

ORIGINAL ARTICLE

IJPHY

A RANDOMISED CONTROLLED STUDY ON CORE STABILITY EXERCISE PROGRAMME USING SWISS BALL, THERABAND AND FLOOR EXERCISES IN CRICKETERS WITH LOW BACK PAIN

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ABSTRACT

Background: Low back pain is one of the common complaints seen in cricketers. Core stability is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities and generally given as treatment in many instances. No randomized controlled studies were there for low back pain in cricketers. So, purpose of this study was to know the efficacy of Swiss ball(SB), Thera-band(TB), and Floor exercises(FE) in cricketers with low back pain.

Methods: Sixty male competitive cricket players between 15-35 years age were randomly assigned into 4 groups. SB (n=15), TB (n=15), FE (n=15), control group (n=15). Analysis of data within group and between groups of the pre and post treatment values of pain-disability(Modified Oswestry Low Back Pain Questionnaire) and core strength(double-leg lowering test) was done statistically using t test and ANOVA test.

Results: The results of within group analysis, showed extremely significant improvement in terms of pain & disability and back strength ($p < 0.0001$) in all the groups, whereas in between groups, TB(theraband) group showed significant improvement compared to SB(swissball), FE(floor-exercise) and control groups.

Conclusion: The results revealed that Thera-band (TB) group had better improvement than the other three groups in decreasing low back pain and improving core stability.

Keywords: Low back pain, Core stability, Swiss ball, Thera-band, Floor exercise, Modified Oswestry Low Back Pain Questionnaire, Double leg lowering test, Cricketers.

Received 23rd September 2015, revised 12th November 2015, accepted 16th November 2015



www.ijphy.org

DOI: 10.15621/ijphy/2015/v2i6/80780

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INTRODUCTION

Low back pain is one of the most common complaints seen in primary care, with 60-85% of adults experiencing it at some time in their lives. Athletes are no exception, with the added strain of long training period contributing to the problem, especially in adolescents.¹ Schmidt et al 2014 found that competitive adolescent athletes compared to aged matched individuals have increased prevalence of back pain.² In addition, athletes are at high risk of back pain both from trauma and from overuse injuries, especially in sports requiring hyperextension, flexion and rotation.³ There are enormous causes of low back ache with or without radiating pain. Up to 75% of elite athletes experience back pain.⁴

Fast bowlers have a far higher incidence of spondylolysis (11-55%) than the general population (5%). There is a clear association between bowling with a mixed side/front-on action and stress fractures of the pars inter-articularis. Other factors that have been shown to be associated with stress fractures are landing on an extended knee; an excessive workload of bowling (overs per match and games per season); and poor foot structure, (collapsed longitudinal arches). Cricket Australia Injury Report 2003 on Australian cricketers, it was shown that the incidence of LBP was 8%, and as high as 14% among fast bowlers.⁵ Physical therapists are at the forefront of this change in the management of patients who suffer with low back pain.⁶

The core has been referred to as the “powerhouse,” the foundation or engine of all limb movement. ‘Core stability’ is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities. Core muscle activity is best understood as the pre-programmed integration of local, single-joint muscles and multi-joint muscles to provide stability and produce motion. ‘Core stability’ is seen as being pivotal for efficient biomechanical function to maximize force generation and minimize joint loads in all types of activities ranging from running to throwing, there is less clarity about what exactly constitutes ‘the core’, either anatomically or physiologically, and physical evaluation of core function is also variable.⁷

Stability is achieved through the co-activation of trunk muscles; therefore, endurance training has been postulated to be beneficial in training trunk muscles to provide stability. There has been a considerable increase in the use of the gym ball or

Swiss ball as an exercise tool in the last several years.⁸ The gym ball is used by trainers in fitness programs and by therapists for injury rehabilitation and prevention. This is due to an improved understanding of spinal stabilization and the role that it plays in back pain. The model put forward by Panjabi, other researchers and therapists has promoted a significant increase in the use of the gym ball as a rehabilitation and exercise tool.⁹

Thera-band and Floor exercises are crucial programs used in core strengthening as adopted by the concept of Pilates, but to the best of our knowledge comparison between the individual modes of strengthening of these muscles is scarce. The use of elastic resistance products in therapeutic exercise programs has become widespread in rehabilitation and has been shown to be an effective method of providing resistance and improving muscle strength.¹⁰ Elastic bands are available in an assortment of grades or thicknesses. Tubing comes in graduated diameters and wall thickness that provide progressive levels of resistance. Color coding denotes the thickness of the products and grades of resistance.¹¹

Safe exercises on stable ground have been advocated and thoroughly investigated with a detailed biomechanical model.¹² Performing strength exercises on Swiss balls has been advocated on the belief that a labile surface will provide a greater challenge to the trunk musculature, increase the dynamic balance of the user and possibly train users to stabilize their spines to prevent and treat injury.¹³

Exercise therapy was more effective than usual care by the general practitioner and equally as effective as conventional physiotherapy for chronic low back pain and may be helpful for chronic low back pain patients to increase return to normal daily activities and work.¹⁴⁻²⁰ The evidence review included all types of exercises such as specific back exercises, abdominal exercises, flexion, extension, static, dynamic, strengthening, stretching or aerobic exercises. A review of the evidence suggests that those with greater ranges of spine motion have increased risk of future troubles and that endurance, not strength, is related to reduced symptoms.²¹

Very little has been published about the effectiveness of Swiss ball, Thera-band and Floor exercises in cricketers with low back ache. Studies have shown efficacy of Swiss ball, Thera-band and Floor exercises individually, but there are no randomized controlled studies between these three techniques on cricketers. Hence the present study is designed to determine the effectiveness of Swiss

ball, Thera-band and Floor exercises on core strength and pain in cricketers with low back ache.

METHODOLOGY

Prior to the commencement of the procedure, written informed consent was taken from the participants. Only those willing to take treatment intervention for four times a week for four weeks for ten repetitions of each exercise with 10 seconds hold of three sets were recruited for the study. 60 cricket athletes were randomly allocated to four groups of 15 each. Randomized method by coin toss was used for the purpose of allocation of the subjects to the four groups. All the participants with low back ache who reported the complaints on field were screened for inclusion and exclusion criteria and then they were requested to participate in the study. Those willing to participate in the study were given a brief idea about the nature of the study and the intervention. The demographic data including age, height, weight, side of affection and duration of symptom were collected through data collection sheet. Initial evaluation of pain intensity and disability was done using Modified Oswestry Low Back Pain Questionnaire. Core stability/strength was measured by Double Leg Loweing Test.

PROCEDURE OF MEASURING PARAMETERS:

Modified Oswestry Low Back Pain Questionnaire²² - Pain and disability was assessed by using the above questionnaire with the help of data collection sheet.

Double Leg Lowering Test²³ - The examiner positioned a flat table in the corner of the room. Goniometer and portable sphygmomanometer used for assessing. The athlete was positioned on the table in supine. The examiner first taught the subject how to move the pelvis into a posterior pelvic tilt. In this position the low back is flattened against the bed. The examiner did not initiate testing until the subject could perform a posterior pelvic tilt adequately. The examiner instructed the patient to keep his back flat against the bed and maintain the posterior tilt of the pelvis as he lowered his legs from 90 degrees of hip flexion. The athlete was given one practice trial without the cuff in place. Following the practice trial the therapist placed a cuff underneath the athlete's low back. The cuff was filled with air using a hand pump and there was a dial to read the amount of pressure in the bladder. The athlete was instructed to perform a posterior pelvic tilt with the cuff under his low back. The therapist pumped the cuff to 40 mmHg of pressure. The athlete was instructed and verbally cued to maintain the 40 mmHg of pressure throughout the test. The therapist passively lifted

the subject's legs to 90 degrees of hip flexion with bilateral knee extension. The athlete actively slowly lowered his legs while maintaining a posterior pelvic tilt and the 40 mmHg of pressure in the cuff. If the athlete was unable to maintain the posterior pelvic tilt, his low back came off the table and the pressure would drop in the cuff. When the therapist saw the pressure drop below 40 mmHg of pressure (and was unable to regain pressure when urged) he stopped the movement by putting his arms under the athlete's legs. The examiner would measure the angle of the thighs using the Goniometer as described by Lanning et al. The score was recorded to the nearest degree.

NOTE: If the athlete performed the technique incorrectly no score was recorded and the subject repeated the test following a 4 minute rest break.

TREATMENT PROCEDURE:-

GROUP A: SWISS BALL EXERCISES

Back Extensions: The athlete was lying prone with hands placed away from head, knees extended, toes curled with plantar flexion and ball placed under the stomach of the athlete.

Procedure: The therapist commanded the athlete to exhale, draw in his abdominals and lift his chest off of the ball as much as possible keeping the ball stable and the position was maintained.

Planks Exercises: The athlete was lying on mat in prone on forearms with elbows flexed, extension of knees and feet placed on the ball with plantar flexion.

Procedure: The therapist commanded the athlete to draw in his abdominals and make sure that he is in a straight plank position (no sagging in the lower back) keeping the ball stable and the position was maintained.

NOTE: Be sure to breathe.

Pelvic Bridge: The athlete was lying supine with knees extended and feet placed on the ball and arms were at the side.

Procedure: The therapist commanded the athlete to lift his pelvis off the floor as much as possible comfortably and the position was maintained.

Spine Rotation: The athlete was sitting on the ball with arms straight to front without twisting at the spine, knees flexed to 90° and foot on the floor.

Procedure: The therapist commanded the athlete to move his both arms across the body to the right, bending the left elbow and keeping arms at shoulder height, turning the head to the opposite direction from the arm movement still without twisting at the spine and the position was maintained. Repeat on other side in the same

manner (both arms to the left, bending right elbow).

NOTE: Increase the difficulty by spreading feet slightly and twisting the spine in the direction of the arm movement, straightening the opposite knee and rocking forward slightly on the ball as necessary

GROUP B: THERABAND EXERCISES

Trunk Curl-up: The athlete was lying supine on floor with knees bent, arms in front and elbows straight, holding Thera-band with both the hands where the ends attached securely to a stationary object near floor.

Procedure: The therapist commanded the athlete to hold the Thera-band and Keep his hands close together and curl trunk upward, until his shoulder come up off the floor, and the position was maintained.

Trunk Twist: The athlete was sitting in chair with elbows flexed and feet apart holding one end of Thera-band with both the hands and hold at navel, where another end is attached securely to stationary object at waist level.

Procedure: The therapist commanded the athlete to hold the Thera-band and twist away from band at navel to opposite side and the position was maintained. Slowly return and repeat the sets in the other direction. Stretch its end by extending the back

Back Extension: The athlete was sitting in chair with elbows flexed at chest and feet apart holding one end of Thera-band with both the hands and hold at chest, where another end is attached securely to stationary object at shoulder level.

Procedure: The therapist commanded the athlete to hold the Thera-band and stretch its end backward by extending the back, straightening trunk and the position was maintained.

Side Bend: The athlete stood erect with one end of Thera-band secured below one foot of the athlete, held the other end of Thera-band in his hand with elbow in full extension on a firm surface.

Procedure: The therapist commanded the athlete to hold the Thera-band and stretch it by side flexing to opposite side with elbow in extension and was asked to repeat it for other side by stretching the other end and the position was maintained

GROUP C: FLOOR EXERCISES

Arm Lifts :The athlete was lying in prone with his stomach on floor, with knees extended and foot in plantar flexion and his both the stretched over the head and slightly out to the side (in a V position).

Procedure: The therapist commanded the athlete to Lift one arm, with his hand positioned so that the thumb points upward. Keeping his thighs and opposite arm relaxed and the position was maintained. Slowly lower the raised arm, then raise the other arm in the same manner

Back Extension: The athlete was lying in prone with his stomach on floor, with knees extended and foot in plantar flexion and his both arms at his side, so the hands are towards his hips.

Procedure: The therapist commanded the athlete to raise his head and shoulders off the mat as high as possible comfortably and position was maintained. Slowly lower the head and shoulders without making shoulder muscles tensed.

Pelvic Tilt: The athlete was lying supine on his back with small, flat cushion or book under his head and hip-width apart, knees are flexed, feet straight on floor, upper body relaxed and chin gently tucked in.

Procedure: The therapist commanded the athlete to gently flatten his low back into the floor and contract his stomach muscles and now tilt pelvis towards heels until feel a gentle arch in his lower back, feeling his back muscles contracting and return to the starting position. Tilting his pelvis back and forth in a slow rocking motion.

Prone On Hands: The athlete was lying prone on his stomach on a mat with knees and elbows extended.

Procedure: The therapist commanded the athlete to take weight on his hands, extend his back as much as possible comfortably and the position was maintained.

GROUP D:-CONTROL GROUP

Rest was given up to completion of the study duration.

After 4 weeks of treatment period outcome parameters pretreatment and post treatment values were measured and analyzed statistically.

RESULTS

Results were analyzed using students 't' test for pre & post treatment values and ANOVA test for post-post treatment comparison to know pain-disability and core strength in low back pain. The improvement in scores was measured by the difference between post values of outcomes. The post treatment values of Modified Oswestry Low back Pain Questionnaire for pain-disability and Double Leg Lowering Test for core strength in Swiss ball, Thera-band, Floor exercises and control group is considered extremely significant(P value is <0.0001).

All the groups Pre treatment values were similar without any significant change, so we had done post-post in between analysis by using ANOVA

GRAPH 1: Modified Oswestry Low Back Pain Questionnaire Post Treatment values of mean and standard deviation.

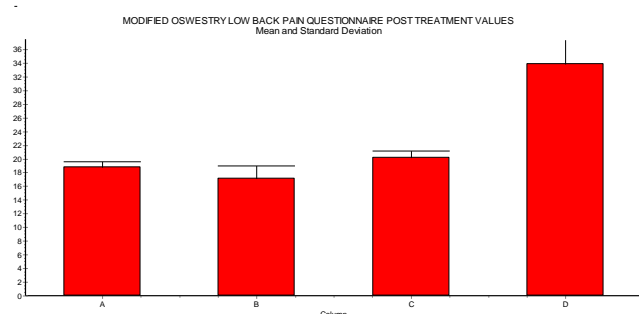


TABLE 1: Mean, Standard Deviation, Sample Size, Standard Error of Mean and P value of modified oswestry low back pain questionnaire in all the groups after treatment

	Swissball	Theraband	Floor Exercises	Control
Mean	18.8	17.2	20.2	33.866666667
Standard deviation (SD)	0.7746	1.781	1.014	3.523
Sample size (N)	15	15	15	15
Std. error of mean(SEM)	0.2000	0.4598	0.2619	0.9096
P value	< 0.0001			

GRAPH 2: Double leg lowering test post treatment values of mean and standard deviation

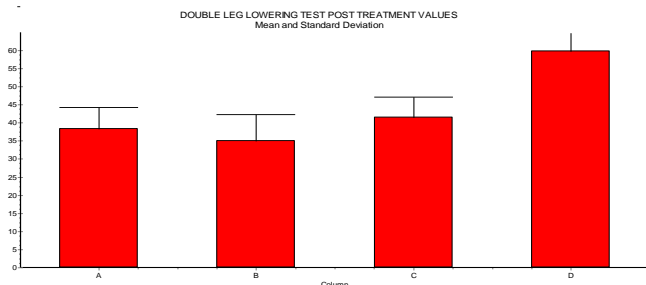


TABLE 2: Mean, Standard Deviation, Sample Size, Standard Error of Mean and P value of double leg lowering test in all the groups after treatment

	Swissball	Theraband	Floor Exercises	Control
Mean	38.4	35	41.6	59.8
Standard deviation (SD)	5.877	7.319	5.501	5.017
Sample size (N)	15	15	15	15
Std. error of mean(SEM)	1.518	1.890	1.420	1.295
P value	< 0.0001			

DISCUSSION

The purpose of this study was to determine the effectiveness of Swiss ball, Thera-band, and Floor exercises on improving the core strength and

decreasing pain and disability in cricketers with low back pain. Pre and post treatment values of Modified Oswestry Low Back Pain Questionnaire and Double Leg Lowering Test were recorded. Although the study shows improvements in all the groups other than control group, increase in core strength and decrease in pain and disability is more significant in Thera-band exercise group.

Modified Oswestry Low Back Pain Questionnaire showed P value < 0.0001 considered extremely significant in all groups in pain and disability whereas when compared to other groups, control group showed less improvement because of no treatment.

A study by JooSoo Yoon, et al,²⁴ concluded that lumbar stabilization exercises using a ball are thought to be an effective interventional therapy for the alleviation of chronic low back pain and to increase bone mineral density in athletes and even in another study by SinHoChung, et al,²⁵ revealed that stabilization exercises using ball can increase in the CSA of the MF segments, improvement in weight bearing, pain relief, and recovery from functional disorders with low back pain. Emil Sundstrup E, et al,²⁶ suggested that Crunches on a Swiss ball with added elastic resistance induces high rectus abdominis activity accompanied by low hip flexor activity which could be beneficial for individuals with low back pain and Krabak & Kennedy, et al,²⁷ on Functional rehabilitation of lumbar spine injuries in the athlete showed that low back pain can cause muscle atrophy and inhibit muscle firing which leads to altered spinal mechanics which may exacerbate the pain-spasm-pain cycle leading to increased dysfunction, decreased muscle endurance and delayed return to play, so in initial stages floor exercises are effective to perform.

In this study there is betterment in pain and disability in all 3 exercise groups because all these groups exercises are leading to stimulate the core muscles by which segmental enhancement will be there by decreasing stress and dysfunction on low back region which reduces pain and disability. Theraband exercises showed more improvement than others may be because these exercises are easy to perform depending on capability to do exercise from baseline.

In Double Leg Lowering Test Thera-band group showed more improvement in core strength with P value < 0.0001 which is extremely significant when compared to other groups in core strengthening.

A study by Thomas E. Hyde. et al,²⁸ said about difficulty of exercises using an exercise ball will vary for each person and will challenge areas of

inflexibility, maybe that's why strength improvement is not better than Thera-band group and in another study Akron,²⁹ reported that greater activation of the abdominal muscles by 24%, using Thera band than mechanical devices for resistance is better for improving core strength which is similar to Saied Jalal Aboodarda. et al,³⁰ who suggests elastic training is a viable mode of resistance exercise that can provide a training stimulus that is significantly greater than that employed in rehabilitation settings. Cheri L. Drysdale, et al,³¹ said that Abdominal hollowing may be performed with minimal activation of the large global abdominal muscles which suggest floor exercises can also activate core muscles which is similar to Axler CT, et al,³² who said that a variety of selected abdominal exercises are required to sufficiently challenge all of the abdominal muscles and that these exercises will-differ to best meet the different training objectives of individuals which is one more reason to say Thera-band exercises are easy to perform without discomfort. Even though Swiss ball group and Floor exercise group showed improvement in core strength which is less than Thera-band group may be because using Thera-band exercises for core strength is better comfortable than Swiss ball and effective than Floor exercises.

A study by Waddell GF, et al,³³ suggested a positive advice about staying active could improve clinical outcomes and reduce the personal and social impact of back pain likewise Hagen KB, et al,³⁴ suggested that people with acute low back pain, advice to rest in bed is less effective than advice to stay active. In the present study improvement in control group is less because there is no physical activity or position modification or any treatment intervention was undertaken.

From this, it is clear that Thera band exercises are effective and beneficial in decreasing pain-disability and improving core stability in cricketers with low back pain.

CONCLUSION

In conclusion, the results of the current study demonstrated that the effectiveness in 4 groups (Swiss ball, Thera-band, Floor exercises, Control group) on pain & disability, core strengthening in cricketers with low back pain after 10 repetitions of each exercise per 4 times a week for four weeks suggested that there is an improvement in all the groups other than control group. Although significant difference is shown in all the groups, Thera-band group had better effectiveness compared to other 3 groups in core strengthening and pain & disability.

LIMITATIONS & RECOMMENDATIONS

LIMITATIONS:-

- Sample size is small.
- Short duration study.
- Study done only on male cricketers.

RECOMMENDATIONS:-

- Sample size can be large in number.
- Long duration study should be done for generalizing the results.
- Female cricketers also can be included in the study.

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Citation

M.Seshagirirao, K.L.V.R.Susmitha, & K.Suvarna Sundari. (2015). A RANDOMISED CONTROLLED STUDY ON CORE STABILITY EXERCISE PROGRAMME USING SWISS BALL, THERABAND AND FLOOR EXERCISES IN CRICKETERS WITH LOW BACK PAIN. *International Journal of Physiotherapy*, 2(6), 885-893.

Appendix: Pictures of Exercise Program

Picture1: Group-A Swiss ball exercises



1.1: BACK EXTENSION



1.2: PLANK EXERCISE



1.3: BRIDGING



1.4: SPINE ROTATION

Picture2: Group B- Theraband Exercises



2.1: TRUNK CURL UP



2.2: TRUNK TWIST



2.3. BACK EXTENSION



2.4: SIDE BEND

Picture3: Group C- Floor Exercises



3.1: ARM LIFTS



3.2: BACK EXTENSION



3.3: PELVIC TILT



3.4: PRONE ON HANDS