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Original Research Article

Impact of Trunk Stabilization Training on Cricketers with Chronic Non-Specific Low Back Pain

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Abstract: ***Background*:** The endeavour of this study was to check the impact of trunk stabilization training on cricketers suffering from chronic non-specific low back pain. ***Objectives*:** The objectives of the study was to examine the effects of trunk stabilizing exercises in cricketers with chronic low back pain for the change in level of pain, disability and improvement of endurance of trunk muscles. ***Methods*:** The related literature was searched and reviewed for the efficacy of interventions, reliability and validity of outcome measures. Quasi-experimental approach was chosen for conducting the study with pre-intervention and post-intervention evaluation of the outcomes. Convenient sampling and random allocation in to groups were used to select and assign the sample that comprised of 15 subjects in each groups out of total sample size of 30. Standardized tools such as VAS for evaluating the pain, modified Oswestry LBP disability questionnaire for evaluating disability trunk stabilization exercises to check improvement of endurance of trunk muscles were utilized. Trunk stabilization exercises with warm up, stretching and cool down were given to group A (experimental group). Heating pads and back care advice was given in the form of a leaflet to the group B (control group). ***Results*:** The data were analysed with help of SPSS version 21. Paired t-test was done for intra group analysis and un-paired t-test for intergroup analysis. The results of the study suggested that there was significant difference between the difference in mean values of pain, disability and endurance between the group-A&B. The findings also suggested that there was significant difference within group-A and group-B for pain, disability and endurance. ***Conclusion*:** This study concluded that on both groups, the significant reductions were seen in pain, disability and endurance of subjects after 8 weeks of intervention. However, there was more reduction in pain, disability and endurance in group-A (experimental group) as compare to group-B (control group).

Keywords: Chronic non-specific low back pain, cricketers, trunk stabilization training, VAS, Oswestry LBP disability questionnaire.

INTRODUCTION

Cricket is a non-contact sport and the athletes are at risk from direct trauma and chronic overuse injuries. Low back pain is one of the most common complaint in fast bowlers, poor bowling technique and the repetitive motions of activity in bowling place lot of stresses on back, during fast bowling there is hyperextension and rotation of thoraco-lumbar spine, which stresses the back [1]. The incidence of Low Back Pain in cricketers is 8% and 14% among fast bowlers [2]. Despite of their high fitness level and intensive strength training programs, they still suffer from low back pain [3]. Instability of the lumbar motion segment is considered to be important in chronic low back pain, instability is a loss of control or excessive motion in the spinal segment's neutral zone. Which may be caused by injury, degenerative disc disease or muscle weakness [4]. The muscles and tendons surrounding the spinal column that can apply forces to the spinal column constitute the active stabilizers [5]. Although the passive spine alone exhibits little resistance to a vertical load, its load-bearing capacity in neutral posture is significantly enhanced by the muscles, i.e. the passive spine and its muscles must be considered as a synergetic system [6].

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Biomechanical and clinical studies have shown that muscles can provide segmental stabilization by controlling motion in the neutral zone, and the neutral zone can be regained to within physiological limits by effective muscle control. Many authors have highlighted the importance of the lumbar multifidus muscle in providing dynamic control. In a computed tomography study, it was found that there was selective atrophy of the multifidus muscle in chronic low back pain, and, in a magnetic resonance image, (MRI) study multifidus muscle atrophy was present in 80% of patients with low back pain. This may permit spinal instability and therefore be an important factor in the high rate of recurrence of chronic low back pain [4]. Rehabilitation programs that address impairments in the multifidus muscle may have long term benefits in reducing the risk of recurrent Low Back Pain [3]. Trunk stabilization exercise as a training has been promoted as preventive regimen, as a performance enhancing program for various lumbar spine and musculoskeletal injuries [7]. Studies have shown that this stabilization programs multifidus rehabilitation in association with the transverses abdominis and pelvic floor muscle are effective in reducing lumbopelvic pain [8].

The stabilization training is increasing in fitness, athletic and rehabilitation training. They are focused on improving strength, endurance, and neuro muscular control strategies such as synergist and antagonist co-activation and coordination of muscles responsible for controlling lumbar spine and pelvic motion [9].

In addition to the use of stabilization training for rehabilitation and treatment of subjects with Low Back pain, also used as sports training method and commonly incorporated into the programs of many athletes. Randomized Control Trial shown improvements in leg power and agility increased vertical take-off velocity in subjects who underwent trunk stabilization training [10, 11].

So the purpose of study is to determine the effects of a specific stabilization exercise program in cricketers with chronic low back pain and compare it with control group.

MATERIALS AND METHODOLOGY

Thirty (30) cricketers with low back pain are included in this study as subjects. Informed consent was obtained from subjects in written format before commencement of the study. The convenient sampling method was used for sampling.

The subjects were divided into two groups. Group A i.e., 15 subjects (experimental group) given trunk stabilizing exercise. Group B i.e., 15 subjects (control group) given back care advice and heating pad. The duration of study was 8 weeks (supervised therapy sessions twice a week and perform exercises dally at home) [12].

OUTCOME MEASURES

- VAS Scale
- Modified Oswestry Disability Questionnaire
- Endurance testing

INCLUSION CRITERIA: Low back pain without radiation**,** Chronic low back pain more than 3 months**,** Low back pain severe enough to interfere with current sporting or training performance**,** Males of age group 18-30 years**,** Non-specific mechanical type without identifiable specific anatomical or neurophysiological causative factors and medically fit.

EXCLUSION CRITERIA: Patient with nerve root compression**,** any spinal cord surgeries**,** tumour**,** inflammatory conditions**,** instabilities**,** infections**,** acute injuries**,** fractures

MATERIALS USED: Stopwatch, Record sheet, Pillow, Couch

PROCEDURE: Subjects who met the inclusion criteria were randomly assigned into two groups of 15 each. A detailed standardized history was taken and Physical examination was done.

GROUP A (EXPERIMENTAL GROUP)

Warm-up Exercise: For 10 minutes which include walking slowly [13, 14].

Stretching Exercises

Back stretches:

- Low back sustained rotation from supine position,
- Single and double knee to chest from supine position,

Pelvic/leg stretches:

- Hip flexors stretch from the Thomas test position,
- Hamstring muscle stretch from long-sitting position on the side of a treatment table for each leg individually

Trunk stabilization program:

All the subjects were taught the neutral position of spine and asked to adopt the neutral position of spine with normal lumbar lordosis. After the neutral spine, abdominal bracing was taught which includes isometric contraction of all the trunk muscles. Subjects were first provided with tactile facilitation (fingers placed adjacent to spinous process of the vertebral level facilitated to direct the contraction) [3, 13].

Exercises [12]

Primary Muscle Group		**Exercises**	**Ceriteria For Progression**
Transverse Abdominus	1	abdominal bracing	30 repetitions with 8-s hold
	2	bracing with heel slides	20 repetition per leg with 4-s hold
	3	bracing with leg lifts	20 repetition per leg with 4-s hold
	4	bracing with bridging	30 repetitions with 8-s hold then progress to one leg
	5	bracing in standing	30 repetitions with 8-s hold
Erectorspinae/ Multifidus	1	quadruped arm lifts with bracing	30 repetitions with 8-s hold on each side
	2	quadruped leg lifts with bracing	30 repetitions with 8-s hold on each side
	3	quadruped alternate arm and leg lifts with bracing	30 repetitions with 8-s hold on each side
Quadratus Lumborum/ Oblique Abdominals	1	side support with knees flexed	30 repetitions with 8-s hold on each side
	2	side support with knees extended	30 repetitions with 8-s hold on each side

Progression of exercises for the three group of muscles were given according to subject's capability, the rest period between each set was 30seconds, and each muscle group was 60 seconds.

Cool down period: For 5-10 minutes, which include walking slowly [13].

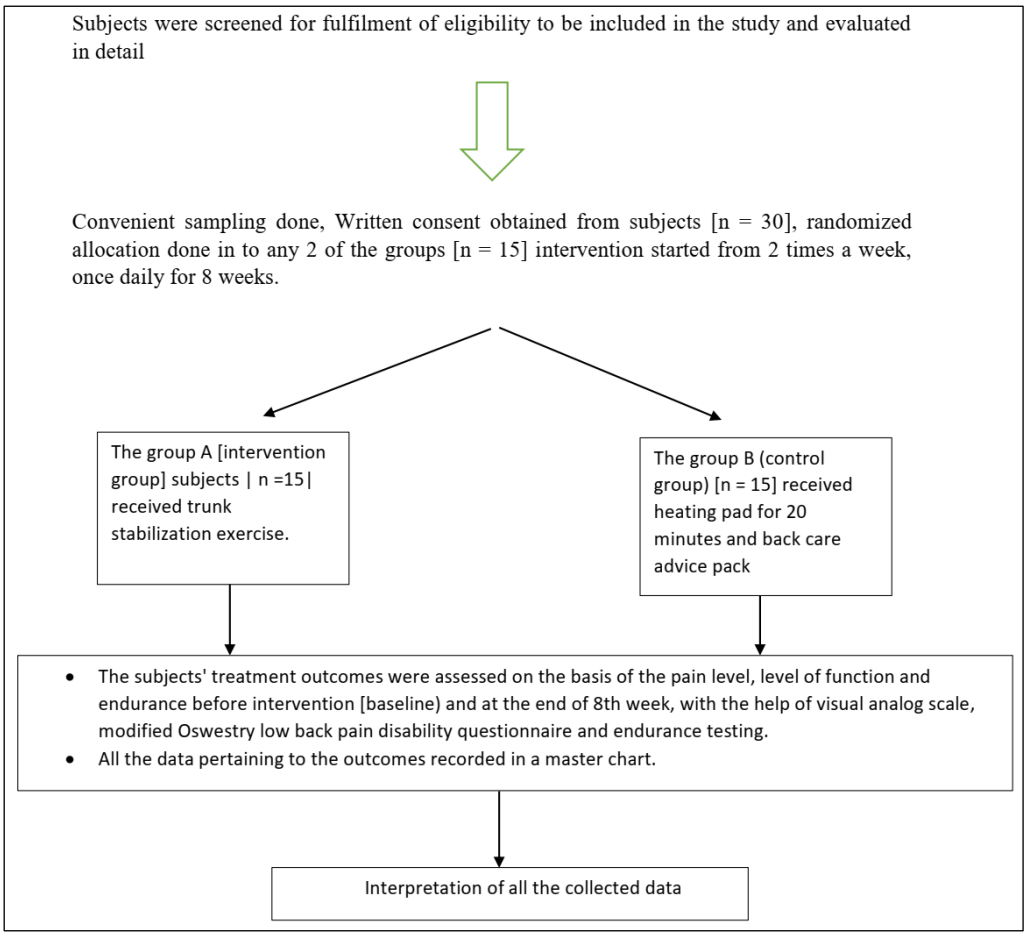
GROUP B (CONTROL GROUP): Heating pads and back care advice was given [15].

Thermotherapy: Heating pads placed on the back for 20 minutes [16].

Backcare Advice:

All the subjects received back care advice at initial session with the help of a leaflet illustration by which they got an idea about proper body postures during lying, sitting, standing and lifting objects to avoid extra stress on back.

FLOW-CHART ABOUT STEPWISE PROCEDURES



RESULTS

Statistical analyses were performed by using the SPSS version 21. Results were calculated by using 0.05 levels of significance.

Intragroup analysis:

Table-1: Mean standard deviation of age for the subjects of group-A and group-B

Demographic Data	Group -A		Group-B	
Age	Mean	S.D	Mean	S.D
	25.73	3.03	23.73	3.55

Table-2: Mean,standard deviation of pain for the subject of group-A and group-B

Pain	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	3.86	0.74	4.2	0.77
Post-Intervention	1.93	0.59	3.5	0.74

It describes the mean and standard deviation of pain for the subjects of group-A and group-B at pre-intervention and post-intervention levels. For group-A it comes out to be 3.86±0.74, 1.93±0.59 and for group-B it comes out to be 4.2±0.77, 3.5±0.74 respectively.

Table-3: Comparison of mean value for pain and post-intervention for pain values within subjects of group-A and group-B

Pain	Group-A		Group-B	
	t-value	p-value	t-value	p-value
Pre vs Post	12.61	0.001	3.16	0.01

It describes paired t-test done between pre & post intervention for pain values within group-A & group-B. The t-values are 12. 61 and 3.16 respectively.

Table-4: Mean, standard deviation of disability index for the subjects of group –A and group-B

Disability index	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	35.2	7.04	37.46	6.2
Post-Intervention	20.4	4.01	39.53	4.8

It describes the mean and standard deviation of disability index for the subjects of group-A and group-B at pre-intervention and post-intervention levels. For group-A it comes out to be 35.2±7.04, 20.4±4.01 and for group-B it comes out to be 37.46±6.2,39.53±4.8 respectively.

Table-5: Comparison of mean values for disability index pre and post- intervention within subjects of group-A and group-B

Disability index	Group-A		Group-B	
	t-value	p-value	t-value	p-value
Pre Vs Post	11.87	$p \leq 0.001$	3.01	$p \leq 0.01$

It describes paired t-test done between pre and post intervention for disability index values for subjects within group-A and group-B. The t-values are 11.87 and 3.01 respectively.

Table-6: Mean standard deviation of flexor endurance for the subjects of group-A and group-B

Flexor endurance	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	66	6.05	64.2	5.83
Post-Intervention	80.8	2.93	66.06	6.83

It describes the mean and standard deviation of flexor endurance for the subjects of group-A-and group-B at pre-intervention and post-intervention levels. For group-A it comes out to be 66±6.05, 80.8±2.93 and for

group-B it comes out to be 64.2±5.83, 66.06±6.83 respectively.

Table-7: Comparison of mean values for flexor endurance at pre and post-intervention within subjects of group-A and group-B

Flexor endurance	Group-A		Group-B	
Pre vs post	t-value	p-value	t-value	p-value
	-11.29	p≤0.001	-1.45	0

It describes paired t-test done between pre and post intervention for flexor endurance values for subjects within group-A and group-B. The t-values are -11.29 and -1.45 respectively.

Tables-8: Mean standard deviation of extensor endurance for the subjects of group-A and group-B

Extensor endurance	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	83.2	12.48	81.33	7.84
Post-Intervention	123.8	8.52	85	6.31

It describes the mean and standard deviation of extensor endurance for the subjects of group A-and group-B at pre-intervention and post-intervention levels. For group-A it comes out to be 83.2±12.48, 123.8±8.52and for group-B it comes out to be 81.33±7.84, 85±6.31respectively.

Table-9: Comparison of mean values for extensor endurance at pre and post-intervention within subjects of group-A and group-B

Extensor endurance	Group-A		Group-B	
Pre vs post Intervention	t-value	p-vale	t-value	p-value
	-14.95	p≤0.001	-3.72	p≤0.01

It describes paired t-test done between pre and post intervention for extensor endurance values for subjects within group-A and group-B. The t-values are -14.95 and -3.72 respectively.

Table-10: Mean, standard deviation of right side flexor endurance for the subjects of group-A and group-B

Right side flexor endurance	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	57.2	7.38	58.93	4.92
Post-Intervention	78.3	4.5	61.06	5.2

It describes the mean and standard deviation of right side flexor endurance for the subjects of group-A and group-B at pre-intervention and post-intervention levels. For group-A it comes out to be 57.2±7.38, 78.3±4.5 and for group-B it comes out to be 58.93±4.92, 61.06±5.2 respectively.

Table-11: Comparison of mean values for right side flexor endurance at pre and post- intervention within subjects of group-A and group-B

Right side flexor endurance	Group-A		Group-B	
Pre vs post Intervention	t-value	p-vale	t-value	p-value
	-14.49	p≤0.001	-4.57	p≤0.001

It describes paired t-test done between pre and post intervention for right side flexor endurance values for subjects within group-A and group-B. The t-values are -14.94 and - 4.57 respectively.

Table-12: Mean, standard deviation of left side flexor endurance for the subjects of group-A and group-B

Left side flexor endurance	Group-A		Group-B	
Pre-Intervention	Mean	S.D	Mean	S.D
	58.4	6.12	57.86	3.39
Post-Intervention	78.86	4.56	60	4.24

It describes the mean and standard deviation of left side flexor endurance for the subjects of group-A and group-B at pre-intervention and post-intervention levels. For group-A. It comes out to be 58.4±6.12, 78.86±4.56 and for group-B it comes out to be 57.86±3.39, 60±4.24 respectively.

Table-13: Comparison of mean values for left side flexor endurance at pre and post- intervention within subjects of group-A and group-B

Left side flexor endurance	Group-A		Group-B	
Pre vs post	t-value	p-vale	t-value	p-value
	-14.68	p≤0.001	-1.89	p≤0.05

It describes paired t-test done between pre and post intervention for left side flexor endurance values for subjects within group-A and group-B. The t-values are -14.68 and - 1.89 respectively.

Intergroup analysis:

Table-14: Comparison of mean values of differences in pain between group- A & B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
Pain	4.85	p≤0.001

It describes un-paired t-test done between group-A&B for mean values of differences in pain, which is 4.85.

Table-15: Comparison of mean values of differences in disability index between group-A&B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
Disability Index	7.5	p≤0.001

It describes un-paired t-test done between group-A&B for mean values of differences in disability index, which is 7.5

Table-16: Comparison of mean values of differences in flexor endurance between group-A&B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
Flexor endurance	6..89	p≤0.001

It describes un-paired t-test done between group-A&B for mean values of differences in flexor endurance, which is 6.89.

Table 17: Comparison of mean values of differences in extensor endurance between groups-A &B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
Extensor endurance	12.56	p≤0.001

It describes un-paired t-test done between groups A&B for mean values of differences in extensor endurance, which is 12.56.

Table-18: Comparison of mean values of differences in right side flexor endurance between group-A&B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
Right side flexor endurance	12.44	p≤0.001

It describes un-paired t-test done between group-A&B mean values of difference in right side flexor endurance, which is 12.44.

Table-19: Comparison of mean values of differences in left side flexor endurance between group-A&B

Mean values of difference between groups	Group-A& B	
	t-value	p-values
left side Flexor endurance	10.2	p≤0.001

It describes un-paired t-test done between group-A&B for mean values of difference in left side flexor endurance, which is 10.2.

DISCUSSION

The result of this study showed that trunk stabilization exercise significantly increases trunk

muscle endurance, decrease pain and functional disability in cricketers with chronic low back pain.

There is considerable evidence for the role of lumbar multifidus muscle in stabilization of the lumbar spine. Bio mechanically multifidus plays important role in providing stiffness control of spinal segment's neutral zone and capacity to stabilize spine when spinal stability is challenged Multifidus also contributes to the proprioception.

Impairments of multifidus muscle is documented in subjects with CLBP. Despite vigorous training and activity, elite athletes can present with specific muscle impairments and multifidus muscle atrophy in subjects with LBP.

Stabilization exercises used in the study is to target multifidus and other stabilizers of the spine. Subjects were asked to adopt neutral position of spine and perform abdominal bracing to activate all group of muscles then stabilization exercises were introduced to challenge and increase load on all group of muscles. The stabilization exercises used in the study were low load in nature and did not induce pain.

Results of the training showed a significant decrease in reported pain level for the subjects in trunk stabilization group. The difference in VAS pain scores was minimum clinically significant and exceeded the VAS pain scores reported in clinical studies.

Reduction in pain can be due to hypertrophy of multifidus muscle, increase in multifidus muscle CSA and restoration of between side symmetry, which is shown with trunk stabilization exercise in the previous studies. Multifidus as it contributes to the proprioception, hypertrophy of multifidus leads to increased proprioception which increases the sensory input and can improve motor control thus segmental stability is increased which thereby decreases the unwanted pathomechanical stresses.

There was no significant change in VAS score in control group and even the results suggest that trunk stabilization exercises are more significantly effective in reducing the intensity of pain than the control group. Some subjects in the control group showed slight decrease in pain, which can be due to decrease in the activity level. Some subjects shown Increase in pain level. Which can be due to increase in mechanical stresses due to loss of segmental stability, which increases the load on spine when compared to normal spine.

The stabilization exercises used in the study focused on encouraging repeated sub maximal efforts. As this exercises are low load in nature and repeated many times results in the pain of endurance of the trunk. Therefore, appropriate endurance training of back stabilizers is important for all the athletes for rehabilitating low back pain or preventing low back pain.

CONCLUSION

Despite rigorous training programs, cricketers may still suffer from low back pain with specific impairments. This study demonstrated that a staged stabilization program, which includes awareness of neutral position, abdominal bracing and stabilization exercise program, focused on encouraging repeated sub maximal efforts to mimic the function of these muscles in spine stabilization results in decrease in pain intensity, increase in trunk muscles endurance and decrease in functional disability.

Declaration by Authors
Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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