ejpmr, 2021,8(2), 360-365

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

EFFECTS OF PLYOMETRIC TRAINING AND PROPRIOCEPTIVE TRAINING TO IMPROVE SPRINT SPEED AMONG THE COMPETITIVE SPRINTERS

***S. Karthikeyan, N. Mohamed Ishaq and P. Senthil Selvam**

School of Physiotherapy, Vels Institute of Science, Technology and Advanced Studies.

***Corresponding Author: S. Karthikeyan**

School of Physiotherapy, Vels Institute of Science, Technology and Advanced Studies.

Article Received on 30/11/2020 **Article Revised on 20/12/2020** **Article Accepted on 10/01/2021**

ABSTRACT

Background: Sprint is a run at maximum speed over a short distance in which athletes try to run throughout the entire distance. Plyometric is a training technique used by athletes in all types of sports to increase strength and explosiveness. Proprioceptive capabilities have great impacts on sports performance. During sports activities, performance development and decrease in risks of being injured depend on athletes because most of sports activities are performed in a high speed. The 40-yd sprint has become the most widely used method for evaluating sprint speed among athletes in various sports. **Methodology:** There were 30 athletes taken for the study in which they were divided into two groups. The group A received Plyometric training and group B received Proprioceptive training. The pre and post test values were taken in the duration of 6 weeks using 40-yard test. **Results:** The results of these study show that there will be significant improvement in group A [plyometric training] compare to group B [proprioceptive training] sprinters as measured by 40-yard test. **Conclusion:** The study concluded that Plyometric training can significantly improve sprint speed in competitive sprinters. The statistical analysis on mean and standard deviation has been done by paired t test.

KEYWORDS: Plyometric training, Proprioceptive training, Sprinters, BOSU ball, Swiss ball.

INTRODUCTION

Sprint is a run which can be performed in short distances in which athletes try to run at their maximum speed throughout the entire distance. Sprint performance can be considered to contain 3 independent components: Drive in i.e., acceleration, transition and top speed. Sprinting is influenced by neuromuscular function because of its complexity and many different muscles must be activated at the appropriate times with intensities to maximize speed.

The term plyometric is actually a derivation from the Greek words 'plythein, or 'plyo' means to increase and metric means to measure. Consequently, the purpose of plyometrics may be thought of as "to increase the measurement." Typically, the measurement is sports performance outcomes demonstrated in testing or competition such as throwing, serving velocity, jump height or sprint speed.

Plyometric exercises constitute a natural part of most sport movements because they involve jumping, hopping and skipping (i.e., such as high jumping, throwing or kicking). Sprint running contributes in varying degrees to successful performance in many sports. A variety of training regimes are commonly used to improve sprinting performance, including sprint drills, over speed training, sprinting against resistance, weight training and Plyometric. Plyometric training improves sprint performance. Plyometric is a type of training that develops the ability of muscles to produce force at high speeds (produce power) in dynamic movements.

This training techniques are used by athletes in all types of sports to increase strength and explosiveness. It is a form of explosive strength training that uses explosive movements to develop muscular power, which is the ability to generate a large amount of force quickly. Plyometric exercises involve a rapid eccentric movement, followed by a short amortization phase, which is then followed by an explosive concentric movement. The stored elastic energy within the muscle is used to produce more force than can be provided by a concentric action alone.

The identifying feature of plyometric exercise is a lengthening (eccentric contraction) of the muscle-tendon unit followed directly by a shortening or concentric contraction, otherwise termed a stretch-shortening cycle (SSC). The synergistic muscles engage in the myotatic-stretch reflex during the stretch-shortening cycle. This cycle enhances the ability of the muscle-tendon unit to produce maximal force in the shortest amount of time.

This rapid deceleration-acceleration produces an explosive reaction that increases both speed and power

of the limb during athletic activities. This explosive reaction facilitates the production of maximal force in the shortest amount of time.

Explosive strength training may involve body weight jumping type exercises also called plyometric exercises, commonly used to increase explosive strength by means of the stretch-shortening cycle. This type of training is a highly effective neuromuscular stimulus with the advantage of requiring reduced physical space, time and equipment to complete the training sessions.

Plyometric training involves exercises in which the active muscles are stretched prior to its shortening. Plyometric exercises can be done with or without external load and both are increase power, jumping height, and sprint performance.

Plyometric training can enhance explosive contractions in both pre pubertal and pubertal populations. Such a regimen is a natural preparation for many sports, with its emphasis on jumping, throwing, hopping, and skipping, and it is particularly appropriate in runners, where there is a need to develop explosive movements, such as sprint departure, sprint acceleration, and maximal running velocity. Such contractions are often made during the different phases of running.

Proprioception is defined as "the reception of stimuli produced within the organism," whereas balance is defined as "physical equilibrium". It is important to understand the difference because many balance activities will train proprioceptive pathways. Therefore, balance is the ability to remain in an upright position, whereas proprioception is a neurologic process. This process encompasses both peripheral nervous system receptors and central nervous system integration to produce an awareness of one's surroundings.

Proprioceptive capabilities have great impacts on sports performance. During sports activities, performance development and decrease in risks of being injured depend on athletes because most of sports activities are performed in a high speed. Good proprioception is important for promoting dynamic joint and functional stability in sports (standing, walking and running) and in daily activities living. The ankle plays an integral role in maintaining balance.

Speed in athletics is particularly influenced by the amplitude and frequency of all body movements. To improve both parameters, training must include muscle contractions at maximum intensity, correct biomechanical movements, and good stability in order to focus and maximize strength in movements. In response to the stability factor, it has been shown that in unstable conditions force is considerably decreased, due to the fact that an accurate and precise contraction requires that the nervous system receives adequate information about the location and position from receptors in muscles, ligaments, joints, and skin. This is called proprioception and helps perceiving conscious and unconscious sensations of muscle sense, postural balance and joint stability. Athletes with continued fatigue and disturbances that alter the proprioceptive system by sending distorted proprioceptive information suffer biomechanical alterations and lose movement efficiency.

Proprioception has been considered an irreplaceable tool in the rehabilitation of muscle injuries. Restoring neuromuscular control after a muscle injury by means of proprioceptive exercises performance is based on the fact that the ligaments have proprioceptors and any damage on these structures would change the afferent information, requiring a neurological restoration to obtain a complete recovery. If there is no complete restoration and the sense of proprioception is damaged, it provides wrong information to the central nervous system, which cannot be managed, producing uncontrolled and fast body movements. This situation increases the risk of injury and affects the stability of the subject. The effect of a sprinter-specific proprioceptive training program with unstable platforms, using the Swiss ball and BOSU as maintaining tools on postural stability and sprinters gravity centre control.

METHODS

This is an experimental study with comparative type. The samples were taken on convenient sampling who fulfilled the inclusion criteria. The study includes 30 samples who were taken from the School of physiotherapy, VISTAS Thalambur. The male sprinters were included with age 18-25 years. Informed consent obtained from the participants and they were divided into Group A [(n=15) Plyometric training] and Group B [(n=15) Proprioceptive training]. 40 Yard test (36.5 m) will be done pre-test (before) and post-test (after) training. Duration of the training period is 6 weeks. Group A three times a week for 6 weeks and Group B three times a week for 6 weeks training session takes approximately 30 minutes.

All the training sessions were preceded by a 15 minutes warm up including submaximal running, dynamic stretching, low intensity forward, sideways, backward running several acceleration run, jumping at a progressively increased intensity, range of mobility exercises that provides activation of lower limb musculature.

The test required running 40 Yard at maximum speed on the track. Participants were instructed to run at maximal effort throughout the full distance of the sprint. All the athletes have 2 trails with at least 5 minutes of run between them. The time was recorded using stop watch. Best sprint time was used for statistical analysis.

Group A (Plyometric Training).

WEEKS	EXERCISE	REPETITION
WEEK 1	Vertical jump Alternate leg bounding Split Squat Jump Double leg tuck jump Single leg hop Single leg speed hop	5 8 5/5 5 8 8
WEEK 2	Vertical Jump Alternate leg bounding Split Squat Jump Double leg tuck jump Single leg hop Single leg speed hop	8 10 8/8 10 10 10
WEEK 3	Vertical Jump Alternate leg bounding Split Squat Jump Double Leg tuck jump Single leg hop Single leg speed hop	10 16 10/10 15 16 16
WEEK 4	Vertical Jump Alternate leg bounding Split squat jump Double leg tuck jump Single leg hop Single leg speed hop	12 20 15/15 20 20 20
WEEK 5	Vertical Jump Alternate leg bounding Split squat jump Double leg tuck jump Single leg hop Single leg speed hop	15 24 20/20 25 25 25
WEEK 6	Vertical jump Alternate leg bounding Split squat jump Double leg tuck jump Single leg hop Single leg speed hop	15 30 20/20 25 25 25

Group B (Proprioceptive Training).

INITIAL PHASE FIRST 3 WEEKS	**FINAL PHASE** LAST 3 WEEKS
Position: standing on the bosu ball on a single limb support Each limb into flexion – extension 30^0	Position: standing on the bosu ball on a single limb support but with added weights – 2 kg and gradually increase to 1.5 kg per week Each limb into flexion – extension 30^0
Position: single limb support in bosu ball with Swiss ball on the wall performing hip flexion – extension along with shoulder flexion – extension Repetitions: 10	Position: single limb support in bosu ball with Swiss ball on the wall performing hip flexion – extension along with shoulder flexion – extension Here the weight is added 2kg and gradually increase 1.5 kg per week Repetitions: 10
Position: one leg on the swiss ball and one leg on the bosu ball performing alternate flexion – extension 30^0 each limb	Position: one leg on the swiss ball and one leg on the bosu ball performing alternate flexion – extension with 2 kg weight added The movement can be repeated by increasing 1.5 kg per week gradually 30^0 each limb

Position: prone – upper limb supported on bosu ball and lower extremity on the Swiss ball The cycling movement can be performed in free leg alternatively Repetitions: 10	Position: prone – upper limb supported on bosu ball and lower extremity on the swiss ball The cycling movement can be performed in free leg alternatively Repetitions: 10
Position: sinlge limb support on the bosu ball with free leg performing hip flexion, knee flexion and ankle dorsiflexion Repeat the same on the opposite leg Repetitions: 10	Position: single limb support on the bosu ball with free leg performing hip flexion, knee flexion and ankle dorsiflexion – 2 kg on hand 1.5 kg increase per week and 3 kg on the ankle Repeat the same on the opposite leg Repetitions: 10

Data Analysis

Statistical analysis was performed by using IBM SPSS software for windows version 25. The results were calculated using paired t test. Paired t test is used in the analysis of pretest and posttest values of both the groups and the Independent t test is used in the analysis of post session values of the groups.

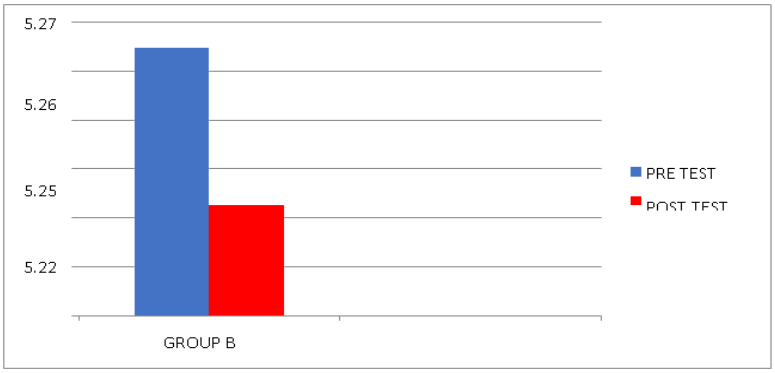
Table 1: Comparison Of Pre-Test And Post Test Value Of 40 Yard Test In Group A.

GROUP A	N	MEAN	STANDARD DEVIATION	't' VALUE	'p' VALUE
40 YARD TEST PRE TREATMENT	15	5.2967	0.11172	9.979	0.000
40 YARD TEST POST TREATMENT	15	5.1893	0.13588		

Graph 1:

Table 2: Comparison Of Pre-Test And Post -Test Values Of 40 Yard Test In Group B.

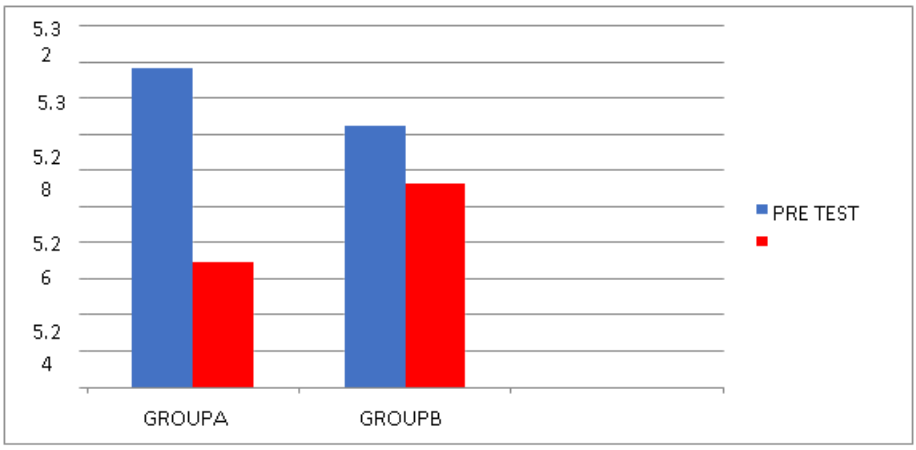
GROUP B	N	MEAN	STANDARD DEVIATION	't' VALUE	'p' VALUE
40 YARD TEST PRE TREATMENT	15	5.2647	0.15123	16.000	0.000
40 YARD TEST POST TREATMENT	15	5.2327	0.14983		



Graph 2:

Table 3: Comparison Of Pre-Test And Post Test Value Of 40- Yard Test In Group A And Group B.

40 YARD TEST	N	MEAN		STANDARD DEVIATION		't' VALUE	'p' VALUE
		PRE TEST	POST TEST	PRE TEST	PRE TEST		
GROUP A	15	5.2967	5.1893	`0.11172	0.13588	9.979	<0.0001
GROUP B	15	5.2647	5.2327	0.15123	0.14983	16.000	<0.0001



Graph 3

RESULTS

The results of the present study with the mean and standard deviation in which the post mean value of Group A (5.1893) and Group B (5.2327). The result shows highly significant difference ($p < 0.0001$) for Group A which is comparatively better than Group B. Both the groups were statistically significant but Group A is highly significant from the analysis. Thus the present study shows significant improvement in Group A compare to Group B with the (value of p less than 0.0001

DISCUSSION

The aim of the present study was to compare the effect of Plyometric training and Proprioceptive training on improving sprint performance among the sprinters. This study proved the efficacy of Plyometric training improved Sprint performance among Sprinters. The samples in the study among the sprinters was evaluated with 40 yard test. Plyometric exercise that designed to enhance muscles mainly through the jump training.

Plyometric training can be safe and effective can improve muscular strength and power and vertical jump height, rebound jump height, running speed, agility and balance.

Proprioceptive training influence on the neuromuscular system due to the initiation of the generated force i.e. an improvement of explosive strength and neuromuscular activation at the start of a voluntary muscle activity.

According to the result in the present study, both the groups are significantly improved thus showed minimum difference in the Group A values than Group B values. Group A (5.1893) and Group B (5.2327).

Eduardo Saez de Villarreal et al., 2016 analyzed the effect of Plyometric training on sprint performance and concluded that when Plyometric exercise intensity is high during the session, that there is greater improvement in sprint performance. Sanga Simek Salaj et al, 2007 examined the effects of Proprioceptive training on jumping and agility performance and concluded that the improvement of Proprioception can have a positive impact on neural activation excitation of the motor neural system especially concerning the stretch shortening cycle. The identifying feature of Plyometric exercise is a lengthening (eccentric contraction) muscle tendon unit followed directly by a shortening concentric contraction. The Stretch Shortening Cycle is integral to Plyometric exercise because it enhances the ability of the muscle tendon unit to produce maximal force in the short amount of time. Hence it is concluded that Plyometric exercise group showed better improvement in sprint performance than Proprioceptive exercise group. Group A [Plyometric Training] shows statistically significant improvement comparing to Group B [Proprioceptive Training]. The present study shows that incorporating both Group A and B clinically significant but statistically Group A participants trained with Plyometric Training mild more significant than Group B participants trained with Proprioceptive Training.

CONCLUSION

The study concluded that Plyometric training can significantly improve the sprint performance in sprinters. However, who received group A participants treated with Plyometric training had a better improvement in sprint performance when compared with group B participants treated with Proprioceptive training

REFFERENCE

1. Raanaalikhani, Shahnaz Shahrejerdi “the effect of a 6-week plyometric training on dynamic balance and knee proprioception in female badminton players” Journal of Canadian chiropractic Association, 2019; 63(3): 144-153.
2. Danny Lum, Frankie Fan “effects of intermittent sprint and plyometric training on endurance running performance” Journals of Sports and health science, Aug 2019; 8: 471-478.
3. Naveed Ashraf, Ismat Ullah “effects of plyometric training program on speed and agility in young cricketers”. T. Rehabili.J., June 2019; 03(01): 85-89.
4. Gregory C. Bogdanis, Olyvia Donti “effect of plyometric training on jumping, sprinting and change of direction speed in child female athletes” Sports, May 2019; 7: 116.

5. Raouf Hammami, Urs Granacher "sequencing effects of balance and plyometric training on physical performance in youth soccer athletes" Journal of Strength Cond Res, Dec 2016; 30(12): 3278-3269.
6. Cengiz Taskin "the effects of an 8 weeks proprioception training program on agility, quickness and acceleration" Turkish journal of sports and exercise, 2015; 17(2): 26-30.
7. George Danies, Bryan L. Riemann "current concepts of plyometric exercise- clinical commentary" The International Journal of Sports Physical Therapy, Nov 2015; 10(6): 760.
8. Rodrigo Ramirez Campillo, Francisco Gallardo "effects of vertical, horizontal and combined plyometric training on explosive, balance and endurance performance in young soccer players" J Strength Cond Res., July 2015; 29(7): 1784-1795.
9. J. Bryan Mann, Pat J. William F. Brechueet "validity and reliability of hand and electronic timing for 40-yard sprint in college football players". J Strength Cond Res., June 2015; 29(6): 1509-1514.
10. Nurper Ozbar, Seda Atos "the effect of 8 weeks plyometric training on leg power,jump and sprint performance in female soccer players" J Strength Cond Res., Oct 2014; 28(10): 2888-2894.
11. Anis Chaouachi, Aymen Ben Othman "the combination of plyometric and balance training to improve sprint and shuttle run performances more often than plyometric- only training with children". J Strength Cond Res., Feb 2014; 28(2): 401-412.
12. Antonio Martinez- Amat "effects of 12 weeks proprioception training programe on postural stability, gait and balance in older adults: a controlled clinical trial J Strength Cond Res., Aug 2013; 27(8): 2180-2188.
13. Harvey W Wallmann "the acute effects of various types of stretching static, dynamic, ballistic and no stretch of the iliopsoas on 40-yard sprint times in recreation runners" The International Journal of Sports Physical Therapy Oct2012; 7(5): 540-547.
14. Natalia Romero-Fanco, Emilo Martivez-lopez "effects of proprioceptive training program on core stability and center of gravity control in sprinters". J Strength Cond Res., Aug 2012; 26(8): 2071-2077.
15. Salvi Shah et al, "PLYOMETRIC EXERCISES" International journal of health sciences and research ISSN 2249-9571. April 2012; 2(11): 115-120.
16. Jamie M. Highton, Craig Twist "the effects of exercise – induced muscle damage on agility and sprint running performance" Journal of Exercise and science & fitness 2009; 7(1): 24-30.
17. Bent R. Ronnestad, Nils H. Kvamme "short term effects of strength and plyometric training on sprint and jump performance in professional soccer players" Journal of Strength Cond Res., 2008; 22(3): 773-780.
18. Michael G. Miller, Jeremy J. Herniman "the effects of a 6-week plyometric training program on agility" Journals of Sports Science and Medicine-5; 2006; 459-465.
19. Mallion P "proprioceptive training (balance exercise) reduces lower extremity injuries in young soccer players" Journal of Back and Musculoskeletal Rehabilitation Dec 2004; 17(3-4): 101-104.
20. William J Hanney "proprioceptive training for ankle instability" Strength and conditioning Journal, Oct 2000.