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Research Article

A Comparative Study of Sports-specific Balance Training versus Plyometric Balance Training

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A B S T R A C T

Introduction: Football is a sport that involves running as the foremost part in which the lower limb plays a vital role in participation. Balance training is vital to athletic performance and should be integrated into an athlete's daily training. Plyometric represents the performance of stretch-shortening cycle (SSC) activities that involve a high-intensity eccentric contraction straightaway after a rapid and powerful concentric contraction.

Method: It is an experimental study with 30 college male football players in the age group of 18-25 years. Based on inclusion and exclusion criteria, they were divided into 2 groups. Group A consisted of 15 individuals who were trained with sports-specific balance training programmes. Group B consisted of 15 individuals who were trained with plyometric balance training. The individuals were trained for 4 weeks with 3 sessions per week (12 sessions). The pre-test and post-test measurements were measured using the triple hop test, stork balance test, and modified star excursion balance test (MSEBT).

Results: Pre-test and post-test results of both groups were compared. The results showed a highly significant difference in mean values at $p \leq 0.001$.

Conclusion: 4 weeks of sports-specific balance training and plyometric balance training showed significant improvement in lower limb muscle strength in collegiate football players.

Keywords: Football Players, Triple Hop Test, Stork Balance Test, Modified Star Excursion Balance Test (MSEBT), Plyometric Balance Training, Sports Specific Balance Training

Introduction

Football is a sport that includes running as a major part; lower limbs play a vital role in football participation. Sport offers many benefits such as improvement in physical and psychological health. The ankle helps in bearing weight and in the adjustment of lower limb movements while exercising and walking,[1] which are essential in daily

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living. Numerous findings have noted that sports that are essential to sudden stop cutting activities,[2] such as soccer, produce the highest percentage of injuries and cause significant time loss from sports participation but they can also cause long-term disability.[3] Ankle sprains are the most frequent musculoskeletal injuries that occur among athletes and physically active people.[4] Neuromotor impairment, an after effect of IAS, is a major factor resulting in the observed injury rates (75%-85%) of ankle injuries such as chronic ankle instability (CAI). Generally, ankle injury and sprain indicate the stretch/ tear of the lateral ligament complex of the ankle joint including the posterior talofibular ligament, calcaneofibular ligament, and anterior talofibular ligament[5] as a consequence of an unanticipated/ unprovoked plantar flexion, supination, as well as inversion movement of fixed foot coupled with external rotation of the tibia.[6] Postural control, which is reduced due to impaired proprioception and neuromotor control caused by chronic ankle instability (CAI), is essential for good performance in sports.[7] Proprioception is a somatosensory afferent involving kinaesthesia as well as joint position sense.[8] Traditional/ dynamic balance training of 4 weeks, in spite of its controversial nature, has proven its efficacy in the improvement of static and dynamic postural control, and self-reported function, in recreational athletes and physically active individuals.

Balance, which is defined as the capability of maintaining the body's centre of gravity within its base of support,[9] is categorised as static and dynamic. The lower body plyometric involves the performance of numerous kinds of bodyweight jumping type exercises identical to drop jumps (DJ),[10] Countermovement Jump (CMJ), alternate leg bounding, hopping, and additional SSC jumping exercises. Sports such as soccer include numerous bursts of 4 explosive activities,[11] using triple hop test,[12] stork balance test,[13], modified star excursion balance test (MSEBT),[14] plyometric balance training, and sports specific balance training.[15]

Methodology

An experimental study was prepared to compare the effectiveness of sport-specific balance training and plyometric balance training in preventing ankle joint injuries in collegiate football players.

Study Type: Comparative (pre and post).

Sample Size: 30 subjects.

Sampling Method: The sampling technique used was simple random sampling. Numbers 1 to 30 were printed on cards. If the drawn card contained an odd number, the subject was assigned to Group A - sports specific balance training, and if the drawn card had an even number, the subject was assigned to Group B - plyometric balance training.

Study Duration: Four weeks (12 sessions).

Inclusion Criteria

- Collegiate male football players
- Age group between 18 and 25 years
- Offseason players
- Players who were not being trained in any specific lower limb strength training protocol

Exclusion Criteria

- Fracture in recent past
- Injury in the lower extremity or back
- Hypermobility of joints
- Acute inflammation

Outcome Measures

- Stork balance test
- Modified star excursion balance test (MSEBT)
- Triple hop test

Procedure

Informed consent was obtained from the 30 athletes who were selected for the study. The study was described to them. They were divided into 2 groups: Group A consisted of 15 individuals who were trained by sports specific balance training and Group B consisted of 15 individuals who were trained by plyometric balance training. The procedure for the training has been shown in Tables 1 and 2.

Table 1.Sports Specific Balance Training

Weeks	Surface	Procedure	Exercises
Week 1	Workout on floor	Eye open and closed	Standing on a single leg
			Standing on a single leg with the other leg swinging
			Standing on a single leg with squat up and down
			Standing in tandem stance
		Eyes open	Standing on single leg and tandem stance with power dribbling

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			Standing on single leg and tandem stance
			passing a tennis ball
			Standing on a single leg with a basketball on the backboard
Week 2	Workout on floor	Eyes open & closed	Standing on a single leg with raised ankle
	Workout on air cushion	Eyes open & closed	Standing on a single leg
			Standing on a single leg with the other leg swinging
			Tandem stand
		Eyes open	Standing on single leg and tandem stand with overhead passing
			Standing on single leg and tandem stand along with power dribbling
		Techniques of jumping and landing	Jumping from 2 feet to 2 feet alternate landing with a football on backboard
			Jumping from 2 feet to 1 foot alternate landing with a football on the backboard
Week 3	Workout on air cushion	Eyes open & closed	Standing on a single leg
			Jumping to hopping with landing on a single leg and switching the landing leg every time
		Techniques of jumping and landing	Jumping and landing from 2 feet to 1 foot with partner throwing the ball
			Jumping and landing from 2 feet to 2 feet with a 180 degrees body twist with the ball being passed by the coach
Week 4	Workout on air cushion	Eyes open and close	Standing on a single leg with disturbance
			Tandem stand with disturbance
			Standing on a single leg with power dribbling
	Techniques of jumping and landing		Jumping to hopping with landing on a single leg and changing the leg every time
			Jumping to landing to catch a high-held football
			Rebounding exercises on both legs and standing on a single leg with disturbance

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Table 2.Plyometric Balance Training

Workout	Week 1	Week 2	Week 3	Week 4
Jump in a counter-movement	1 × 8	2 × 10	2 × 12	2 × 15
Jump on a line (standing distance jump)	1 × 8	2 × 10	2 × 12	2 × 15
Drop jump with one step	1 × 8	2 × 10	2 × 12	2 × 15
Cone hops front to back	1 × 8	2 × 10	2 × 12	2 × 15
Jump push-off in lateral box	1 × 8	2 × 10	2 × 12	2 × 15
Jump in one leg distance + one step	1 × 8	2 × 10	2 × 12	2 × 15
Cone jumps front to back on a single leg	1 × 8	2 × 10	2 × 12	2 × 15
Cone jumps side to side on a single leg	1 × 8	2 × 10	2 × 12	2 × 15
Box push-off on single leg	1 × 8	2 × 10	2 × 12	2 × 15

Group A subjects underwent sports specific balance training programme for 4 weeks, each week consisted of 3 sessions and each session lasted for an hour. Group B subjects underwent a plyometric balance training programme for 4 weeks, each week consisting of 3 sessions. Week 1 consisted of 8 repetitions per set, week 2 consisted of 10 repetitions per set, week 3 consisted of 12 repetitions per set, and week 4 consisted of 15 repetitions per set.

Results

Table 3 shows the pre-test and post-test values of Group A and Group B for stork balance stand test. The results revealed no significant difference in pre-test values between Group A and Group B ($p > 0.05$) and a statistically significant difference in post-test values between Group A and Group B ($p \leq 0.05$).

Table 4 shows the pre-test and post-test values of Group A and Group B for triple hop test. The results revealed no significant difference in pre-test values between Group A and Group B ($p > 0.05$) and a statistically significant difference in post-test values between Group A and Group B ($p \leq 0.05$).

Table 5 shows the pre-test and post-test values of dependent variables of Group A and Group B for triple hop test. It reveals a statistically highly significant difference between the pre-test and post-test values within Group A ($p \leq 0.001$).

On comparing the mean values of Group A and Group B regarding the modified star excursion balance test in terms of dynamic balance, both groups showed a significant increase in the post-test mean values, but Group B showed a better performance with a higher mean value (anterior - 69.18 cm, posteromedial - 97.09 cm, and posterolateral - 89.02 cm) than Group A (anterior - 66.44 cm, posteromedial - 92.77 cm, and posterolateral - 84.90 cm) at $p \leq 0.05$.

Table 3.Comparison of Stork Balance Stand Test between Group A and Group B in Pre and Post-test

#SBST (seconds)	#GROUP A		#GROUP B		t-test	df	Significance
	Mean	SD	Mean	SD			
Pre-test	31.26	3.78	31.20	2.80	0.055	28	0.957*
Post-test	37.06	3.71	40.13	3.22	-2.41	28	0.023**

#Refers to categories, *p > 0.05, **p ≤ 0.05

Table 4.Comparison of Triple Hop Test between Group A and Group B in Pre and Post-Test

#Group A		#Group B		t-test	df	Significance
Mean	SD	Mean	SD			
280.13	4.89	280.53	4.82	-0.225	28	0.823*
298.00	6.57	305.80	8.59	-2.79	28	0.009**

#Refers to categories, *p > 0.05, **p ≤ 0.05

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Table 5.Comparison of Pre and Post-test Values of Dependent Variables within Group A

#Group A	Pre-test		Post-test		t-test	Significance
	Mean	SD	Mean	SD		
MSEBT anterior	63.32	1.80	66.44	1.66	-20.17	0.000***
MSEBT posteromedial	89.25	3.35	92.77	2.64	-7.90	0.000***
MSEBT posterolateral	81.08	2.02	84.90	1.81	-11.82	0.000***
Stock balance test	31.26	3.78	37.06	3.71	-22.14	0.000***
Triple hop test	280.13	4.89	298.00	6.57	-17.87	0.000***

#Refers to categories, *p > 0.05, **p ≤ 0.05

On comparing the mean values of Group A and Group B regarding the stork balance stand test in terms of static balance, both groups showed a significant increase in the post-test mean values, with Group B having a higher mean value (40.13 sec) and hence demonstrating better performance than Group A (37.06 sec) at p ≤ 0.05.

A comparison of the mean values of Group A and Group B regarding the triple hop test in terms of lower limb strength showed a significant increase in the post-test mean values in both groups, with Group B having a higher mean value (305.80) than Group A (298.00) at p ≤ 0.05.

Hence the results showed a highly significant difference in mean values at p ≤ 0.001.

Discussion

The main objective of this study is to compare the effectiveness of sports specific balance training and plyometric balance training to prevent ankle injuries in collegiate football players. Hale SA et al. reported that balance training showed improvement in balance among the players who had a history of ankle injury or functional ankle instability.[16] Surakhamhaeng A et al. reported that plyometric training provided benefits in both static and dynamic balance.[17]

Comparison of Balance Variables within the Sports Specific Balance Training

Specific balance training could improve the dynamic balance in anterior, posteromedial and posterolateral directions after 4 weeks of training; each week consisting of 3 sessions and each session lasting for an hour, whereas, the other variables could be less improved. This shows that most types of balance training emphasised the dynamic movement rather than the static balance.

Comparison of Balance Variables within the Plyometric Training Group

After 4 weeks of training, the plyometric group showed more improvement. The development of static balance control in both anteroposterior and mediolateral directions may be influenced by plyometric training which mainly includes jumping and moving in multiple directions.

All 30 participants underwent three tests namely the triple hop test (muscle strength), stork test (static balance), and modified star excursion balance test (dynamic balance). On comparing the mean values of Group A and Group B regarding the modified star excursion balance test in terms of dynamic balance, both groups showed a significant increase in the post-test mean values, but Group B showed a better performance with a higher mean value (anterior - 69.18 cm) than Group A (anterior - 66.44 cm, posteromedial - 92.77 cm, and posterolateral - 84.90 cm) at p ≤ 0.05. On comparing the mean values of Group A and Group B regarding the stork balance test in terms of static balance, both groups showed a significant increase in the post-test mean values, Group B having a higher mean value (40.13 sec) and hence demonstrating better performance than Group A (37.06) at p ≤ 0.05. On comparing the mean values of Group A and Group B regarding the triple hop test in terms of lower limb muscle strength, Group A showed a significant increase in the post-test with a higher mean value (305.80) than Group B (298.00) at p ≤ 0.05.

On comparing pre-test and post-test values between Group A and Group B, a highly significant difference was found in mean values at p ≤ 0.001. The results showed an improvement in proprioception balance in subjects of both groups indicating that both training protocols were effective. On intergroup analysis, the p-value was found to be highly significant in the plyometric training (Group B) when compared to specific balance training (Group A), indicating that plyometric balance training was more effective than specific balance training.

Limitations

The study was performed only in the age group of 18-25 years. It was done with smaller samples and was limited to muscle strength variations. Only collegiate football players were selected for the study.

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Conclusion

This study concludes that 4 weeks of sports-specific balance training and plyometric balance training showed significant improvement in lower limb muscle strength in collegiate football players. Balance training is effective in reducing musculoskeletal injuries among athletes. Our prime recommendation is that both athletes and trainers should add balance training in their training protocol to increase athletic performance and prevent injuries. Plyometric balance training improved the static, dynamic, and muscular strength promoting balance which prevents ankle joint injuries among collegiate football players. Understanding the effectiveness of plyometric balance training when compared to sports specific balance training, this study concludes that due to better performance in-game and early recovery in case of ankle joint injuries, the plyometric balance training programme is more useful for sports players.

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Conflict of Interest: None

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