



A COMPARATIVE STUDY BETWEEN CORE STABILIZATION AND SUPERFICIAL STRENGTHENING EXERCISES FOR THE TREATMENT OF LOW BACK PAIN IN TWO WHEELER RIDERS

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ABSTRACT

Low back Pain (LBP) is a major musculoskeletal problem affecting the two wheeler riders. Various factors have been implicated, including lack of/uncomfortable lumbar support, the long time spent in one position, poor conditions of the road and exposure to whole body vibration (WBV). In addition to these extrinsic factors, alteration in neuromuscular control of core stabilizers and/or poor strength of the superficial muscles has also been considered to predispose an individual to LBP. Thus, present study compared the effectiveness of core stabilization v/s superficial strengthening on pain, health outcome and Transversus abdominis (TrA) activation capacity in two wheeler riders with LBP. 52 subjects were randomly allocated to either of two groups. Exercises were done after 6 weeks, 4 times in a week, each session lasting 30 minutes. Results revealed that both exercise protocols are equally effective in reducing pain and improving health outcome. However, core stabilization exercises were more effective in improving TrA activation capacity.

KEYWORDS: Chronic low back pain, segmental stabilization, core stabilization, lumbar strengthening, two-wheeler riding.



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INTRODUCTION

In today's world, millions of people prefer two wheelers over four wheelers. This is due to economical reasons as well as to reach to their destination keeping in mind the current traffic scenario.¹ Lack of or uncomfortable lumbar support in two wheeler seat and the long time spent in one position is a major concern. Studies have been conducted to find out the problems faced by the 2 wheeler riders and musculoskeletal problems particularly low back pain (LBP) has been found out to be one of the major concern bothering them.¹ Recently a survey was conducted in a city of India, which found high prevalence of low back pain among the two wheeler riders.² It also showed strong relationship with the duration of exposure to two wheeler riding thereby, predisposing the person to chronicity. Various factors have been attributed to this problem of LBP. The two wheeler riders are exposed to whole body vibration (WBV) i.e. mechanical vibration which is considered to be a major factor leading to the musculoskeletal problems.³ Various structures in the low back including the inter-vertebral discs, paraspinal ligaments and muscles are at risk of injury in WBV (International Organization for Standardization, 2004)². Due to this there is disturbance to the nutrition pathways of spinal segments, leading to increased degenerative and pathological processes in the lumbar spine.⁴ Other contributing factors include the bad conditions of road which in our country are bumpy and with widespread pot holes. The scenario of Indian roads is such that most of rural roads as well as urban roads and some highway are not proper in construction or they get damage due to different reasons.² Other factors are suspension of the vehicle and tyre quality as poor quality of these doesn't allow good shock absorption by the vehicle which in turn is transferred to the person's body particularly the spine. Due to all these factors, a large number of people suffer from back pain.^{5,6,7} In addition to the above mentioned extrinsic factors, various intrinsic factors can also be considered to be contributing/causative factor for predisposing to LBP. Based on anatomic characteristics hierarchical structure of the muscular control

system, Bergmark identified stabilizing muscle system as either 'global' or 'local'.⁸ The local muscles are deep muscles that cross one or a few segments. They have a limited moment arm and their primary function is stabilizing the segments and controlling the inter-vertebral motion. Transversus abdominis (TrA) and lumbar multifidus are examples of local muscles. The global muscles are large superficial muscles that cross multiple segments. These muscles are responsible for bringing about axial movements with very little contribution to segmental stability.⁹ Internal and external obliques and rectus abdominis are examples of global muscles. Due to the sedentary lifestyle and lack of physical exercise, weakness of superficial trunk and abdominal muscles is one important risk factor for low back pain and it warrants strengthening of these muscles and is often associated with significant improvements of LBP, as well as with decreased functional disability. Another independent risk factor for LBP is altered motor control of the deeper core muscles such as the lumbar multifidus (LM) and transversus abdominis (TrA). These in turn leads to fear of movement, pain and muscle atrophy. Thus, keeping in mind the high extent of LBP problem among this population, the present study aimed to compare the effect of 2 potentially effective treatment programs for LBP i.e core stabilization exercises vs strengthening of the superficial muscles on LBP, health outcome and TrA activation capacity.

MATERIALS AND METHODS

A Randomized clinical trial was conducted at Dr. D.Y Patil College of Physiotherapy, India. Study was approved by the institutional sub-ethics committee. Purpose of the study was explained and written informed consent was obtained from the participants.

Subjects

A convenient sample of 52 male subjects were recruited for the study. Inclusion criteria for the study was males within the age group of 21-45 years, presenting with LBP for more than 3 months, willing and able to participate

in an exercise program safely and without cognitive impairments that would limit their participation and using two wheelers as their main mode of commutation. Participants were considered if they ride two wheelers for at least 2 hours daily for at least 5 days a week. Participants were excluded if they exhibited any recent trauma or surgery to back, any diagnosed spinal pathologies, spinal deformities, rheumatologic disorders and if they are actively participating in any kind of spinal exercises or exercising in gym.

Outcome Measures

Visual Analogue Scale

Pain was measured on Visual Analogue Scale (VAS). The VAS consisted of a 10-cm line, with the left extreme indicating “no pain” and the right extreme indicating “extreme pain” Participants were asked to indicate their current level of pain on the scale.

Aberdeen Low Back Pain Scale

This valid and reliable tool was developed in University of Aberdeen and the Aberdeen Royal Infirmary in Scotland. It is used to measure health outcome in patients with low back pain. It can be used for initial evaluation of the patient and to monitor the effectiveness of any interventions.

TrA Activation Capacity

TrA activation capacity was assessed using the Stabilizer Pressure Biofeedback Unit. The PBU consists of a combined gauge/inflation bulb which is connected to a pressure cell.

The patient lies prone and the inflation device is placed over the TrA muscle i.e between the 2 anterior superior iliac spines (ASIS). The cuff is inflated to 70 mmHg. The patient is then instructed to draw their lower abdomen gently in and off the pressure sensor and hold it for 10 seconds. Validation of the PBU test has been validated by the gold standard tests for measurements of TrA performance i.e electro-myography 17 and imaging 19 tests. The PBU test has demonstrated that individuals with low back pain have an impaired ability to depress the abdominal wall.⁹ A successful performance reduced the pressure by 6–10mmHg and indicated correct localized contraction of the TrA independent of the other abdominal muscles.¹⁰ A drop of <6mmHg, no change or an increase in pressure indicated a fail test result.¹¹

Interventions

68 patients were screened for eligibility of which 52 met the inclusion criteria and using a randomization table obtained from www.randomization.com, subjects were assigned to either core stabilization group or muscular strengthening group. Core stabilization program consisted of the spinal segmental stabilization protocol proposed by Richardson et al.^{12,13} which consists of exercises focusing on TrA and lumbar multifidus. Exercises in superficial muscular strengthening group focused on the rectus abdominis (RA), abdominus obliquus internus (OI), abdominus obliquus externus (OE), and erector spinae (ES) (Table 1)

Table 1
Exercise protocol used in the study

Core Stabilization Exercises	Muscular Strengthening Exercises
Core activation in hook lying position	Trunk Flexion in dorsal decubitus with knees flexed
TrA exercises in 4 point kneeling	Trunk flexion + Rotation in dorsal decubitus with knees flexed
TrA exercises in dorsal decubitus with knees flexed	Hip flexion in dorsal decubitus with knees semi flexed
LM exercises in ventral decubitus	Trunk Extension in ventral decubitus
TrA and LM co-contraction in upright position	

Three sets of 15 repetitions were done for each exercise. Exercises were done over 6 weeks, 4 times in a week, each session lasting 30 minutes. Sessions were supervised by the primary investigator, and participants were instructed not to participate in any other

physical program during the study and not to exercise while at home.

Statistical Analysis

Baseline demographic data between the 2 groups was compared using student unpaired

t-test. Descriptive statistics (mean, standard deviation, 95% CI) were calculated for pre and post intervention for averaged values of all the outcome measures for the 2 groups. Paired t test was applied to analyze the Pre-Post difference within the groups and independent t test was used to find out between group differences. Statistical analysis was done using primer of biostatistics, the level of significance set <0.05 with 95% confidence interval.

RESULTS

A total of 52 subjects were selected and randomly allocated to core stabilization group or muscular strengthening group (Figure 1). Characteristics of the study sample:age, BMI and baseline measurements are summarized in Table 2. At the end of 6 weeks, significant improvement was seen in all the outcome measures within both the groups (Figure 2). However, between group analysis showed that only TrA activation capacity showed statistically significant difference being more in Core stabilization group. Both VAS and Aberdeen's score was similar in both the groups

(Figure 3)
TABLE 2 : Baseline Data

	Core Stabilization MEAN (\pm SD)	Muscular strengthening MEAN (\pm SD)	p Value
Age (Years)	36 \pm 4.6	38 \pm 4.4	0.23
BMI	26.60 \pm 3.62	28.40 \pm 3.44	0.17
VAS (cm)	5 \pm 1	4.27 \pm 1.16	0.08
Aberdeen's score	36.72 \pm 7.55	38.02 \pm 10.8	0.71
TrA activation capacity (mmHg)	4.46 \pm 0.52	4.53 \pm 1.4	0.73

Figure 2
Within Group Analysis of all the parameters

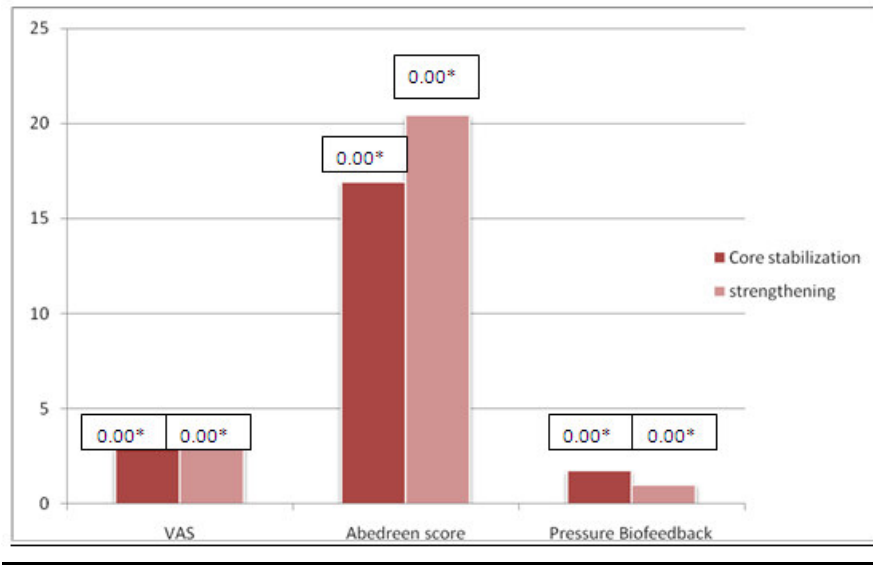


Figure 3
Between Group Analysis of all the parameters

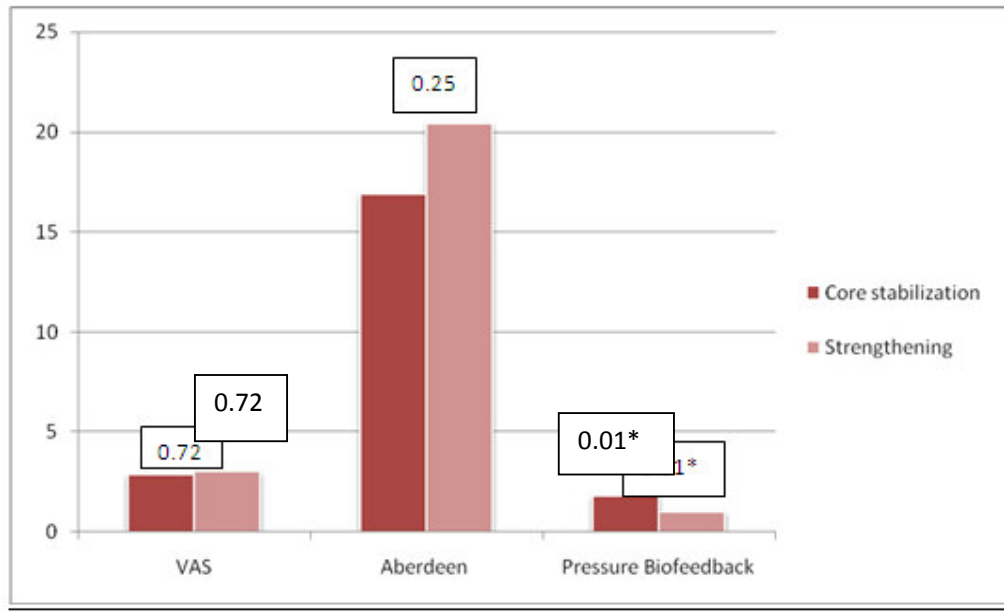
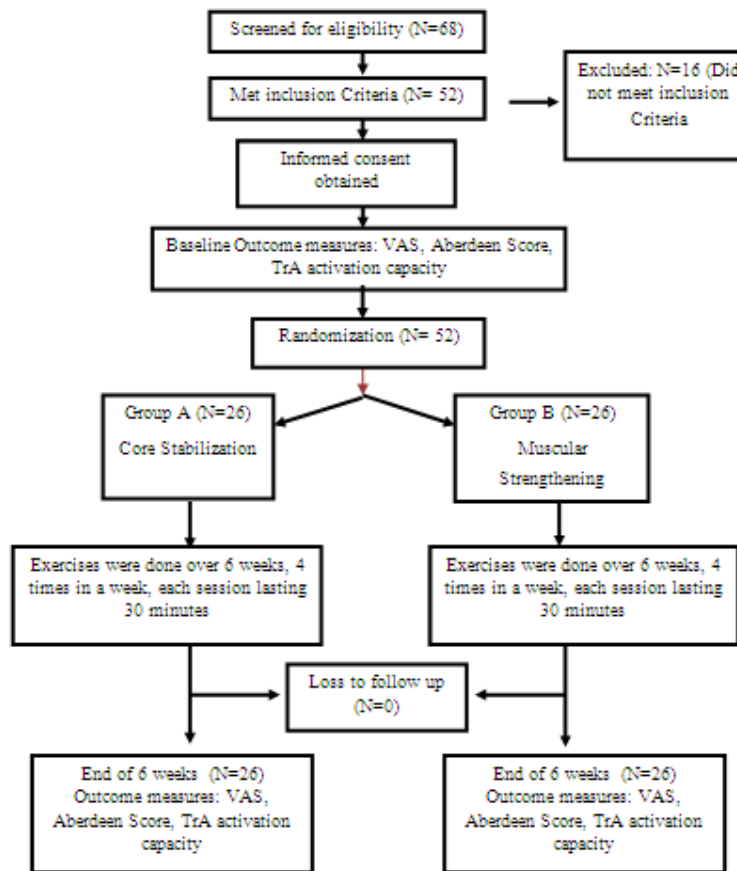


Figure 1
CONSORT FLOW CHART



DISCUSSION

The aim of this study was to compare the effect of core stabilization and lumbar strengthening exercise program on pain, health outcome and TrA activation capacity in two wheeler riders with CLBP. The result of the present study showed that there was improvement in all the outcome measures within both the groups, however, only TrA activation capacity showed significant difference between the two groups; favouring the group that received core stabilization exercises. Studies have identified two muscles which are primarily affected by low back pain and these are TrA and LM. Hides¹⁴ identified selective atrophy of the LM and TrA after the first episode of back pain and that this atrophy was unlikely to revert without specific training, and this also predisposes an individual to further episodes of low back pain. Studies also indicate that the transverse muscle of the abdomen changes its functional performance

in people with low back pain.^{15,16} In individuals with low back pain, the TrA has decreased anticipatory capacity, meaning that it has reduced segmental protective function. Richardson et al.¹² suggested that both muscles are primary stabilizers of the lumbar segment, minimizing compressive forces on spinal structures.⁹ The better results of the core stabilization group with regard to TrA activation capacity may be explained by the fact that this technique primarily addressed TrA and LM muscles. The results are consistent with that of previous researches of Ferreira et al.¹⁷ and Teyhen et al.¹⁸ who suggested that TrA exercising improves muscle activation in individuals with low back pain.⁹ Hides et al.¹⁹ has also suggested that the conditioning of TrA is accompanied by functional improvement.⁹ Rodacki et al.²⁰ suggested that abdominal exercises are associated with low back pain improvement,

since during abdominal contraction the pressure on the intervertebral disks was decreased as a consequence of the increased intra-abdominal pressure. Cairns et al.²¹ found that individuals with a history of but no current low back pain had impairments in TrA contraction. Accordingly, pain remission does not necessarily translate into improved muscle activation capacity.⁹ Improvement in outcome following the exercise program can be contributed to reduction in pain. The muscular strengthening group performed exercises that aimed to strengthen the superficial muscles of the abdomen and trunk. Previous studies assessing the effects of lumbar extensor strengthening exercises mainly look at the changes in physical strength. In the present study effect of muscular strengthening on pain, health outcome and TrA activation capacity was noted. The result of the study showed similar improvement in pain and health outcome as compared to core stabilization exercise group. According to evidence, pain and fear avoidance which is often seen in people with CLBP often results in de-conditioning thereby muscle atrophy.²²⁻²⁸ Physical / Muscular reconditioning is considered to be an important treatment modality. The results of the present study are in accordance with that of the previous study²⁹ which has proved reduction in pain and improvement in function following strengthening of lumbar muscles. They

attributed the improvement to increase in strength and subsequent reduction in fear avoidance behaviour and perceived improvements in physical and psychological functioning. Certain limitations of the present study should be acknowledged. Firstly, the sample size is small. Secondly, no intermediate and long-term follow up assessment was done. Furthermore, bio-psychosocial factors were not observed in this study. Therefore, future studies should address these limitations

CONCLUSION

Core stabilization and muscular strengthening exercises are equally effective in reducing pain and improving the health outcome in two-wheeler riders with CLBP. However, core stabilization exercises are superior in terms of TrA activation

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CONFLICT OF INTEREST

Conflict of interest declared none.

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