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Effect of Squat Jump and Split Jump Training on Dynamic Balance among Male Kabaddi Players: A Comparative Study

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Abstract: ***Background: Kabaddi is an indigenous game which is popular in India. It requires tremendous physical stamina, aerobic and anaerobic fitness, dynamic balance, agility, neuromuscular coordination, lung capacity, quick reflexes, intelligence and presence of mind on the part of both attackers and defenders during the game. Squat jump and split jump are the types of plyometric exercises which are often used by athletes. Aim: The aim of the study is toevaluate the effect of squat jump and split jump training on dynamic balance among male Kabaddi players. Method: 44 male Kabaddi players were selected according to the inclusion and exclusion criteria from 3 Kabaddi clubs from Jalgaon city. Their age ranged between 18-25 years. All the players were assessed prior to the intervention for dynamic balance using SEBT. 22 players were recruited in group with Squat jump (Group A) and 22 players were recruited in group with Split jump (Group B). Both the squat jump and split jump were included in their daily practise for 6 weeks for 5 days/week with 3 sets of 10 reps. After 6 weeks all the 44 players were reassessed for dynamic balance by using SEBT. Result: The result of our study showed that both the squat jump and split jump are equally effective in improving balance among the male Kabaddi players. Conclusion: The study concluded that, both the squat jump and split jump were equally effective in improving dynamic balance among male Kabaddi players aged between 18-25 years, as the comparative study showed no statistical significance (p value >0.05) between group A and group B.***

Keywords: Dynamic balance, Kabaddi, Plyometric, SEBT

1. Introduction

Kabaddi is an indigenous game which is popular in India. It a simple and inexpensive game, played throughout Asia with minor modification. According to some historians in India this game is a version of chakravyuha used in Mahabharat[1].

In Kabaddi, the players need strength, sprint and agility, which provide the athlete to face the physiological and psychological challenges in his competitive sports career. It requires tremendous physical stamina, aerobic and anaerobic fitness, dynamic balance, agility, neuromuscular coordination, lung capacity, quick reflexes, intelligence and presence of mind on the part of both attackers and defenders during the game [2].

In Kabaddi motor fitness is the ability of the neuromuscular system to perform specific tasks. Most skills used in sports and movement activities are advanced versions of fundamental motor skills. Motor fitness is a more comprehensive term which includes five motor performance components such as power, speed, agility, balance and reaction time, these components are important mainly for success in sports [2].

Plyometric training is used by athletes in all types of sports to increase strength and explosiveness. Plyometric drills usually involved stopping, starting, and changing directions in an explosive manner these movements are components that can assist in developing agility. It consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle and connective tissue. The stored elastic energy within the muscle is used to produce more force that can be provided by a concentric action alone. The specific goals of plyometric training are achieved through manipulation of four variables intensity, volume, frequency, and recovery. By enhancing balance and control of body positions during movement agility theoretically should improve [3].

Squat jump and split jump are the types of plyometric exercises which are often used by athletes. The known effects of both jumps are increase in strength and aerobic fitness; it also improves mobility and balance, toning legs and abs, boosting circulation and improve sports performance [6].

Dynamic balance is defined as "ability to maintain postural stability and orientation with center of mass over the base of support while the body parts are in motion" [7]. Whereas proprioceptive receptors play important role in maintaining balance. Proprioception has been defined as "one's ability to integrate the sensory signal from various mechanoreceptors to thereby determine body position and movements in space and it plays a crucial role balance control" [9].

Ankle proprioception is considered as important component contributing to balance control in sports, because during activities in Kabaddi the Ankle-Foot complex is the only part of the body contacting the ground [9]. Ankle proprioception provides essential information for adjustment of ankle position and movement of upper body for successfully performing complex motor skills required elite level player [10].

Ankle proprioception can be altered by general and sports specific training, sports related injuries and sports induced fatigue and this factor alters the balance ability [9]. Ankle proprioception is one of the intrinsic factors associated with ankle injury, as identified by Witchalls et al. in their systemic review [10].

Assessment of dynamic balance is an important measure in athletic populations for establishing levels of balance and neuromuscular co-ordination for the purposes of injury prevention and rehabilitation. Numerous tests have been developed to assess dynamic balance in athletic population. However, the space and cost requirements associated with balance measuring devices are not affordable or feasible for many clinical setting or during on-field assessments. The star excursion balance test (SEBT) challenges an athlete's dynamic postural control system [11].

SEBT is a reliable tool to measure and a valid dynamic test that requires strength, flexibility, and proprioception. The SEBT has been used to measure physical performance, compare balance ability among different sports, and identify individual with ankle instability, and identify athletes at greater risk for lower extremity injury. Researchers have suggested using the SEBT as a screening tool for sport participation and as a post-rehabilitation test to ensure dynamic functional symmetry [12] [11]. SEBT has 8 components which has to be reach by the players by one leg [11].

2. Material and Methodology

1) **Study design -** Comparative study.
2) **Study place-**
   - **Kailas Krida Mandal, Jalgaon.**
   - Netaji Subhash Chandra Bose Kabaddi Sangh, Jalgaon.
   - Maharshri Valmik Krida Mandal, Jalgaon.
3) **Duration of study – 6 months**
   a) **Inclusion criteria**
      - 18-25 years old males
      - 2+ years' experience
   b) **Exclusion criteria** – Patello-femoral pain syndrome, lower limb fracture, chronic ankle instability, players with neurological condition, recent ankle injuries, musculoskeletal pain.
4) **Materials -** Pen, set square, consent form, colour tape
5) **Outcome measure -** Star Excursion Balance Test
6) **Sample size -** 44 (minimum sample size to compare the equality of two means)

$$n = \frac{2s^2\,(z_1 + z_2)}{(m_1 - m_2)}$$

7) **Sampling technique-** Simple random sampling using odd and even method

3. Procedure

Ethical clearance was obtained from institutional ethical committee.

The male Kabaddi players were screened from 3 clubs and 44 players were selected who fulfils the inclusion criteria.

The purpose and procedure of study was explained to the participant and written consent will be taken.

Subjects were taken between age of 18-25 yrs.

44 male Kabaddi players were selected for the study to assess the dynamic balance among them. Two group were created as Group A and Group B both were assess by SEBT.

Squat jump has explained to Group A and Split jump has explained to Group B.

All the necessary information is provided such as technique and proper position.

Both groups were assessed by using SEBT for dynamic balance before intervention.

Group A – 22 players were included in Group A for Squat Jump.
Protocol – 10 reps × 3 for 5 days for 6 weeks.

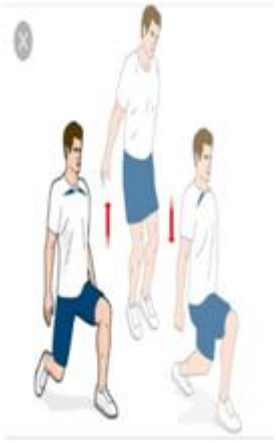
Group B – 22 players were included in Group B for Split Jump.
Protocol – 10 reps × 3 for 5 days for 6 weeks.

All routine exercise programs was continued which includes warm up, stretching, agility drills, Kabaddi practise and cool down along squat jump and split jump.

After 6 weeks of training players were re-assessed for dynamic balance by SEBT.
Both group were asses later after by SEBT to check the effect of squat jump and split jump on dynamic balance.

Squat Jump

Stand with your feet shoulder width apart. Start by doing a regular squat, engage your core, and jump up explosively.
When you land, lower your body back into the squat position to complete one rep. Make sure you land with your entire foot on the ground. Do 3 sets of 10 reps.



Split Jump

Stand in a staggered stance with your feet 2-3 feet apart, your one foot in front of the other. Keeping your trunk upright, bend your legs and lower your body into a lunge.
Now jump with enough force to propel both feet off the floor. While you are in the air, scissor-kick your legs so you land with your opposite leg forward. Land in a lunge. Repeat, alternating your forward leg with each rep. Do 3 sets of 10 reps

Data Analysis

The collected Data i.e. pre and post values of reach outs in male Kabaddi players using SEBT is quantitative in nature. Hence the paired t-test and unpaired t-test was applied to values to compare the effect on reach out. All the statistical analysis was performed by using – Mini Tab-13.

Group A

Table 1

	N	Minimum	Maximum	Mean	SD
Age	22	18	25	20.00	2.09
Weight	22	42	85	62.55	10.33
Height	22	160	187	171.14	6.21

Inference: Table no 1 shows baseline data of group A 22 players – Age, Weight, Height.

Group B

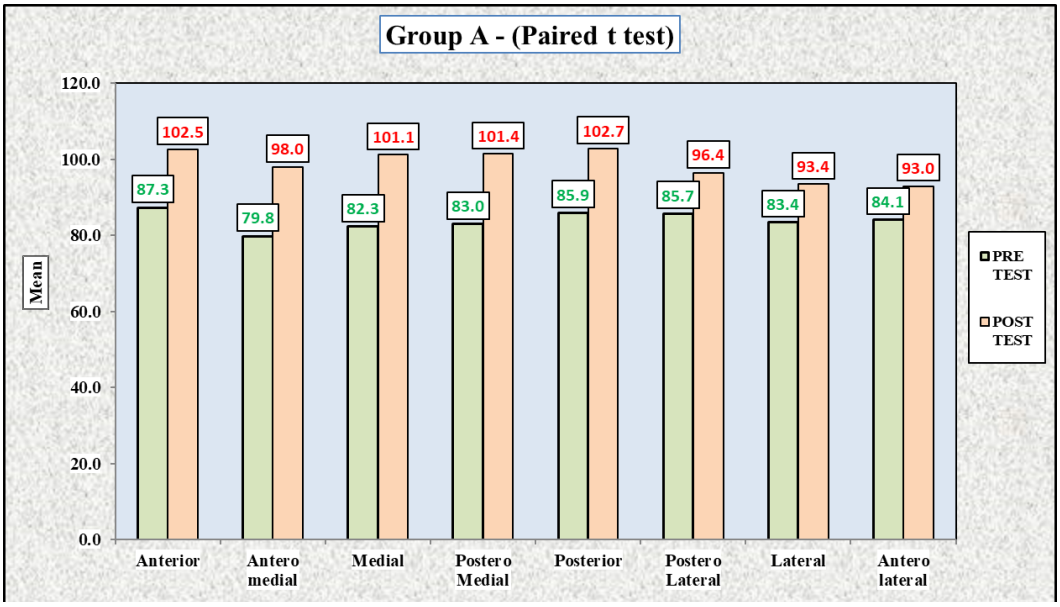
Table 2

	N	Minimum	Maximum	Mean	SD
Age	22	18	25	19.81	2.34
Weight	22	43	70	54.41	7.57
Height	22	160	178	169.68	5.17

Inference: Table no 2 shows baseline data of group B 22 players – Age, Weight, Height.

Group A (Paired t- Test)
Table 3

Variable	Group A	Mean	SD	Mean Diff.	t value	p value
Anterior	Pre Test	87.27	9.48	15.23	9.36	0.00
	Post Test	102.50	7.83			
Antero medial	Pre Test	79.77	8.09	18.18	9.02	0.00
	Post Test	97.95	8.54			
Medial	Pre Test	82.27	11.31	18.87	8.37	0.00
	Post Test	101.14	10.79			
Postero Medial	Pre Test	82.95	12.02	18.41	6.87	0.00
	Post Test	101.36	11.87			
Posterior	Pre Test	85.91	9.08	16.82	9.41	0.00
	Post Test	102.73	9.09			
Postero Lateral	Pre Test	85.68	11.37	10.68	5.25	0.00
	Post Test	96.36	7.90			
Lateral	Pre Test	83.41	11.17	10.00	5.29	0.00
	Post Test	93.41	8.92			
Antero lateral	Pre Test	84.09	9.47	8.86	4.84	0.00
	Post Test	92.95	9.21			

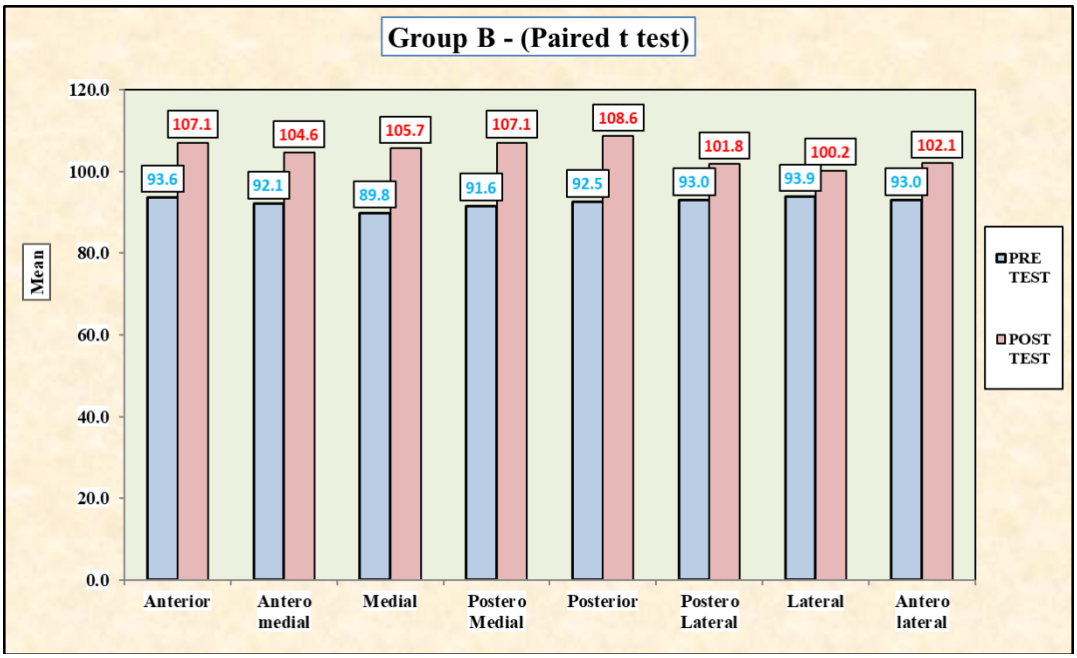


Group A	PRE TEST	POST TEST
Anterior	87.3	102.5
Antero medial	79.8	98.0
Medial	82.3	101.1
Postero Medial	83.0	101.4
Posterior	85.9	102.7
Postero Lateral	85.7	96.4
Lateral	83.4	93.4
Antero lateral	84.1	93.0

Inference: Table no 3 and Graph shows results of paired t-test between pre and post intervention values of Group A (Squat Jump), the result shows significant changes in pre and post values with the p value 0.00

Group B (Paired t- Test)

Variable	Group B	Mean	SD	Mean Diff.	t value	p value
Anterior	Pre Test	93.64	10.93	13.41	8.81	0.00
	Post Test	107.05	14.53			
Antero medial	Pre Test	92.05	9.96	12.50	6.85	0.00
	Post Test	104.55	14.30			
Medial	Pre Test	89.77	10.41	15.91	6.86	0.00
	Post Test	105.68	14.17			
Postero Medial	Pre Test	91.59	11.79	15.46	8.19	0.00
	Post Test	107.05	15.40			
Posterior	Pre Test	92.50	10.99	16.14	13.14	0.00
	Post Test	108.64	10.02			
Postero Lateral	Pre Test	92.95	13.24	8.87	4.56	0.00
	Post Test	101.82	17.96			
Lateral	Pre Test	93.86	13.09	6.37	3.41	0.003
	Post Test	100.23	16.22			
Antero lateral	Pre Test	92.95	11.41	9.10	3.31	0.003
	Post Test	102.05	19.19			



Group B	PRE TEST	POST TEST
Anterior	93.6	107.1
Antero medial	92.1	104.6
Medial	89.8	105.7
Postero Medial	91.6	107.1
Posterior	92.5	108.6
Postero Lateral	93.0	101.8
Lateral	93.9	100.2
Antero lateral	93.0	102.1

Inference: Table no 4 and Graph shows results of paired t-test between pre and post intervention values of Group B (Split Jump), the result shows significant changes in pre and post values with the p value 0.00 for Ant, Ant-medial, Medial, post-medial, Post, Post- lateral and for the lateral and Ant-lateral the p value is 0.003

Group A vs. Group B- (Unpaired t test)

Variable	Post Test	Mean	SD	Mean Diff.	t value	p value
Anterior	Group A	102.50	7.83	4.50	1.29	0.21
	Group B	107.00	14.50			
Antero medial	Group A	97.95	8.54	6.55	1.86	0.072
	Group B	104.50	14.30			
Medial	Group A	101.10	10.80	4.60	1.20	0.24
	Group B	105.70	14.20			
Postero Medial	Group A	101.40	11.90	5.60	1.37	0.17
	Group B	107.00	15.40			
Posterior	Group A	102.73	9.09	5.87	2.05	0.047
	Group B	108.60	10.00			
Postero Lateral	Group A	96.36	7.90	5.44	1.30	0.20
	Group B	101.80	18.00			
Lateral	Group A	93.41	8.92	6.79	1.73	0.094
	Group B	100.20	16.20			
Antero lateral	Group A	92.95	9.21	12.05	2.00	0.054
	Group B	105.00	19.20			

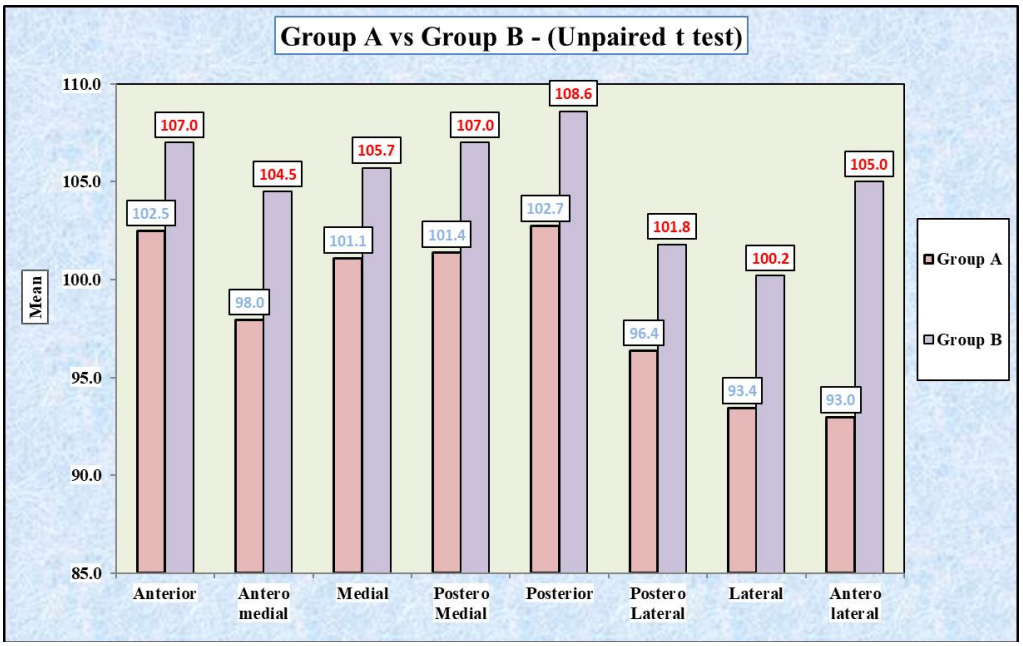


Table 5

	Group A	Group B
Anterior	102.5	107.0
Antero medial	98.0	104.5
Medial	101.1	105.7
Postero Medial	101.4	107.0
Posterior	102.7	108.6
Postero Lateral	96.4	101.8
Lateral	93.4	100.2
Antero lateral	93.0	105.0

Inference: Table no 5 and Graph shows results of unpaired t-test between pre and post mean values of Group A (Squat Jump) and Group B (Split Jump), the result shows significant changes (The p values of unpaired t-test are showed in table no 5).

4. Results

The data of pre and post intervention shows significant improvement in dynamic balance in both the groups with p value of 0.00 in group A for all the direction and in group B- p value 0.00 for anterior, anteromedial, medial,

posteromedial, posterior, posterolateral and 0.003 for lateral and anterolateral.

When post-test values were compared between the group A and B, the mean of group B (split jump) is greater than the mean of group A (split jump) but the p value is >0.05 hence, it shows no statistical significant difference between post-test mean of group A and group B.

5. Discussion

Dynamic balance is the ability to maintain postural stability and orientation with center of mass over the base of support while the body parts are in motion [7].

The current research study was performed to determine the effect of squat jump and split jump programme shows significant difference ($p<0.05$) in dynamic balance among the male Kabaddi players. Plyometric exercise is known to improve balance and explosive power. Forty four male players selected for the study. A paired t-test showed that there is significant improvement in balance within the group A (Squat jump) and B (Split jump). When post mean of group A and B were compared using unpaired t-test it shows split jump is more effective than squat jump. The findings of present study were in contrast to the study done by Jibi Paul et.al. (2017) studied the comparative effects of squat jump and split jump exercise on dynamic balance among female netball players with 80 female players and the study concluded that there is significant effect on dynamic with squat jump and split jump exercise in anterior, lateral, posterior, medial direction and squat jump exercise showed more significant improvement than split jump [13].

The improvement in balance could be due to physiological changes in muscles due to stretch-shortening cycle as a result of plyometric training. Also can be due to neuromuscular adaptation, such as increase inhibition of antagonist muscle as well a better activation and contraction of synergistic muscle or increase in muscle fiber size [14].

Another reason could be heavy joint compression applied by body weight which is facilitate co-contraction at the joint undergoing compression. Receptors in joint and muscles are involved with the awareness of joint position and movement which is stimulated by joint compression [8].

6. Conclusion

The present study concluded that squat jump and split jump shows significant effect on the dynamic balance among the male Kabaddi players in anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral and anterolateral. The comparative study showed no statistical significant difference in group A and group B; hence study concluded that both the jumps are equally effective in in improving dynamic balance among the male Kabaddi players.

7. Limitation

- Numbers of the players included in present study is less.
- Only experienced male Kabaddi players are included in present study.

8. Suggestions

- Number of the players included could be more.
- Amateur players and female Kabaddi players could be included.

Clinical Implication

On the basis of results of present study both the squat jump and split jump which are the type of plyometric exercise can be used in daily routine practice of Kabaddi as it shows significant effect on dynamic balance.

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