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Effectiveness of Lumbar Stabilization Exercise in Low Back Pain with Heavy Back Packs among School Children - An Experimental Study

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ABSTRACT

Introduction: When children reach school age, they go through a series of stages that include growth spurts, the development of balance and coordination, and postural stability. In physical therapy, lumbar stabilization is an active kind of exercise. It helps to prevent low back pain by strengthening muscles that support the spine. The goal of the study was to find out the effectiveness of lumbar stabilization exercise in low back pain with heavy back packs among school children.
Methodology: In the study, 30 participants were randomly selected for the study and they were divided into two groups - experimental group and control group. The participants were assessed with the help of VAS, MMST and ODI. The experimental group was given lumbar stabilization exercise along with conventional exercise and control group was given conventional exercise alone. Pre and post test were taken before and after the interventions. Exercises were given three times per week for six weeks.
Result: The results were analysed using t-test. Paired t-test was used to compare the result. In both the group there was improvement in pain, functional ability, and ROM within group. When comparing the post-test values between the experimental and control group, the experimental group showed higher results than that of control. Hence, lumbar stabilization exercise is effective in reducing low back pain among school children with heavy back pack.
Conclusion: The study concluded that lumbar stabilization exercise is effective in reducing low back pain with heavy back pack among school children.

Keywords: Lumbar stabilization Exercise, Low Back pain, Bag packs, School Children, Functional disability.

INTRODUCTION

Back pain is one of the common musculoskeletal disorders among people. Almost every one born today has a high risk of developing a crippling back injury, regardless of their career. The most typically affected location is the lumbar region. The lumbar spine is responsible for supporting the upper body and transferring its weight to the pelvis and to lower limbs. Back pain can be acute, sub acute and chronic depending on how long it lasts. A dull aching, acute or piercing pain, or burning feeling may be experienced. Numbness or weakness in the legs and arms can extend into the arms and hands as well as the legs and feet, causing discomfort **[1].** LBP frequently begins in infancy, and the prevalence of LBP in adolescents is similar to that of adults. The high recurrence of LBP in childhood and adolescents, as well as the potential for it to reoccur with higher intensity, are two characteristics of the condition. LBP creates difficulties in

carrying out activities, school absences, and the reduction or cessation of physical activity, despite the fact that the severity is usually mild and it lasts for less than a week **[2].** LBP is a common health concerns among adolescents. The prevalence in children increases with age. And by the age of 14–17years, 11 percentages to 71 percentages has experienced at least an episode of low back pain. LBP recurrences occur in 5 percent to 19percent of children. A standard part of the evaluation of patient with any type of back pain is with spinal range of motion measurements with most commonly assessed movement is flexion **[3].**

Lumbar Stabilization Exercises

Back extension strength, mobility, endurance and functional impairment can all be improved with exercise. Various exercises have been proposed to alleviate chronic low back pain, including lumbar stabilization exercise (SE), motor control exercise, core exercise, lumbar flexion exercise, walking exercise (WE), bracing exercise, flexibility exercises and so on. These exercises are designed to help for core strengthening and lumbar stabilization. Lumbar SE aims to improve the muscles neuromuscular control, strength and endurance, which are thought to be essential for maintaining dynamic spinal and trunk stability. It is thought to be safe workout with the added benefit of several stages and cost effectiveness. As everyone's lumbar muscle strength is different, lumbar SE programmes should be tailored to each person's needs, incorporating a variety of postures with differing intensities to maximize therapeutic benefit. To increase compliance, the intensity level of each exercise can be changed according to each patient's capacity, with changes in upper and lower extremity or neck postures, as well as adjustments in exercise time duration [4]. However, the aim of the study was to find out the effectiveness of lumbar stabilization exercise in reducing low back pain in school children with heavy backpack.

MATERIALS AND METHODS

STUDY DESIGN:-Two group pre-test and post-test Experimental study.

STUDY SETTING:- Shanthi Niketan School, Thiruvananthapuram

SAMPLING METHOD:-Convenient Sampling.

SAMPLE SIZE:- N=30

INCLUSION CRITERIA:

- Age- 10-15
- BMI– 18.0-24.9 Kg/m2
- Bag weight should be more than10% of the body weight.
- (According to American Occupational Therapy Asscociation(AOTA) and America Academy of Paediatrics)
- Mechanical low back pain at least for last 3 months
- Students who carry heavy back pack in both shoulders

EXCLUSIONCRITERIA:

- Anyother MSD, neurological Students are not willing to participate
- Students who carry heavy back pack in one shoulder
- Any spinal pathologiesordeformities
- Any other seriouscomorbidities(cancer, severe lungpathology)

OUTCOME MEASURES:-

- **Visual Analouge Scale:** For assessing pain
- **Modified-Modified Schobers Test:** For assessing lumbar ROM
- **Oswestry Disability Index:** For assessing functional disability

PROCEDURE:

Thirty participants were included after fulfilling the inclusion criteria were taken for the study. The total study duration was of 3 months. Participants were divided into two groups:-

I. Group A – Experimental Group of Lumbar stabilization exercise and

Conventional exercises – 15 participants.

II. Group B – Control Group of Conventional exercises alone – 15 participants

Pre-Interventional Procedures

The participant are School children identified from Shanthiniketan school in Trivandrum and those who satisfy the inclusion criteria were asked to join in the study by a consent form. They were divided into 2 groups and explained detailed about the study procedures of their group and about the Lumbar stabilization exercise in experimental group only. They were assessed by a pre-design Practical Performa and outcomes were measured. Outcomes are VAS, Oswetry disability questionnaire and Modified-modified schober test. These measures were noted as pre-test values before the intervention was given.

Protocol

Experimental Group

The experimental group was educated on IGLSE, focusing on the modifiable intensity level based on the exercise capacities of each participant. The IGLSE protocol consisted of 2 parts: stretching exercises and stabilization exercises (SE). All participants were performed stretching exercises for 10 minutes as a warm-up before beginning the SEs for 20 minutes. This program ranged from easy to difficult, based on participants exercise capacity. Each exercise level had 7 basic positions: supine, dead bug, side lying, prone, bird dog, bridge, and plank. We gradually increased the degree of instability until the most unstable posture was achieved.At the beginning, participants were placed into a level with moderate difficulty. To challenge the stabilization of all trunk muscles (anterior, lateral, and posterior), including the transverse abdominis, rectus abdominis, erector spinae and multifidus, internal oblique abdominals, and quadrates lumborum, participants were instructed to complete all five exercise positions in each session. Patients repeated each of the seven postures 5times for about 30seconds each, to the best of their ability, for a total of 30 minutes.

Control Group

Conventional Exercises follows the parameters of FIDM (frequency, intensity, duration and mode). Below exercises are FIDM recommendations from ACSM.

Post Intervention Procedure

Outcomes are VAS, Oswetry disability questionnaire and Modified-modified schober test were again measured after six weeks of interventions. These measures were noted as post-test values. These measures were recorded for the further analysis.

RESULTS

Pre and Post test measurements were done before and after the interventions. The results were analyzed using t-test. Paired t-test was used to compare the result within the group and independent t-test to compare results between the groups. Significance level was kept at p value<0.

I. Statistical analysis of pain (VAS) using t-tests

Table 1: Mean, S.D. and t-value to compare pre-test and post-test pain (VAS) in Control Group

Test	Mean	SD	Mean Change	N	t	Df	p-value
Pre-test	6.4	0.83	2.13	15	16.0	14	$p < 0.001$
Post-test	4.27	1.03					

The mean column displays the mean pre-test and post-test pain among individuals in the Control Group. SD is the standard deviations of the pain scores in pre & post respectively. Mean change 2.13 is the difference between pre-test and post-test (6.4 & 4.27). Since the *p-value < 0.001,* there is a significant difference existing between the pre-test and post-test pain among individuals in the Control Group. The pain has significantly decreased in the post test. This proves the effect of Conventional exercises on pain.

Table 2: Mean, S.D. and t-value to compare pre-test and post-test pain (VAS) in Experimental Group

Test	Mean	SD	Mean change	N	T	Df	p-value
Pre-test	6.2	0.86	3.2	15	22.11	14	p < 0.001
Post-test	3.0	0.85					

The mean column displays the mean pre-test and post-test pain among individuals in the Experimental Group. Mean change 3.2 is the difference between pre-test and post-test (6.2 & 3.2). Since the *p-value <0.001,* there is a significant difference existing between the pre-test and post-test pain among individuals in the Experimental Group. The pain has significantly decreased in the post test. This proves the effect of lumbar stabilization exercise on pain. So that, there is significant decrease in pain among the individuals in Control Group as well as in Experimental Group. There was homogeneity among pain scores in the pre-test between Control Group and Experimental Group and when compared between both groups, it showed that lumbar stabilization exercises are effective than conventional exercises reducing low back pain.

III. a: Statistical analysis of MMST Flexion using t-tests

Table 3: Mean, S.D. and t-value to compare pre-test and post-test MMST Flexion in Control Group

Test	Mean	SD	Mean change	N	T	Df	p-value
Pre-test	4.8	0.78	0.4	15	2.45	14	p < 0.05
Post-test	5.2	0.41					

The mean column displays the mean pre-test and post-test MMST Flexion among individuals in the Control Group. SD is the standard deviations of the flexion scores in pre & post respectively. Mean change 0.4 is the difference between pre-test and post-test (4.8 & 5.2). Since the *p-value < 0.05,* there is a significant difference existing between the pre-test and post-test flexion among individuals in the Control Group. The flexion has significantly improved in the post test. This proves the effect of conventional exercises on flexion.

Table 4: Mean, S.D. and t-value to compare pre-test and post-test MMST Flexion in Experimental Group

Test	Mean	SD	Mean change	N	T	Df	p-value
Pre-test	4.73	0.79	2.0	15	10.25	14	p < 0.001
Post-test	6.73	0.96					

The mean column displays the mean pre-test and post-test MMST Flexion among individuals in the Experimental Group. Mean change 2.0 is the difference between pre-test and post-test (4.73 & 6.73). Since the *p-value < 0.001,* there is a significant difference existing between the pre-test and post-test flexion among individuals in the Experimental Group. The flexion has significantly improved in the post test. This proves the effect of lumbar stabilization exercise on flexion. So, it is concluded that there is significant improvement in flexion among the individuals in Control Group as well as in Experimental Group when compare within the group. But when compared between both groups, lumbar stabilization exercises were better than conventional exercises on improving lumbar flexion.

II. b. Statistical analysis of MMST Extension using t-tests

Table 5: Mean, S.D. and t-value to compare pre-test and post-test MMST Extension in Control Group

Test	Mean	SD	Mean Change	N	t	df	p-value
Pre-test	2.13	0.58	0.24	15	2.43	14	$p < 0.05$
Post-test	2.37	0.48					

The mean column displays the mean pre-test and post-test MMST Extension among individuals in the Control Group. Mean change 0.24 is the difference between pre-test and post-test (2.13 & 2.37). Since the *p-value < 0.05,* there is a significant difference existing between the pre-test and post-test extension among individuals in the Control Group. The extension has significantly improved in the post test. This proves the effect of conventional exercises on lumbar extension.

Table 6: Mean, S.D. and t-value to compare pre-test and post-test MMST Extension in Experimental Group

Test	Mean	SD	Mean Change	n	t	df	p-value
Pre-test	2.07	0.79	1.13	15	5.91	14	$p < 0.001$
Post-test	3.2	0.94					

The mean column displays the mean pre-test and post-test MMST Extension among individuals in the Experimental Group. Mean change 1.13 is the difference between pre-test and post-test (2.07 & 3.2). Since the p-value <0.001, there is a significant difference existing between the pre-test and post-test extension among individuals in the Experimental Group. The extension has significantly improved in the post test. This proves the effect of lumbar stabilization exercise on extension. So, there is significant improvement in extension among the individuals in Control Group as well as in Experimental Group. There was homogeneity among extension scores in the pre-test between Control Group and Experimental Group and when compared between both groups, it showed that lumbar stabilization exercises were better than conventional exercises in improving lumbar extension.

III. Statistical analysis of disability (ODI) using t-tests

Table 7 : Mean, S.D. and t-value to compare pre-test and post-test Disability (ODI) in Control Group

Test	Mean	SD	Mean change	n	*t*	*df*	*p-value*
Pre-test	27.73	4.76	5.73	15	8.27	14	*p < 0.001*
Post-test	22.0	3.85					

The mean column displays the mean pre-test and post-test disability index (ODI) among individuals in the Control Group. SD is the standard deviations of the disability scores in pre & post respectively. Mean change 5.73 is the difference between pre-test and post-test (27.73 & 22.0). Since the *p-value < 0.001,* there is a significant difference existing between the pre-test and post-test disability index among individuals in the Control Group. The disability index has significantly reduced in the post test. This proves the effect of conventional exercises on disability.

Table8: Mean, S.D. and t-value to compare pre-test and post-test Disability (ODI) in Experimental Group

Test	Mean	SD	Mean change	n	t	Df	p-value
Pre-test	29.27	6.49	13.67	15	7.62	14	$p < 0.001$
Post-test	15.6	2.67					

The mean column displays the mean pre-test and post-test disability index (ODI) among individuals in the Experimental Group. Mean change 13.67 is the difference between pre-test and post-test (29.27 & 15.6). Since the p-value <0.001, there is a

significant difference existing between the pre-test and post-test disability index among individuals in the Experimental Group. The disability has significantly reduced in the post test. This proves the effect of lumbar stabilization exercise on disability. So, there is significant reduction in disability among the individuals in Control Group as well as in Experimental Group. There was homogeneity among disability scores in the pre-test between Control Group and Experimental Group and hence when compared between both groups, it showed that lumbar stabilization exercises were effective than conventional exercises on disability.

DISCUSSION

Lumbar SE aims to improve the neuromuscular control, strength, and endurance of muscles which are thought to be essential for maintaining dynamic spinal and trunk mobility. It is thought to be safe workout with the added benefit of several stages and cost effectiveness. Because everyone's lumbar muscle strength is different, lumbar SE exercise should be tailored to each person's needs, incorporating a variety of postures with different intensities to maximize the therapeutic effects. The intensity level of each exercise can be varied according to each patient's capacity, with variations in upper and lower extremity or neck postures, as well as changes in the duration of exercise time, to promote compliance [4].

Above results showed that there was significant difference in VAS, MMST, ODI among both control and experimental groups.so, lumbar stabilization exercises and conventional exercises were effective in reducing pain, improving lumbar range of motion, and reducing functional disability. But when compared between both groups, it was clear that lumbar stabilization exercise along with conventional exercises are effective than conventional exercises alone. The activation ratio of the transverse abdominus and internal oblique muscles relative to the rectus abdominus muscle improved in patients who were given core stability training. It has been proposed that core stability training improves the ability of the segmental muscles, resulting in enhanced function and reduced discomfort in people suffering from chronic non specific low back pain **[5].** Some lumbar dynamic activities were included in our stabilization exercise group, which may have strengthened the lumbar extensors in this group of patients with a large lumbar flexion angle**.** The stabilization exercise group had better functional improvements and lumbar extensor strength at low lumbar flexion angles, implying that these benefits were related to the stabilization exercise. CLBP sufferers should practice exercises to engage the deep abdominal muscles, which include the superficial muscles, transverse abdominus muscle and multifidus muscle. The deep abdominal muscles are necessary for maintaining and strengthening the lumbar spine. The transverse abdominis is vital for muscular stabilizing of the spine, which helps to support posture, and patients often have delayed muscle response during movement. Exercises for spinal stabilization are designed to improve the strength and endurance of these muscles, hence enhancing spine stability and lowering functional impairment. The spine's stability is improved via lumbar stabilization programmes **[6].** Lumbar stabilization exercises are thought to alleviate pain by lowering the stimulation supplied to pain-sensing tissues including ligaments and joint capsules by reducing the stress on the lumbar vertebra. As a result, they improve the function of the stabilizer muscles, which help control the trunk's position [7]. Strong abdominal musculature, according to Emil Sundersturp, offers support for the lumbar spine during routine activities, hence strengthening the abdominal musculature reduces low back pain. Lumbar stability exercises are more beneficial in relieving low back pain for the following reasons **[8].** However, in the stability exercise group, functional gains and lumbar extensor strength at low lumbar flexion angles were

both better, implying that these improvements were related to the stabilization exercises **[9].**

CONCLUSION

The result of the study showed that the lumbar stabilization exercise was effective in reducing low back pain, improving lumbar range of motion and functional ability when compared between experimental and control group. So, we concluded that lumbar stabilization exercises along with conventional exercise are more effective than conventional exercise alone in reducing low back pain with heavy back packs among school children.

Limitations

The number of subjects was small.

Only one school, in a similar geographic and socioeconomic area was included, and therefore the results may not necessarily generalise to a larger population.

Study has taken only three outcomes into account for the interpretation of result.

Future scope

Further research is needed into the benefits of a combined exercise intervention programme involving muscular strength, flexibility and aerobic fitness for NSCLBP patients.

Further studies are needed to determine a reliable and objective method with normative values for measuring lumbar side flexion and rotation. More samples can be added for increasing the accuracy in study.

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