

The Effect of Core Stability Training on Dynamic Balance and Smash Stroke Performance in Badminton Players - An Evidence Based Study

Heena Ghanshyam Solanki¹, Manmitkaur A Gill²

¹M.P.T. (Sports Sciences),

²M.P.T. (Orthopaedics), PhD Scholar Gujarat University, Senior Lecturer, Government Spine Institute and Government Physiotherapy College, Civil Hospital, Asarwa, Ahmedabad.

Corresponding Author: Heena Ghanshyam Solanki

ABSTRACT

Background: Badminton is one of the most popular sports and fastest racket sports in the world in which single or double players striking shuttle cock to and fro across the net to score a point. The important components for badminton players are muscle strength, muscular endurance, power, speed, agility, flexibility, balance and coordination. Core stability training is one of the essential fitness components of any racket sports player, especially for badminton players during smashing the shuttlecock smash through the game.

Purpose: The purpose is to study the scientific evidences regarding the effect of core stability training on dynamic balance and smash stroke performance in badminton players.

Methodology: A search for relevant articles was carried out using key words- Badminton, core stability training, dynamic balance and smash stroke performance and search engines- Google Scholar, PubMed, PEDro, Science Direct, SPOERT Discuss, Research Gate and CINAHL. Studies were selected from year 2010-2019. Ten studies were included in which there were 2 systemic reviews, 5 RCT, 2 correlation study, 2 experimental study, and 1 cross sectional study.

Results: 12 studies were reviewed from which 11 studies concluded that core stability training is effective in improving dynamic balance and smash stroke performance in badminton players.

Conclusion: Based on the analysis of these 12 articles, it can be concluded that core stability training is effective in improving dynamic

balance and smash stroke performance in badminton players.

Clinical Implication: Core stability training is found to be effective improving and smash stroke performance in athletes with various racquet sports and can be performed to improve athletics skill performance.

Key words: Badminton, Core stability training, Dynamic balance and Smash stroke performance

INTRODUCTION

Badminton is contemplated as one of the most popular racket sports over the world, in which two or four opposing players strike a shuttlecock over a dividing net between them to score a point. The overhead technique is one of the three main categories of badminton strokes, which divided into three strokes drop, clear and smash [1]

The important factors required in badminton players are muscle strength, muscular endurance, power, speed, agility, flexibility, balance and coordination. Functional moments are highly dependent on core muscles of body and lack of core musculature can result in predisposition of injury. [2]

Player who performs overhead smash stroke undergo various movement and direction patterns to achieve within the superlative hitting point with stretched entire body, which implies that upper body

and smashing arm are going to be within the optimum coordinated stretching position. Moreover, the core musculature acts as a connecting path between upper and lower extremities limb in overhead athletic ventures like smashing in badminton or throwing in handball sport, and plays a crucial role with deference to transferring energy from the proximal to the distal body segments. [3,4,5]

Core stability is defined in athletic set-up as the superlative production, which can transfer and control the force from the centre of the body to the limbs, through stabilization of the position and motion of torso. [6] A core stability training is an essential fitness component of any racket sports player, particularly for badminton players during smashing the shuttlecock smash through the game. In badminton, the non-contact technique when player landing from the jump after smash overhead stroke, sometimes get injured at knee which probably occurs as a result of reduced strength or instability and balance issues. [7]

Balance defined as an ability to maintain a base support with minimal movement actions and dynamically to perform a motor task while maintaining a stable position. Badminton is a dynamic equilibrium process which involves loss of balance in the air to restore balance after landing. Thus, players need body coordination and dynamic balance. [8]

METHODOLOGY

Study Type

This is an Evidence Based Study, conducted according to Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines (Figure 1).

Search strategy

The search engines used to find the appropriate articles were: Google Scholar, PubMed, PEDro, Science Direct, Research Gate, SPORTDiscuss, CINAHL.

Key words used for the search were

Badminton, Core stability training, Dynamic balance and Smash stroke performance

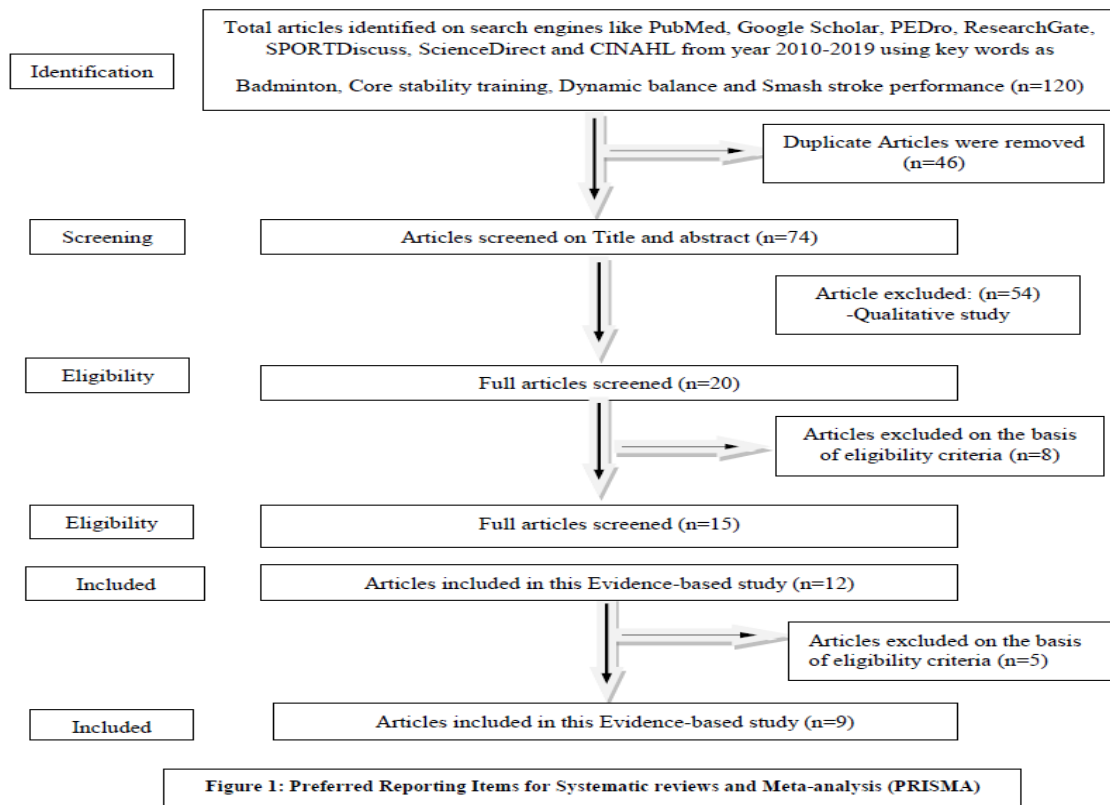
Eligibility criteria

Articles were selected from last 10 years (2010-2019). Total 120 articles were found, out of which 20 articles were relevant. Out of 20 articles, 12 articles were included in the study (Table 1). Other articles were excluded because it didn't involve population of racquet sports and having different training program.

Data Analysis: All 12 articles were assessed using 2 scales:

1. **The PEDro scale:** It assesses methodological quality and consists of a checklist of 11 criteria, 10 of which are scored. For each criterion the study met, 1 point was awarded. The points were calculated and presented as score out of 10. The scale applies only to experimental studies. For this review, investigations with PEDro many 6 to 10 were considered high quality, of 4 to five were considered moderate quality, and of 0 to three were considered low quality. The PEDro score has exhibited 'fair' to 'excellent' inter-rater reliability (Intraclass coefficient of correlation 0.53-0.91) for randomized controlled trials of physiotherapy interventions. Convergent validity is supported for the PEDro score through correlation with other quality rating scales including: the Jadad scale (0.35) and van Tulder 2003 scale (0.71) for clinical trials of physiotherapy related interventions. [9] (Appendix 1)

2. **The CEBM's Levels of Evidence scale:** It assesses quality based on study type, which classify studies in a scale ranging from 1 to 5 with further subdivision for each. (Appendix 2)



Characteristics of included studies:

Sr no.	Title	Study design & duration	Articles or Sample Size	Outcome Measures	PEDro and Level of Evidence
1	Core stability and its impact on upper extremity function in racket sports ^[10]	Systemic review	17studies	-	1a
2	Impact of core stability on upper extremity athletic injury and performance ^[11]	Systemic review	10 RCTs and 14 non-randomized trials	-	1a
3	The Effect of Core Stability Training on Dynamic Balance and Smash Stroke Performance in Badminton Player ^[Error! Reference source not found.]	Randomized control trial	20	SEBT Forehand smash stroke performance Test Core stability test	7/10 1b
4	The Relationship Between Core Endurance and Performance in National Female Badminton Athletes ^[13]	Comparative study	60	Y balance Vertical Jump 20 m sprint agility	3a
5	Effect of core strength training on dynamic balance and agility in adolescent badminton players ^[14]	Randomized control trial	40	Illinois agilitytest SEBT Core muscle endurance tests	6/10 1b
6	Effect of core strengthening on dynamic balance and agility in badminton players ^[15]	Experimental study	30	Ttest SEBT	2a
7	Effect of Core Strengthening and Conditioning Programme on Badminton Beginners ^[16]	Experimental study	30	Core endurance test Y balance test	2a
8	Correlation between core stability and scapulohumeral rhythm in badminton player. ^[17]	Comparative study	40	CST FTPT CKCT SHR	3a
9	Core Stability Training On Muscular Endurance Among Novice Badminton Players ^[18]	Randomized control trial	30	Endurance test	5/10 2a
10	Effects of a 6-Week Junior Tennis Conditioning Program on Service Velocity. ^[19]	Randomized control trial	30	Velocity analysis and radar specifications: first-serve velocity	6/10 1b
11	Comparison of core stability and balance in athletes with and without shoulder Injuries. ^[20]	Cross sectional	80	Cst Y balance test Static balance-BESS	3a
12	Effect of core training on dynamic balance and agility among Indian junior tennis players ^[21]	Randomized control trial	80	SEBT T test	7/10 1b

RESULTS

Evidences were reviewed and analysis was done on the basis of PEDro score and CEBM's Level of Evidence Scale.

Articles were selected from last 10 years (2010-2019). Total 120 articles were found, out of which 20 articles were relevant. Out of 20 articles, 12 articles were included in the study.

11 studies showed that core stability training is found to be effective improving and smash stroke performance in athletes with various racquet sports and can be performed to improve athletic skill performance.

DISCUSSION

Total 12 studies (2 Systematic reviews and 5 Randomized controlled trials, 2 comparative studies, 2 Experimental study and 1 cross sectional study) were included in this evidence-based study. The methodological qualities of included studies were low to high.

There are 2 strong scientific evidences (Systematic review) which suggest that Core stability training is very important for athletic performance enhancement, especially it gives benefits to enhance upper extremity function in racquet sports.

Core strength is important for the upper body and trunk rotation during smashing movements of racket sports. The kinetic chain plays a key role in transferring energy to the upper body which comes from core muscles. The possible reason for the improvement of upper extremity function may be due to routine core stability exercises that include crunch ball, hip thrust, and Russian ball which increases the endurance of core muscle and core muscle allows them to use during upper extremity movements while performing smash stroke.

There are 3 studies which suggest that core stability training programme is an effective training method for developing the dynamic balance for badminton players and elicit significant improvements in the

technical functional performance of smashing velocity and accuracy.

Overhead smash stroke performance is a complex motion, which depends on several components such as lower body strength, leg power, technique and the proper kinetic chain, the core stability training varied movements allows players to perform the exercises at high rhythms speed compared with traditional strength training which depend on free weights or machines, but with greater force compared to those performed during sport competition. Moreover, it can be explained that the positive smashing velocity and accuracy results by the high coordinative closeness of core stability exercises which were selected based on the nature of badminton sport which characterized by many repetitive striking. The upper-body and rotational trunk strength are important vital variables for badminton players because both play an important role to drive the body during smashing movement in the final phase of smash skill. In this regard, trunk rotation and core muscles endurance are integral parts of the improvement power and transfer the energy up to the kinetic chain from lower body to upper body extremity transferred.

8 studies which show that core stability training helps in improving dynamic balance in racquet sports, thus enhancing athletic performance.

The core stability training exercises during the training intervention were varied and included special exercises for hamstring muscles whether exercises static or dynamic to development the strength of pelvic and back muscles. In addition, core exercises such as knee drive and multidirectional lunges may affect total reached distance of players when performed the dynamic balance test and stand on a single limb and also may have a direct influence on hamstring strength values of badminton players.

Core stability training exercises are vital for badminton players who need higher hamstring muscular forces which aiming to

provide a dynamic support for the movements that required a better knee stabilization to complete a landing-based tasks such as overhead smash stroke in short period time and with stand stable leg to ready for following tasks during the badminton game

CONCLUSION

Based on above evidences found from search engines like Google Scholar, PubMed, PEDro, Science Direct, Research Gate and CINAHL from year 2010-2019, 12 out of 20 articles were selected and from its analysis it can be concluded that core stability training given to badminton players and various racquet sports significant improvement in dynamic balance and smash stroke performance.

Clinical Implication

Core stability training is found to be effective in improving and smash stroke performance in athletes with various racquet sports and can be performed to improve athletics skill performance.

Abbreviations

CST: Core Stability Test, SEBT: Star Excursion Balance Test, FTPT: Functional Throwing performance Test, CKCT: Close kinematics chain upper extremity Test, SHR: Scapulohumeral rhythm, BESS: Balance Error Scoring System PEDro: Physiotherapy Evidence Database, CEBM: Center of Evidence Based Medicine, CINAHL: Cumulative Index of Nursing and Allied Health Literature, RCT: Randomized Controlled Trial, PRISMA: Preferred Reporting Items for systematic reviews and meta-analysis.

Conflict of Interest: There is no conflict of interest.

Ethical Approval: Ethical approval was not required

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APPENDIX 1-PEDro SCALE

No.	Description	Yes / No
1	Eligibility criteria were specified (No points awarded)	
2	Subjects were randomly allocated to groups	
3	Allocation was concealed	
4	The groups were similar at baseline regarding the most important prognostic indicators	
5	There was blinding of all subjects	
6	There was blinding of all therapists who administered the therapy	
7	There was blinding of all assessors who measured at least one key outcome	
8	Measure of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups	
9	All subjects for whom outcome measures were available received the treatment or control condition as allocated	
10	The result of between group comparisons are reported for at least one key outcome	
11	The study provides both point measures and measures of variability for at least one key outcome	

APPENDIX 2- CEBM'S LEVEL OF EVIDENCE

Level	Definition
1a	Systematic reviews of randomized controlled trials
1b	Individual randomized controlled trials
1c	All-or-none studies
2a	Systematic reviews of cohort studies
2b	Individual cohort studies or low-quality randomized controlled trials
2c	Outcome research
3a	Systematic reviews of case-control studies
3b	Individual case-control studies
4	Case series, poorly designed cohort or case-control studies
5	Animal and bench research, expert opinion
