Effects of Plyometric Training on Selected Motor Components in Semi-Professional Kabaddi Players – A Randomised Control Study

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Abstract

Background: In Kabaddi, players requirequick reflexes, dynamic balance, agility, neuromuscular coordination and individual proficiency.Plyometric exercises wereutilized to enhance sportsperformance by eliciting numerous positive changes in neural and musculoskeletal system of healthyplayers. The purpose of this study was to evaluate the effects of Plyometric training on selected motor components in semi-professional Kabaddi players.

Methods: 30semi-professional Kabaddi players with an age range of 12-20 years were assigned randomly as Group A performed plyometric training and Group B did their regular training programs. Agility, sprint, explosive power were measured before and after the intervention by agility 't' test, 60m sprint test and sargent jump test respectively.

Results: Group A showed significant improvement in agility time (**p=0.021; <0.05**), Sprinting time (**p=0.0001; <0.05**) and jumping performance (**p=0.0004; <0.05**), and that of group B.

Conclusion: This study proved that the plyometric training is effective in improving Agility, Sprint and Explosive power in semi-professional kabaddi players.

Keywords: *Agility, Explosive power, Kabbadi players, Plyometric training, , Sprint,.*

Introduction

Kabaddi is a contact sport that originated in Ancient India, the word Kabaddi is derived from a Tamil word Kai – pidi which refers to "(let's) Hold Hands", a crucial aspect of play. In India, it is the state game of Tamil Nadu, Punjab and Andhra Pradesh [1]. In Kabaddi, 14 players (seven on each side) take part without equipment and supervised by a referee, two umpires and a scorer. The toss winning side has the option of choosing a particular side or sending the raiders first. By uttering continuous chant 'Kabaddi', the raider takes the maximum possible inspiration and moves to the other side and try to touch one of the defending players. The defenders try to hold the raider within their area and the raider tries to force his way back to his own side without discontinuing the chant. A point is credited to the raider's group if he is able to come back to his area after touching a defender and the person touched is put out of the game [2].

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Kabaddi players require motor, physical and physiological components for achieving their goal. Specific fitness with reference to explosive strength, sprint and agility, physical stamina, dynamic balance, neuromuscular coordination, lung capacity, quick reflexes were required for both the attackers and defenders to face the Physiological and Psychological challenges in Kabbadi[3].

Agility is the rapid whole-body movement with change of velocity or direction in response to a stimulus. To be considered an agility task, the movement will not only involve change in speed or direction, but must also be an open skill, wherein a reaction to a stimulus is involved and the movement is not specifically rehearsed[4].

Sprint running and straight sprinting speed were considered as important qualities which contributes to successful performance in many sports. Most of the team sports require players to produce maximal or near maximal sprints of short duration (1-7s) with brief recovery periods, over an extended period of time (60-90 min)[5].

Explosive strength is defined as the individual ability of the neuromuscular system to show signs of strain in the shortest time as possible and is mainly manifested in jumps and in spiking. Explosive leg power constitutes vertical jumping as an integral component of explosive performance and it considered as important component for successful performance in many athletic events[6].

Plyometric training is movement of one muscle to shift from a state of flexibility (the stretch) into a state of shortening (the return to its original position). Stored elastic energy within the muscle is produces more force that can be provided only by a concentric action. The measurement, the extent of the stretch (the degree), determines the use of the strength that allows flexibility and the transformation of chemical energy into energy used to move muscles [5].Muscle elasticity feature and the myotatic reflex (the stretch reflex) also play an important role in plyometric method. Plyometric training can contribute to improvements in vertical jump performance, acceleration, leg strength, muscular power, increased joint awareness and overall proprioception for kabaddi players [3].

Materials and Methods

Male Semi-professional Kabaddi players with an age between 12-20 years were selected from ChinnaThadagam, Coimbatore district. Study was done on 30 subjects who fulfilled the inclusion criteria were assigned randomly into 2 groups (15 in each group) as Group A (Plyometric training) and Group B (Regular training program). Those Participants who involved in any type of plyometric and strength training before and subjects with any impairments and disabilities were excluded. The purpose and nature of the study were explained to all participants and informed consent was obtained.

Baseline assessment was taken before initiation of training period which includes agility “T” test, 60meters sprint test, Sargent jump test with a training practice for these tests. Players in group A practiced plyometric training for 60 minutes a day, thrice a week for 8 weeks, in which training session includes warm up 15 minutes, plyometric training as mentioned in table 1 were performed for 30minutes, cool down stretches 15 minutes. Players in group B practiced their regular training program for 60 minutes a day which includes thrice a week for 8 weeks which includes warm up 15 minutes, regular training as mentioned in table 2 were performed for 30minutes, cool down stretches 15 minutes. The study methodology flowchart is depicted in figure 3.

Table 1: Plyometric training protocol for Kabbadi players in Group A

Weeks	Sessions	Plyometric training program	Set and Repetitions
1	S1-S3	Side to side ankle hops (2X15) Standing jump and reach (2X15) Front cone hops (5X6)	3×6
2	S4-S6	Side to side ankle hops (2X15) Standing long jump(5X6) Lateral jump over barrier(5X6)	3×6
3	S7-S9	Side to side ankle hops (2X12) Standing long jump(4X6) Lateral jump over barrier(2X12) Double leg hops (3X8) Lateral cone hops(2X12)	3×6
4	S10-S12	Diagonal cone hops(4X8) Standing long jump with lateral sprint(4X8) Lateral cone hops(2X12) Single leg bounding(4X7) Lateral jump single leg(4X6)	3×6
5	S13-S15	Diagonal cone hops(2X7) Standing long jump with lateral sprint(4X7) Lateral cone hops(4X7) Cone hops with 180 degree turn(4X7) Single leg bounding(4X7) Lateral jump single leg(4X7)	3×4
6	S16-S18	Diagonal cone hops(2X12) Hexagon drill(2X12) Cone hops with change of direction sprint(4X6) Double leg hops(3X8) Lateral jump single leg(4X6)	3×4
7	S19-S21	Diagonal cone hops(4X6) Hexagon drill(4X7) Cone hops with change of direction sprint(4X7) Double leg hops(2X12) Lateral jump single leg(2X12)	3×3
8	S22-S24	Diagonal cone hops(2X12) Standing long jump with lateral sprint(2X12) Lateral cone hops(4X7) Double leg hops(2X12)	3×3

Table 2: Regular training program for kabbadi players in Group B

Weeks	Regular training program	Distance and Repetitions
8 weeks	Slow jogging	30 meters
	Sprint running	30 meters x 2 repetitions
	Duck walking	30 meters x 2 repetitions
	Duck walk jumping	30 meters x 2 repetitions
	One leg jumping (for both legs)	30 meters
	Forward jumping	30 meters
	Push-ups	20 repetitions

Outcome Measures:

Agility "T" test – used to measure agility for athletes which includes forward, lateral and backward running by placing out four cones (5 yards = 4.57 m, 10 yards = 9.14 m) as mentioned in figure 1. As the command given the subject starts at cone A and sprints to cone B and touches the base of the cone with their right hand then shuffle sideways to cone C and touches the base with left hand, and then shuffling sideways to the right to cone D and touching the base with the right hand. Finally, they shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A. 3 trails can be noted and take the best time as result.

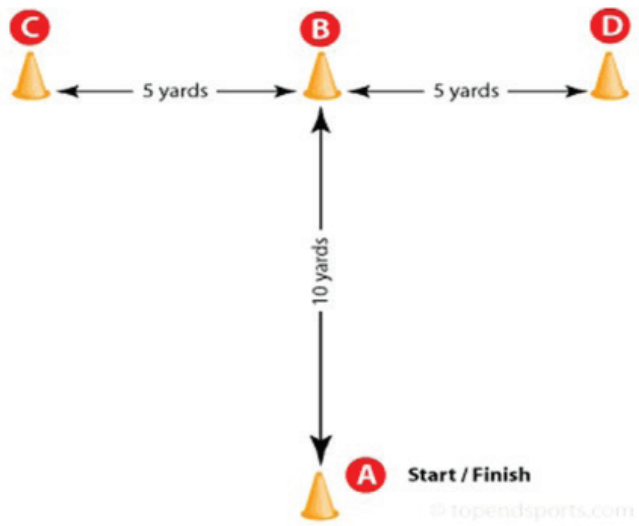

Figure 1 Agility T test

60-meters sprint test – usedto monitor the sprint performance which includes athlete's acceleration and pick up to full flight.The test was comprises of running a single maximum sprint over 60 meters. Three trials are allowed, and the best time is recorded.

Sargent jump test–used to measure the explosive strength of leg in which the subject was positioned with two feet on the platform, followed by a vertical jump, with free movements of the upper limbs and total freedom in joint flexion of the lower limbs. 3 successful trails were noted with a minimum interval of 45 seconds between the jumps, and the highest value was considered.

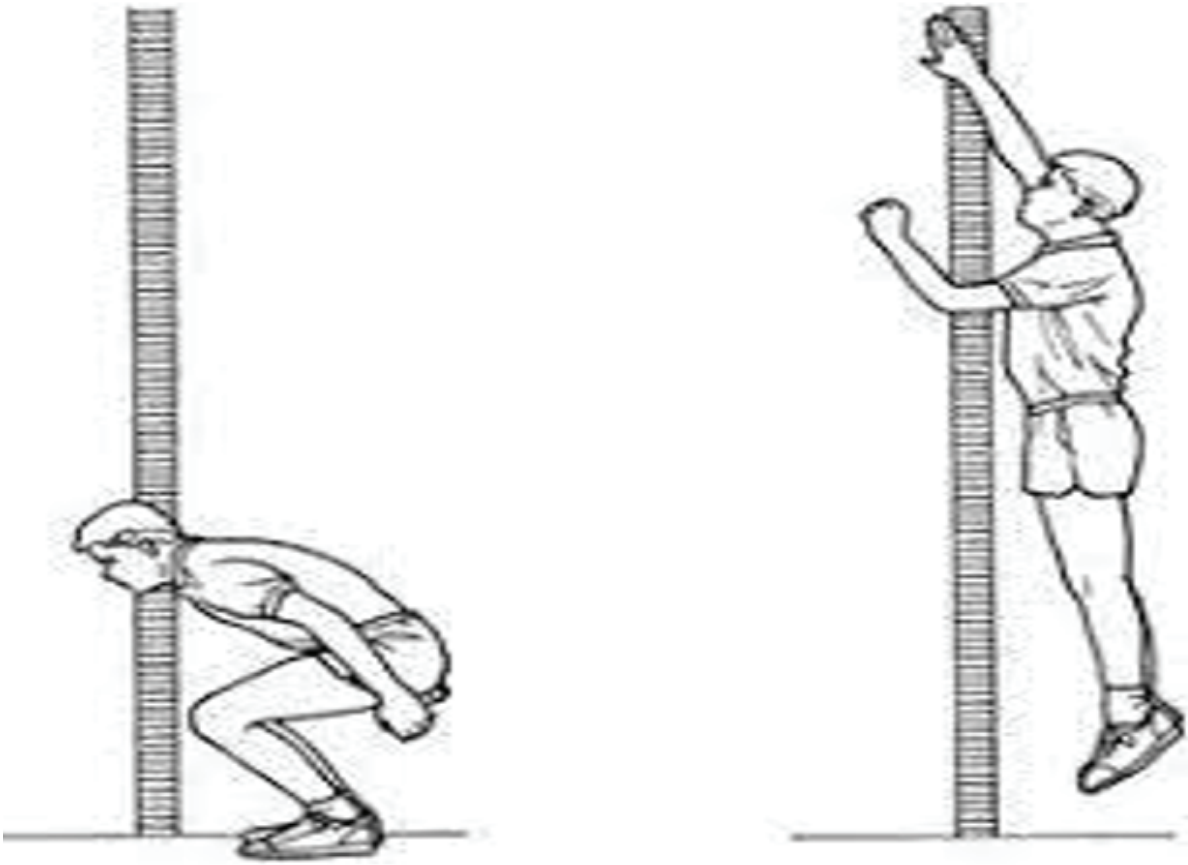

Figure 2 Sargent jump test

Data Analysis

In this study Data collected were statistically analysed by Statistical package for the social sciences (SPSS) computer program (version 20) for Windows and the data were reported as mean + SD. Paired't' test is used to analyse the change in agility, sprint, explosive leg power before and after training protocol within groups, were independent't' tests were used to find out the statistical differences between two groups A and B.

Results

Comparison of pre and post-test values of agility, sprint, explosive leg power in group A

Pre-test and post-test values in Group A were analysed using paired 't' test (Table 3). The pre-intervention mean score of agility 't' test is **11.57,** 60 meter sprint test is **9.97,** sargent jump test is **27.80** were as post-intervention score of agility 't' test is **10.31**, 60

meter sprint test is **8.63**, sargent jump test is **32.26** was statistically significant ($p<0.05$) in subjects who followed plyometric training.

Table 3 Comparison of pre and post-test values of agility, sprint, explosive leg power in group A

Outcome measures	Pre-test values Mean + SD	Post-test values Mean + SD	't' value	Sig (2-tailed) (p<0.05)
Agility 'T' test (seconds)	11.57+1.06	10.31+0.61	6.34	0.0001
60 meters Sprint test(seconds)	9.97+0.98	8.63+1.88	11.30	0.0001
Sargent jump test (cm)	27.80+6.32	32.26+-5.78	-10.68	0.0001

Comparison of pre and post-test values of agility, sprint, explosive leg power in group B

Pre-test and post-test values in Group B were analyzed using paired 't' test (Table 4). The pre-intervention mean score of agility 't' test is **11.57,** 60 meter sprint test is**10.94,** sargent jump test is **24.93** were as post-intervention score of agility 't' test is**11.17**, 60 meter sprint test is**10.52**, sargent jump test is **25.93** was statistically significant ($p<0.05$) in subjects who followed their regular training.

Table 4 Comparison of pre and post-test values of agility, sprint, explosive leg power in group B

Outcome measures	Pre-test values Mean + SD	Post-test values Mean + SD	't' value	Sig (2-tailed) (p<0.05)
Agility 'T' test (seconds)	11.57+1.12	11.17+1.17	4.37	0.001
60 meters Sprint test(seconds)	10.94+1.29	10.52+1.16	3.81	0.002
Sargent jump test (cm)	24.93+5.05	25.93+4.97	4.18	0.0009

Comparison of post-test values of agility, sprint, explosive leg power between groupA & B

Post-test values of agility, sprint, explosive leg power of Group A and B were analyzed by unpaired 't' test (Table 5). The post-test mean agility (**10.31**), sprint (**8.63**) of Group A is lesser than post-test mean agility (**11.17**), sprint (**10.52**) and explosive leg power (**32.27**) of group A is greater than explosive leg power (**25.93**) of Group B, showed a statistical significant change ($p<0.05$) between groups, favouring Group A which had greater significant improvement in agility, sprint, explosive leg power.

Table 5 Comparison of post-test values of agility, sprint, explosive leg power between group A and group B

Outcome measures	Group A Post-test values Mean + SD	Group B Post-test values Mean + SD	't' value	Sig (2-tailed) (p<0.05)
Agility 'T' test (seconds)	10.31+0.61	11.17+1.17	-2.61	0.014
60 meters Sprint test(seconds)	8.63+1.08	10.52+1.16	-4.59	0.0001
Sargent jump test (cm)	32.27+5.78	25.93+4.67	3.303	0.0026

Discussion

The game Kabaddi combines the actions of wrestling, judo, rugby and gymnastics in which the players also require speed, power and agility in executing the movement in faster manner while riding and catching, hence the desirable anthropometric and physiological characteristics will have a greater advantage in executing a better performance in competition. Plyometric training designed to enhance movement patterns which are essential for motor activities like agility, sprinting and jumping. This exercise will evoke the elastic properties of the muscle fibres and connective tissue which allows the muscle to store energy during the deceleration phase and release that energy during the acceleration period; thereby the muscle is capable of performing more work in the concentric phase[1-6].

This study showed that 8-weeks of plyometric training significantly improved agility, sprint performance and explosive leg power when compared to regular training program among semi-professional kabbadi player. Consistent with our study, **Edwin Rimmer et al** proved that a sprint-specific plyometric program can improve 40-m sprint performance than standard training program in rugby players[8]. **Goran Markovic et al** reported that plyometric, either alone or in combination with other training modalities has potential to enhance a wide range of athletic performance such as jump, sprint, agility and endurance performance in children and young adults of both sexes[9]. **Michael G. Miller et al** proved that plyometric training can improve athletes agility and there strength and explosiveness. This results also support that agility can be improve in short duration as 6 weeks of plyometric program. This can be useful for athletes during last preparatory phase in competition [10]. **Ahmet Alptekin et al** concluded that 8 weeks plyometric exercise increased explosive and elastic power in adolescent football players. This study also demonstrated that plyometric training was not sufficient to produce best results in 30m sprint following 8-week of training program [11].

Several studies have found that the plyometric training exploits the Stretch-shortening cycle will enhance the contractile properties of the muscle is more likely to be related either the theory of myosin light chain phosphorylation, or by an increased level of excitation of active motor units which results improvement in selected motor components such as the sprint, agility, explosive power and coordination due to neuromuscular adaptations through selective activation of motors units, synchronization, increased activation of synergistic muscles, and increased recruitment of motor units, an increased inhibition of antagonist muscles, a better co-contraction of synergistic muscle, and an inhibition of neural protective mechanisms, and/or an increased motor neuron excitability. Therefore, plyometric training has been recommended for sports that rely on generation of high power output [9, 12].

Some of the limitations of this study include small sample size, only Semi-professional kabaddi players were recruited, age group between 12-20 years only were involved and only male players were recruited in this study. Future studies can be done with larger sample size, can include with different age groups and can be done with female kabaddi players and other training regimes such strength training, resistance training, SAQ training and circuit training can be compared.

Conclusion

This study shows that both the groups (A & B) are individually effective in improving Agility, Sprint and Explosive power in semi-professional kabaddi players. However, there is extremely significant difference between the two training groups (group A> Group B) in terms of all three parameters, (i.e., Agility T test, Sprint test and Sargent jump test). Hence, we conclude that the Plyometric training (Group-A) is more effective in improving Agility, Sprint and Explosive power in semi-professional kabaddi players.

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