



The effect of core stabilization training versus balance training on agility in young soccer players.

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ABSTRACT

Background

Balance training uses task-specific neural adaptations at the spinal and supraspinal levels. It suppresses spinal reflex excitability such as the muscle stretch reflex during postural tasks, which leads to less destabilizing movements and improved balance as required in sports during the activities such as running, jumping, changing direction. The core training improves agility due to better motor recruitment, better neural recruitment, or better neural adaptation. Due to enhanced core stability players are able to apply force more efficiently when running and jumping, generate more power when kicking a ball, and stand up better when being tackled.

Aim

To compare the effect of Core stabilization training and Balance training on agility in young soccer players.

Methods

In this comparative study, 30 young male soccer players who fulfilled the inclusion criteria were recruited from Nashik united sports academy. Subjects were then divided into two groups- Group A –Core Stabilization training and Group B – Balance Training. First of all, pre – agility tests were recorded in each subject. Then the training was given for next 6 weeks, thrice a week, 35 minutes/session. After 6 weeks, post-agility test was recorded.

Results

'p' values were found significant for paired t tests (<0.0005) and non-significant for unpaired t tests Hexagonal agility test (P value 0.3612), T- Agility test (P value 0.0614) and Pro – Agility Test (P value 0.0208).

Conclusion.

The study concluded that 6-week program of Core stabilization training and Balance training is equally effective in improving agility in young soccer players.

However, the pro-agility test data suggests core stabilization training is more effective than balance training in improving agility in young soccer players

Keywords: Agility, Balance, Core stabilization, Bosu ball.

INTRODUCTION

Soccer players are doing a lot of high-intensity movements such as jumps, and sudden change of directions which affect the score. In a soccer match, soccer players cover a distance of 9-12 km on average¹. Although these high speed runs constitute about 10-15% of the total distance covered, these activities usually involve movements during important positions that affect the score or with the aim of winning the

ball from the opponent team¹. The high-intensity changes of direction that take place within these activities are called agility skills¹.

Agility can be thought of as a systemic integration of neuromuscular coordination, reaction time, speed, strength, balance. Enhanced power, balance, speed, and coordination are some of the objectives of their agility training². In addition, agility includes explosive acceleration, deceleration, and maintaining postural control during the

sudden change of direction, gathering speed fast by reducing the decrease in running speed¹. In short, agility is defined as the ability to change direction quickly, maintaining balance without loss of speed¹.

Balance is maintenance of the body balance base of support fast and accurate with visual vestibular and somatosensory feedback and working of the neuromuscular system coordinately. Static balance is the ability to maintain a base of support with minimal movement¹. Dynamic balance is the regulation and statically maintenance of balance during performance or balance with minimal movements in unstable ground¹. Recently fitness training and injury prevention programs that incorporate spinal musculature training, including core strengthening and stability exercises have become popular because the core is considered to be the anatomic and functional centerpiece and the powerhouse of the body³

During performance of sports skill, a stable core provides a foundation upon which the muscles of the upper and lower extremities can accelerate body segments and transfer force between distal and proximal body segments. ³Core stability is defined as the ability to control motion of the lumbar spine and pelvis relative to an arbitrarily defined neutral position. It consists of static (endurance) and functional components³. The balance ability plays a crucial role and might be considered as an indicator of performance in soccer⁴. Because soccer is a bipedal stance (kicking a ball standing on one leg) required sport, soccer players demonstrate better static and dynamic balance ability than other players whose sport is required unipedal stance⁴. Balance ability is one of the most important parameters for soccer kicking performance⁴. Balance skill can be improved by training on stable or unstable grounds¹. BOSU ball is the first and foremost equipment in soccer training, functional balance training has been performed by using this equipment⁴. In soccer, the pro – agility test is very often used as a measure of agility. Thus, the purpose of this study was to determine the extent to which effectiveness of balance on agility performance in non-professional soccer players⁴.

BALANCE TRAINING⁴

Periodization									
Week	1			2			3		
Session	1	2	3	4	5	6	7	8	9
Training mode	FG	FG	FG	BBA	BBA	BBA	BBA+TA	BBA+TA	BBA+TA
Week	4			5			6		
Session	10	11	12	13	14	15	16	17	18
Training mode	B+TA+R SA	B+TA+R SA	B+TA+R SA	SBA+Ba PA					

Headings

The Effect of Core Stabilization Training versus Balance Training On Agility in Young Soccer Players.

Subheadings

The Effect of Core Stabilization Training versus Balance Training On Agility in Young Soccer Players.

Keywords: Agility, Balance, Core stabilization, Soccer

Total 30 soccer players participated in this study out of 30,15 players of Core stabilization training group (group A) and 15 players of Balance training group (group B); total 30 voluntarily participating players were taken. Full details of the study were provided to the players prior to their participation in the study and informed consent was obtained. Speed and skills of both balance and core stabilization training group were tested by-T agility, hexagonal agility and pro-agility tests prior to 6-week training of both balance and core stabilization training groups, pre-tests and post-tests were applied twice. Upon application of firsts tests, both groups will resume their programmed regular training. Balance and core stabilization training were given for 6 weeks 3 days a week; 35 minutes/session. A comparative study was done with convenient sampling; Samples were collected from Nashik United Sports Academy.

MATERIALS TO BE USED

Pen, Paper, Consent form, Inch tape, Stop watch, Yoga mat, Foam roller, Bosu ball, Cones, Soccer Ball

PROCEDURE

The subjects were selected on the basis of the inclusion and exclusion criteria. Voluntary participation by informed consent was taken. The balance and core stabilization of an individual was assessed by following pre-tests:

- Hexagonal agility test.
- Pro-agility test
- T-agility test.

Flat ground : FG ; Basic Bosu actions : BBA ; Transition actions : TA ; Reverse side adaptation : RSA ; Soccer ball action : SBA ; Bosu and progression actions : BaPA ;

Flat ground	Sets	Rep	Rest (sec)
Standing on one leg (each)	3	10	30
Keeping arm front	3	10	30
Keeping arm side	3	10	30
Keeping arm up	3	10	30
Keeping leg front	3	10	30
Keeping leg side (Right)	3	10	30
Keeping leg side (Left)	3	10	30
Lunge	3	10	30
Squat	3	10	30

Bosu Ball Action	Sets	Rep	Rest (sec)
Standing on one leg (each)	3	10	30
Keeping arm front	3	10	30
Keeping arm side	3	10	30
Keeping arm up	3	10	30
Keeping leg front	3	10	30
Keeping leg side (Right)	3	10	30
Keeping leg side (Left)	3	10	30
Lunge	3	10	30
Squat	3	10	30
Keeping arm in front and kicking	3	10	30

Bosu Ball Action + Transition Action + Reverse Side Adaptation	Sets	Rep	Rest (sec)
Moving to front side and standing on Bosu with both legs			
Header	3	10	30
Kicking with upside of the foot	3	10	30
Kicking with inside cut of the foot	3	10	30
Jumping on Bosu from the ground			
Header	3	10	30
Kicking with upside of the foot	3	10	30
Kicking with inside cut of the foot	3	10	30

Soccer Ball Action + Bosu + Progression Action	Sets	Time (sec)	Rest (sec)
On one leg			
Ankle movement (front and back)	3	30	30
Waiting on one leg	3	30	30
Ankle movement (side to side)	3	30	30
Reverse Arm Action (left and right, up and front)	3	10	30
Jumping and landing on each balance tool with each and both feet (front)	2	30	30
Jumping and landing on each balance tool with each and both feet (side)	2	30	30



Fig no. 1: Balance Training

- A. Standing on one leg with arms up
- B. Header on a Bosu Ball
- C. Standing on Bosu Ball with arms by the side
- D. Jumping and landing on both feet on Bosu (side)

CORE STABILIZATION TRAINING⁵ (WEEK 1, 2 AND 3)

Exercises	Sets	Time (sec)	Rest (sec)
Plank	2	15	60
Side plank	2	15	60
Crunch	2	15	60
Bird Dog	2	15	60
Shoulder bridge with roller	2	15	60
Ball abductor crunch	2	15	60
Squat	2	15	60
Lunge	2	15	60

In week 4, 5 and 6 same exercises were continued, 3 sets with 15 secs hold with 60 secs rest were performed.

DATA ANALYSIS

The collected data is analysed using GraphPad 9.1.2. Comparison is done between the pre and post intervention values within the groups for each outcome measure

(Hexagonal Agility Test, Pro – Agility Test and T-Agility Test) by using Paired t test. Post intervention values are compared between the two groups for all the three outcome measures using unpaired t test.

STATISTICAL ANALYSIS**Table no. 8 – baseline characteristics of group a and group b**

Sr. No.	Demographic Value	Group A N = 15	Group B N = 15
1.	Gender- Male	15	15

Table no. 9 – comparison of pre and post intervention mean scores of hexagonal agility test within group a and group b (paired t test)

Hexagonal Agility Test	Group A	Group B
Mean Pre – interventional Score	6.33	5.67
Mean Post – interventional Score	5.47	5.07
t value	3.3890	4.5826
p value	0.0044	0.0004
Results	Very statistically significant	Extremely statistically significant

Table no. 10 – comparison of pre and post intervention mean scores of pro-agility test within group a and group b (paired t test)

Pro - agility Test	Group A	Group B
Pre – interventional Score	6.47	6.60
Post – interventional Score	5.87	5.60
t value	4.5826	10.2470
p value	0.0004	< 0.0001
Results	Extremely statistically significant	Extremely statistically Significant

Table no. 11 – comparison of pre and post intervention mean scores of t - agility test within group a and group b (paired t test)

T-agility Test	Group A	Group B
Pre – interventional Score	13.33	13.20
Post – interventional Score	12.0	12.40
t value	5.7394	5.52
p value	<0.0001	<0.0001
Results	Extremely statistically significant	Extremely statistically Significant

Table no. 12 – comparison of mean difference scores of hexagonal agility test between group a and group b (unpaired t test)

Hexagonal Agility Test	Between Group A and Group B
Mean of Group A	0.6
Mean of Group B	0.8667
t value	-0.9282
p value	0.3612
Results	Statistically non-significant

Table no. 13 – comparison of mean difference scores of proagility test between group a and group b (unpaired t test)

Pro-agility Test	Between Group A and Group B
Mean of Group A	1.0

Mean of Group B	0.6
t value	-2.4495
p value	0.0208
Results	Statistically significant

Table no. 14 – comparison of mean difference scores of t-agility test between group a and group b (unpaired t test)

T – Agility Test	Between Group A and Group B
Mean of Group A	0.8011
Mean of Group B	1.3333
t value	-1.9485
p value	0.0614
Results	Statistically non-significant

RESULT

After comparing the results of pre and post intervention within the group using Paired t test the graph no. 1, 2, 3 shows the P value is <0.05 that is the core stabilization training and Balance training are extremely statistically significant in improving the Agility skill of the young soccer players. After comparing the results between two groups by using Unpaired t test for core stabilization training and Balance training, the graph no. 5 shows (Hexagon Agility test, P Value 0.3612 and T-Agility Test, P value 0.0614), implies that there is no significant difference between both the groups. So Core stabilization training and Balance training are equally effective in improving the Agility in young soccer players. Although the Pro-agility Test with P value - 0.0208 implies that core stabilization training was more effective than balance training in improving agility in young soccer players.

DISCUSSION

The primary objective of this study was to find out the effect of balance training versus core stabilization training on agility in young soccer players. Experimental groups A and B underwent 6 weeks of balance training and core stabilization training respectively.

Hexagonal agility test, Pro agility test and T-Agility test were used as outcome measures. Pre and post values of group A and group B agility tests were recorded for comparative purpose. Both groups underwent specific training respectively. The duration of training being; thrice a week for 6 weeks for 30 minutes. After a duration of 6 weeks, post values of performing agility test were recorded. The pre and post mean average values of both groups were recorded. The values concluded that balance training and core stabilization training are equally effective in improving agility in young soccer players.

Agility is the key requirement for optimal performance in many sports and one of the most discriminating factors among young soccer players (Oliver et al., 2013; Reilly et al., 2000).³ The peak rate of development of agility performance occurs at approximately the age of 13-14 years in male youths. These results are supported by previous reports among young males and aged 10-14 years (Pettersen and Mathisen, 2012; Jakovljevic et al., 2012; Mathisen and pettersen, 2015)³There was improvement in Agility due to balance training in our subjects as -Weineck (2004) declared

that the first pubertal age lasting from 12/13 to 14/15 years is a crucial period for improving balance and coordination ability in male adolescents.⁴The findings of our 14- years old soccer players imply that, when a different rate of postural maturation considered (Riach and Hayes, 1987; Nolan et al., 2005), the ability of static and dynamic balance could be improved by the end of first pubertal age. Therefore, the findings of the present study indicated that functional balance training has a positive impact on balance ability in soccer players.⁴The ability to change directions in Pro-agility test was found to be remarkable as described in many studies regarding balance training, where the mechanism was task-specific neural adaptations at the spinal and supraspinal levels. It may suppress spinal reflex excitability such as the muscle stretch reflex during postural tasks, which leads to less destabilizing movements and improved balance as required in sports during the activities such as running, jumping, changing direction. (Lloyd D.)¹⁵ Agility is a complex skill that involves coordination, joint mobility, reaction time, strength, balance and speed. It is thought that working these skills properly improves the agility performance. In various studies, it has been indicated that lower extremity exercise with proper balance training affects reaction time, proprioception, muscular activation in leg muscles and balance ability. Apart from these studies, it has been stated in some studies that balance exercises improve the reaction time.¹Studies on the balance trainings mechanism of action have shown that there is no change in muscle activation difference in agonist muscle as a result of balance training. It is seen from the studies that balance training helps in reducing spinal excitability in the mono – synaptic motor pathways by decreasing the h-reflex amplitude; so, an increase in power occurs as a result of adaptation in the motor pathways even if the structural alteration is not obtained in muscle. As a result of this study, it is thought that the increase in agility is caused by the effects of the equilibrium trainings on the maximal force generating mechanism¹It has been concluded that performing exercises on unstable surfaces enhances joint stabilization by increasing the synergy between muscles (Anderson, 2004).⁴Likewise in our study bosu ball was used as an unstable surface in order to improve balance and enhance agility in young soccer players.¹⁶This synergy facilitates neuromuscular ability, readiness and reaction, while unconscious proprioception regulated muscular function and triggered reflexive stabilization.¹⁷ Motor skills can be improved by core exercises. Improved core stability can translate into improved speed, balance and

agility. ³This is because players with enhanced core stability means are able to apply force more efficiently when running and jumping, generate more power when kicking a ball, and stand up better when being tackled. The age span 12-15 years is characterized as the second phase of running speed development. (Rowland, 2005; Reilly et al., 2000). ³The improvement in sprint performance is related to the maturation of the neural system and improved muscle/neural coordination. ³The core training improved agility because of better motor recruitment, better neural recruitment, or better neural adaptation. Improved agility is beneficial to players in certain games, especially soccer which require quick movements and sudden changes in direction and position. A study used t test to measure agility and reported a positive correlation between core stability and athletic performance. (Shalrock et al) Studies have also discovered a moderate co-relation between core stability and agility along with other several sports-specific performance measures. (Nesser et al) As examined the researchers related to core training, a study by Nesser et al. (2008), which investigates the relations among core stability, strength, and power of the 1. League American soccer players, shows that there are some significant correlations among Pro-agility, power clean test values, and core stability values. ³Each agility test may have unique skill requirements. This has lead speculation that some agility test correlates strongly. Given the conflicting results of researches, it would seem difficult to get at a conclusive result on how straight sprint affects change of direction ability, and which agility test is most convenient in soccer players. ¹

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Skilled exercise results in synaptogenesis in the motor cortex and cerebellum, whereas unskilled motor movements training demonstrate no ability to change the number of synapses in these regions ¹⁸. Open-skill exercises are those that require an individual to react in a dynamic way to a changing, unpredictable environment (e.g., kicking a ball in soccer). Exercises such as walking and running would be considered “closed-skill” exercises as the environment is relatively stable, predictable, and self-paced. However, agility results post core stabilisation training was higher than the pre core stabilisation training, suggesting a relationship between core strength and agility. ¹⁸According to our study, core stabilization training was more effective than balance training in improving agility in young soccer players, as observed in t values of pro-agility test. Whereas, the hexagon agility test and t-agility test implies that core stabilization training and balance training are equally effective in improving agility in young soccer players. Limitations in our study were, sample size was less, players were non – professional, physical activity parameters were not screened of the players on a regular basis, relatively short intervention period of 6 weeks.

CONCLUSION

The study concludes that 6-week program of Core stabilization training and Balance training is equally effective in improving agility in young soccer players. However, agility results post core stabilisation training was higher than the pre core stabilisation training, suggesting a relationship between core strength and agility.

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