

ORIGINAL RESEARCH

IJPHY

EFFECTIVENESS OF SWISS BALL VS FLOOR EXERCISES ON CORE MUSCLE STRENGTH IN ELITE CRICKETERS

¹K. Sai sudha²Dr. A. Viswanath reddy, M.P.T(sports), PhD,³Dr. K. Madhavi, M.P.T(C.T), PhD, FIAP

ABSTRACT

Background: Cricket is one of the most popular game in India played by men and women of all ages. The increased physical demands on the players may be associated with an increased risk of injuries. Core muscle strength is important to prevent risk of injuries in elite cricketers. The beginners in the cricket must have enough strength of core muscles, as core is the bridge between upper and lower limbs. So, it should be strong enough to prevent low back and lower limb injuries in cricketers. The aim is to determine the effectiveness of swiss ball exercises versus floor exercises on core muscle strength in elite cricketers. The objective is to study and compare the effectiveness of swiss ball exercises and floor exercises in elite cricketers in terms of back strength.

Method: The total number of students in this study were 30 elite cricketers between 16-25 years out of which 15 subjects were included each in floor exercise(n=15) and swiss ball group(n=15). Back strength was measured before and after the intervention of 6 weeks using isokinetic analyser.

Results: After the analysis, the results revealed significant improvement of back strength in both the groups(p< 0.00). The swiss ball group showed significant results when compared with floor exercise group.

Conclusion: Although the study showed beneficial results in both the groups, the results reflected that swiss ball group had better improvement of core muscle strength than the floor exercise group.

Keywords: Swiss ball, core muscles, cricketers, isokinetic analyser.

Received 21st July 2015, revised 12th September 2015, accepted 21st September 2015



www.ijphy.org

DOI: 10.15621/ijphy/2015/v2i5/78228

²Associate professor, college of physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupathi.

³Professor and principal, college of physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupathi.

CORRESPONDING AUTHOR

¹K. Sai Sudha

M.P.T College of physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupathi.

INTRODUCTION

Cricket is one of the most popular game in India played by men and women of all ages. The increased physical demands on the players may be associated with an increased risk of injuries. This is because the demands on the body from playing cricket are extremely varied as players are required to bat, bowl and field various times throughout the game.

The incidence and nature of cricket injuries during a season have been documented in well-conducted studies.¹ Anatomically, the sites of injuries in cricket have been reported in a number of studies. Cricketers are sustained by back and trunk injuries by 14 -18%. The frequency of lower limb injuries varies from 25% to 30% has been reported.²The major cause of injuries was found to be bowling. 38% of young school boy bowlers³ and 65.7% of provincial bowlers² suffer from back injuries. These are mostly lower back injuries.^{2,3,4,5}

The greatest risk of injury is for younger players,⁶⁻⁹ with bowlers (mean age 16.8 years) showing increased vulnerability to injury because their growth process could not have been completed.¹⁰Injuries were thought to occur as a result of sudden unexpected movements, such as slips or falls, because the neuromuscular system overreacts, and in the process, soft tissues containing nociceptors and proprioceptors are damaged.

The lumbar spine functions as a complex interplay of musculoskeletal and neurovascular structures creating a mobile yet stable transition between the thorax and pelvis.

'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.

Low back pain (LBP) is one of the most common complaints seen in primary care, with 60-85% of adults experiencing it at some time in their lives.¹¹ Athletes are no exception, with the added strain of long training period contributing to the problem, especially in adolescents.¹² 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.¹³

Approximately 75% of elite athletes are experiencing back pain.¹⁴ In young adults, intervertebral discs are so strong that it first damages the adjacent bone after a traumatic injury. Only forcible flexion can damage a healthy disc. Then comparatively minor strains may cause

internal derangement with eccentric displacement of the nucleus pulposus or external derangement, the nucleus pulposus then bulges or bursts through the annulus fibrosis, usually posterolaterally.

The swiss ball is an extremely popular apparatus used for core stability training in populations as varied as spinal disorders to elite athletes. The majority of the research involves abdominal muscle exercises comparing them to the traditional mat (stable surface) styles, however the benefits of swiss ball exercises appear to have been applied to whole body exercises equally.

Performing strength exercises on swiss balls has been advocated that a labile surface will provide a greater challenge to the trunk musculature, increase the dynamic balance of the subject and possibly train subjects to stabilize their spines to prevent and treat injury.

Core stabilization exercise (CSE) with the Abdominal Drawing-In Maneuver (ADIM) technique has been found to primarily activate the deep abdominal muscles with minimal activity of the superficial muscles.¹⁵

Exercise therapy was more effective and equally as effective as conventional physiotherapy for chronic low back pain and may be helpful to increase return to normal daily activities and work.¹⁶⁻²² The evidence review included all types of exercises such as specific back exercises, abdominal exercises, flexion, extension, static, dynamic, strengthening, stretching or aerobic exercises.

The studies have been published about the effectiveness of swiss ball and floor exercises in elite cricketers with low back pain. Studies have shown efficacy of swiss ball and floor exercises comparatively but there are no studies on core muscle strength in elite cricketers to prevent low back pain. Hence, the present study is designed to determine the effectiveness of two exercise therapy interventions such as swiss ball and floor exercises on core strength on elite cricketers.

The most common injury from cricket is lower back strain from different activities of cricket such as bowling, batting and fielding. This is because the repetitive activities of all the above components place considerable stress on the back. In addition, core strength is very essential in all fields of cricket to prevent the injuries. Concentrating mainly on core muscles strengthening along with abdominal drawing in maneuver technique helps to activate all the core muscles which enhances the prevention of injuries.

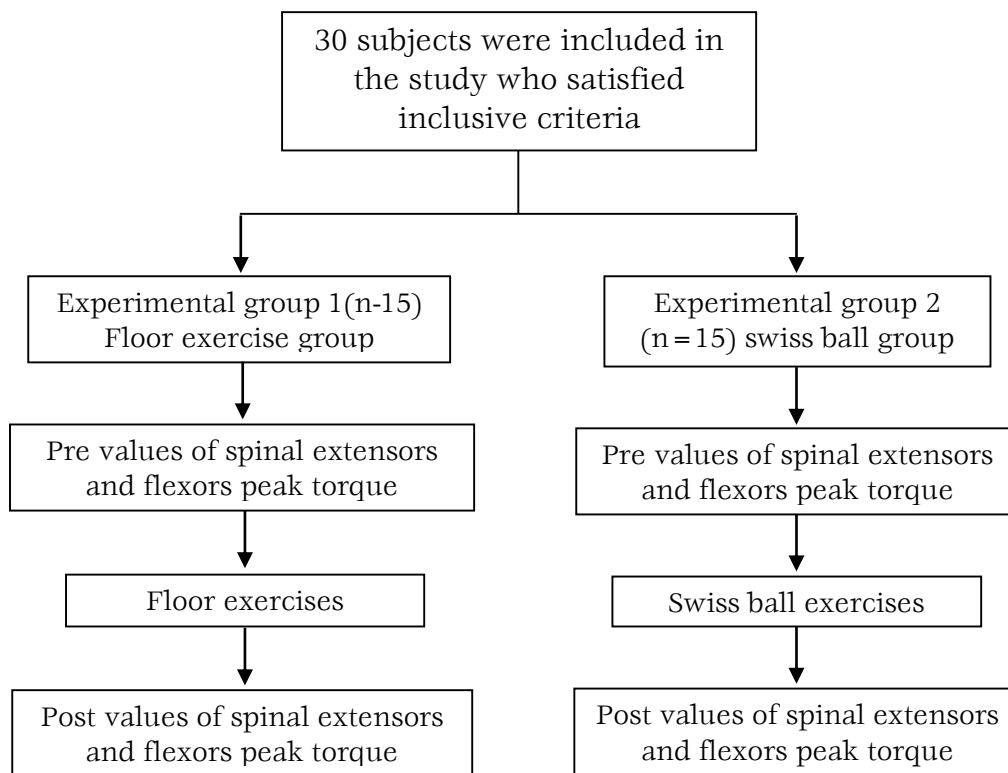
Core muscle strength is important to prevent risk of injuries in elite cricketers. The beginners in the

cricket must have enough strength of core muscles, as core is the bridge between upper limbs and lower limbs. So, it should be strong enough to prevent low back injuries, lower limb injuries in cricketers. Instead of rehabilitating the player after any injury, concentrating on core muscles strength priorly in elite cricketers prevents the risk of injury in future.

Although there is general fitness training, concentrating the core muscles is lagging in the training. Hence, there is a possibility of back and lower limb injuries in cricketers at the time of game or after the game. So, the present study concentrated mainly on the core muscle stability with the help of swiss ball and floor exercises. The need of the study is to determine and compare the

METHODOLOGY

STUDY ALGORITHM



MATERIALS

The materials used in the study are measuring tape, weighing machine, swiss ball, mat, isokinetic analyzer, sphygmomanometer, written informed consent, data collection tool.

The variables and tests used are presented in table-1.

Table 1: Dependent Variables and Tests

Variables	Tests/instruments	Unit
Back strength	Isokinetic Dynamometer	Nm
Muscular strength	DLLT	mm/hg

The primary data was collected from Thummalagunta cricket stadium, Tirupathi and SVIMS College of physiotherapy. The study

effects of swiss ball exercises and floor exercises in improving core muscle strength in cricketers.

The aim of the study is to determine the effectiveness of swiss ball exercises versus floor exercises on core muscle strength in elite cricketers. The objectives of the study is to evaluate the effect of swiss ball exercises on strength of spinal flexors and extensors by peak torque (isokinetic analyser) in elite cricketers and to evaluate the effect of floor exercises on strength of spinal flexors and extensor by peak torque (isokinetic analyser) in elite cricketers and to compare the effect of swiss ball exercises and floor exercises on strength of spinal flexors and extensors in elite cricketers.

duration was from January to March 2015. The study design was an experimental study without control group with a purposive sampling design. The participants are male cricketers who are willing to take part in the study for 6 weeks were recruited for the study.

The sample size for this research study was thirty (30). The study sample included male elite cricketers. Male elite cricketers in between 16-25 years of age group are included in the study. Female cricketers, any associated neuromuscular conditions, any musculoskeletal injuries, any injuries to lower limbs, those who were unable to

perform the exercises because of any reason are excluded from the study.

OUTCOME MEASURES

Core strength: Core strength was measured using standard technique of measuring torque with the help of isokinetic analyzer.

PROCEDURE

Prior to the commencement of the procedure, informed written consent was taken from the participants. Only those willing to take intervention for five times a week for six weeks were recruited for the study. The thirty (30) subjects were randomly allocated to two groups of fifteen (15) each.

All the participants were screened for inclusion and exclusion criteria and then they were requested to participate in the study. Core strength was measured by isokinetic analyzer as an interventional outcome measure.

Then participants were randomly allocated into 2 groups:

1. Floor exercise group
2. Swiss ball group

The two groups received the selected intervention for five times a week for six weeks.

INTERVENTIONS:

Floor exercise group: This group received floor exercises. The exercises includes pelvic bridging, quadruped position, prone cobra, prone plank bridge, side plank bridge. Ten repetitions of each exercise were performed with 10 seconds hold of three sets.

Swiss ball group: This group received swiss ball exercises. The exercises includes stability bridge, stability ball crunch, stability ball diagonal long lever crunch, stability ball push-up, stability ball hamstring curl. Ten repetitions of each exercise were performed with 10 seconds hold of three sets.

RESULTS

Floor exercise group

Table 2: Mean of pre and post intervention of spinal flexors and extensors at 60°/s and 75°/s and abdominals in floor exercise group in elite cricketers.

Parameters		N	Mean	S.D	t- value	Df	p- value
Abdominals	Pre	15	36.33	14.69	7.40	29	.000
	Post	15	18.33	8.16			
Flexors at 60° /s	Pre	15	58.38	23.93	-9.05	14	0.000
	Post	15	96.34	12.20			
Flexors at 75° /s	Pre	15	64.58	24.15	-8.72	14	0.000
	Post	15	100.32	19.08			
Extensors at 60° /s	Pre	15	57.92	13.44	-4.40	14	0.000
	Post	15	79.26	17.02			
Extensors at 75° /s	Pre	15	64.77	16.71	-13.40	14	0.000
	Post	15	81.92	14.75			

Dosage: The exercises were given for ten repetitions of three sets. The above procedure was given for five times a week for six weeks. At the end of six weeks the athlete's back strength was re-assessed and recorded on data collection sheet. The back strength was measured by isokinetic analyzer and double leg lowering test (DLLT). Sphygmomanometer is used in double leg lowering test (DLLT) to assess the core strength. The individual is placed supine. Sphygmomanometer cuff is placed under the lumbar spine at approximately L4-L5.

The cuff pressure is raised to 40 mm hg. The individual's legs are maintained in full extension while flexing the hips to 90 degrees. The individual is instructed to perform a abdominal drawing in maneuver and then flatten the back maximally into the table and pressure cuff.

The individual is instructed to lower the legs toward the table while maintaining the back flat. The test is over when the pressure in the cuff decreases. Then the range in the mercury scale is noted.²³

STATISTICAL ANALYSIS

Statistical analysis has been carried out to analyze the significant impact of the treatment issued to the subjects of both experimental groups by using IBM SPSS Inc.20.0 version. For this purpose the data was entered into microsoft excel spread sheet, tabulated and subjected to statistical analysis.

Statistical tools such as unpaired t-test has been applied for parameters in between groups and paired sample t- test for parameters within group.

Statistical tools such as independent sample t-test and paired sample t-test has been applied to the outcome measures – peak torque for lumbar flexion and extension at 60°/s, 75°/s and double leg lowering test.

Inference: On performing the paired sample t-test, it is observed that there is a statistical significance (< 0.00) is existing between all the pairs of

Swiss ball group

Table 3: Mean of pre and post intervention of spinal flexors and extensors at 60°/s and 75°/s and abdominals in swiss ball group in elite cricketers.

Parameters		N	Mean	S.D	t- value	Df	p- value
Abdominals	Pre	15	50	10.69	14.92	29	.000
	Post	15	25.33	8.33			
Flexors at 60° /s	Pre	15	42.24	25.61	-5.42	14	0.000
	Post	15	67.14	25.48			
Flexors at 75° /s	Pre	15	46.99	22.56	-5.26	14	0.000
	Post	15	69.96	24.35			
Extensors at 60° /s	Pre	15	65.8	38.60	-3.18	14	0.000
	Post	15	75.84	36.97			
Extensors at 75° /s	Pre	15	64.77	46.02	-1.65	14	0.000
	Post	15	81.92	42.04			

Inference: On performing the paired sample t-test, it is observed that there is a statistical significance (< 0.00) is existing between all the pairs of

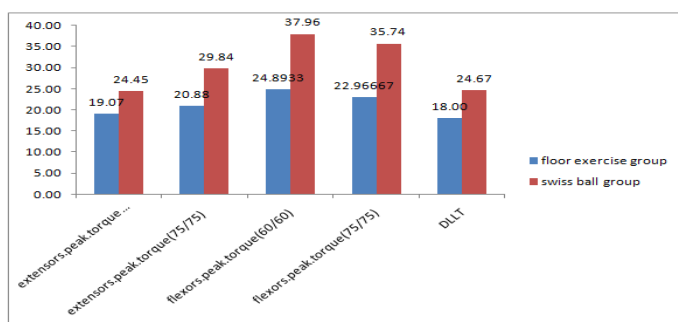
COMPARISON BETWEEN THE GROUPS:

Table 4: Comparison of mean values of spinal flexor and extensor strength between the floor exercise group and swiss ball group in elite cricketers:

Parameters	Groups	N	Mean ± Standard deviation	t- value	P value
Abdominals	Floor exercise	15	18.00 ± 9.411	-2.269	0.032
	Swiss ball	15	24.67 ± 6.399		
Flexors at 60°/s	Floor exercise	15	24.89 ± 17.78	2.102	0.045
	Swiss ball	15	37.96 ± 16.23		
Flexors at 75°/s	Floor exercise	15	22.96 ± 16.88	2.136	0.042
	Swiss ball	15	35.75 ± 15.86		
Extensors at 60°/s	Floor exercise	15	19.07 ± 06.68	-1.294	0.021
	Swiss ball	15	24.45 ± 14.66		
Extensors at 75°/s	Floor exercise	15	20.88 ± 11.87	2.365	0.026
	Swiss ball	15	29.84 ± 08.62		

Inference: On performing the paired sample t-test, it is observed that there is a statistical significance (< 0.00) is existing between floor exercise and swiss ball group with respect to spinal flexor muscle strength. And also it is noticed that the swiss ball group was found to be better with greater mean. Thus the null hypothesis is rejected and alternate hypothesis is accepted.

Graph 1: Graphical representation of mean values of peak torque of spinal flexors and extensors at 60°/s and 75°/s between floor exercise group and swiss ball group in elite cricketers:



observations of pre and post time periods of floor exercise group. It shows that post intervention had shown significant impact on the subjects.

observations of pre and post time periods of swiss ball group. It shows that post intervention had shown significant impact on the subjects.

There was a significant difference between swiss ball group and floor exercise group in peak torque of spinal flexors and extensors at 60°/s and 75°/s in elite cricketers.

RESULTS

After a 6 week protocol period, the subjects in floor exercise group and swiss ball group had shown improvement with the outcome measures. But on comparing both the groups, swiss ball group had shown a statistically significant improvement at 0.05 level with the outcome measures i.e., peak torque of spinal flexors and extensors.

DISCUSSION

The present study is carried out to find the effectiveness of floor exercises and swiss ball exercises on core muscle strength in elite cricketers. The total number of subjects were 30, 15 subjects were allotted into floor exercise group and 15 subjects were allotted into swiss ball group. The protocol was given for 6 weeks.

According to the data analysis, a significant difference was found between the pre and post-test values of peak torque of spinal flexors and extensors and double leg lowering test(DLLT) in floor exercise group($p < 0.00$).

There is a significant difference between pre and post values of peak torque of spinal flexors and extensors and double leg lowering test in swiss ball group($p < 0.00$).

The results of the present study shows that subjects in swiss ball group shows a significant improvement in core muscles strength, i.e., there is an improvement in the peak torque of spinal flexors and extensors where compared to floor exercise group in elite cricketers.

Core stability is an important factor in all sports persons especially in cricketers to prevent the risk of injuries. However, the evidence about the effects of core stability exercises using swiss ball and floor exercises in cricketers has limited studies.

Our results show that an exercise programme on swiss ball of 6 weeks duration improves strength of the core muscles and finally decreases the risk of injuries in elite cricketers in both groups but compared to the floor exercise group, more significant changes seen in swiss ball group.

The technique behind the swiss ball training is to concentrate and shift the weight to maintain stability on the ball, which will not occur in traditional weight training exercises. Postural control during balancing on a swiss ball consists of adapting the motor program to maintain stability, while the overall postural strategy is maintained. Swiss ball training improves nervous system function that results in functional strength gain.

The benefits of performing resistance exercises on unstable equipment originated from research on muscle activation and methods of preventing or rehabilitating low back, knee and ankle injuries. Even though the movement patterns on the swiss ball and floor exercises group may look similar, the underlying neural adaptations such as the increase in nervous system activation, more efficient neuromuscular recruitment patterns, improved synchronization of motor units, lowering of neural inhibitory reflexes and proprioceptive feedback may be completely different (Panjabi, 1992).

Based on the statistical analysis, the results of this study showed that there is a significant improvement in the post values of peak torque of spinal flexors and extensors in floor exercise group(table- 2).

The table no – 3 in this study showed that post values of peak torque of spinal flexors and

extensors showed significant improvement in swiss ball group rather than floor exercise group. A similar study conducted by Vera-garcia and others which concluded that "the muscle activity levels demonstrated on the swiss ball suggested a much higher demand on the motor system and appeared to constitute sufficient stimuli to increase both the strength and endurance properties of muscle".^{24,25}

The table no – 4 in this study showed that both the groups showed significant results but however on comparing swiss ball group showed significant improvement of core muscle strength than floor exercise group. A similar study conducted by Vera-garcia, f.j et al (2000) who studied abdominal muscles response during curl ups on stable and labile surfaces analyzing electromyographic signals. They showed that greater muscle activation and cocontraction of trunk flexor and extensor muscles were elicited if the curl up exercise was performed on the swiss ball.^{24,25}

Limitations

- The study lacked heterogenicity
- No long term effects of this study was monitored
- Small sample size
- Only males are taken in this study

CONCLUSION

The present study was done to find out the effectiveness of floor exercises versus swiss ball exercises on core muscle strength in elite cricketers. For this, 30 subjects were taken & divided in to two groups; floor exercise group received floor exercises and swiss ball group received swiss ball exercises. All the samples were assessed initially for base line values and after six weeks of intervention, the outcome measures i.e., peak torque of spinal flexors and extensors were assessed.

On comparing the mean differences in both the groups, swiss ball group had shown significant improvement in mean values of outcome measures than the swiss ball group after the intervention. Hence the present study conducted revealed that there is improvement in spinal muscle strength and torque of spinal flexors and extensors in elite cricketers, there by core training on swiss ball can be selected as the treatment of choice for the physiotherapist to effectively improve spinal muscle strength in elite cricketers.

REFERENCES

1. R. A. Stretch. The incidence and nature of injuries in first-league and provincial cricketers. *S Air Med J.* 1993; 83(5):339-42.

2. Stretch R.J. Injuries to South African cricketers playing at first-class level. *Spons Med* 1989; 4: 3-20.
3. Foster D, John D, Elliott B, AckJand T, Fitch K. Back injuries to fast bowlers in cricket: a prospective study. *Br J Spons Med.* 1989; 23(3): 150-154.
4. Crisp TA. Cricket injuries. *Spans Therapy* 1990; 1: 22-23.
5. Coleson HC, Armour WJ. *Spons Injuries and Their Trearmene*. London: Stanley Paul, 1975.
6. Stretch RA. The incidence and nature of injuries in club and provincial cricketers. *S Afr Med J.* 1993;83(5):339-41.
7. Stretch RA. Incidence and nature of epidemiological injuries to elite South African cricket players. *S Afr Med J.* 2001;91(4):336-9.
8. Stretch RA. Injuries to South African cricketers playing at first-class level. *Journal of the South African Sports Medicine Association.* 1989;4:3-20.
9. Stretch RA. The incidence and nature of injuries in schoolboy cricketers. *S Afr Med J.* 1995;85:1182-4.
10. Foster D, John D, Elliott B, et al. Back injuries to fast bowlers in cricket: a prospective study. *Br J Sports Med.* 1989;23(3):150-4
11. Krismer M, van Tulder M. Low back pain (non-specific). *Best Pract Res Clin Rheumatol.* 2007;21(1):77-91
12. Trainor TJ, Wiesel SW. Epidemiology of back pain in the athlete. *Clin Sports Med.* 2002;21(1):93-103
13. Nadler SF, Malanga GA, Bartoli LA, Feinberg JH, Prybicien M, Deprince M. Hip muscle imbalance and low back pain in athletes: influence of core strengthening. *Med Sci Sports Exerc.* 2002;34(1):9-16
14. Ong A, Anderson J, Roche J. A pilot study of the prevalence of lumbar disc degeneration in elite athletes with lower back pain at the Sydney 2000 Olympic Games. *Br J Sports Med.* 2003;37(3):263-266
15. Rungthip Puntumetakul. Effect of 10-week core stabilization exercise training and detraining on pain-related outcomes in patients with clinical lumbar instability. *Patient Prefer Adherence.* 2013;7:1189-99.
16. B W Koes, M W van Tulder, S Thomas. Diagnosis and treatment of low back pain. *BMJ.* 2006 ; 332(7555): 1430-1434.
17. Van Tulder M, Malmivaara A, Esmail R, Koes B. Exercise therapy for low back pain. A systematic review within the framework of the Cochrane Collaboration Back Review Group. *Spine* 2000;25(21):2784-96
18. NHS Centre for reviews and dissemination. Acute and chronic low back pain. *Effective Health Care.* 2000;Vol 6 No 5.
19. Waddell G, McIntosh A, Hutchinson A, Feder G, Lewis M. *Low Back Pain evidence Review.* London: Royal College of General Practitioners, 1999
20. Klaber Moffat J, Torgerson D, Bell-Dyer S et al. Randomised controlled trial of exercise for low back pain: clinical outcomes, costs and preferences. *BMJ.* 1999; 319:279-83
21. Faas A. Exercises: which ones are worth trying, for which patients, and when? *Spine.* 1996;21(24):2874-77
22. Van Tulder MW, Malmivaara A, Esmail R, Koes BW. Exercise therapy for low back pain. *Cochrane Database Syst Rev.* 2000;(2):CD000335.
23. William prentice: *Techniques in musculoskeletal rehabilitation.* 1st edition; 2001.
24. MCGILL, S.M. Low back stability: From formal description to issues for performance and rehabilitation. *Exere. Sport Sci. Rev.* 29(1):26-31. 2001.
25. Mggill, s.m., s. Grenier, n. kavcic, and j. cholewicki. Coordination of muscle activity to assure stability of the lumbar spine. *J. Electromyogr. Kinesiol.* 2003; 13(4):353-359.

Citation

K. Sai sudha, Dr. A. Viswanath reddy, & Dr. K. Madhavi. (2015). EFFECTIVENESS OF SWISS BALL VS FLOOR EXERCISES ON CORE MUSCLE STRENGTH IN ELITE CRICKETERS. *International Journal of Physiotherapy*, 2(5), 738-744.