difference; LOS-Level of Significance]



Bar diagram showing the assessment and comparison of the strength of score percent of revised OWDI between baseline and post intervention stages.

DISCUSSION

The purpose of the present study was to find the effectiveness of gluteal muscle strengthening exercises in patient having LBP. Total sixty patients were selected. Each pt was treated for 5days in a week for consecutive 4 weeks and changes in their functional disability and strength of Gmax and Gmed were recorded before and after the intervention, with the help of rewised OWDI and Gmax, Gmed strength by MST. At post intervention stage, the average strength of right Gmax (2.45 ±0.84kilogram) and left Gmax (2.33±0.62kilogram), strength of right Gmed (2.20±0.86kilogram) and left Gmed (2.65±0.04kilogram) and functional disability (20.00±0.99percent) in patient was improved and found to be statistically significant($p<0.001$). From the above statistical analysis, it can be interpreted that there was significant improvement in strength of Gmax, Gmed and reduction in percentage scores of revised oswestry disability index. Thus, null hypothesis is rejected as there was significant difference was seen between baseline and post intervention stage.

As the strengthening of the gluteus maximus and gluteus medius muscle will results in reduction of the lumbar lordosis which in turn decreases the load on sacroiliac joint so the low back pain is relieved by the strengthening of the muscle.

Hence our research hypothesis that the gluteal muscle strengthening exercises are effective in patients with non-specific low back pain is statistically proved.

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