Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study

by

Vishal Pramod Deep

Dissertation Submitted to the
Utkal University, Bhubaneswar, Odisha.

In partial fulfillment
of the requirements for the degree of

Master of Physiotherapy

in

SPORTS

Under the guidance of
Prof Joseph Oliver Raj

Dean

Abhinav Bindra Sports Medicine and Research Institute,
Bhubaneshwar

2021-2023

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation/thesis entitled **"*Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study*"** is a bonafide and genuine research work carried out by me under the guidance of **Prof. Joseph Oliver Raj, Dean, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneshwar.**

Date:

Vishal Pramod Deep

Place:

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled **"Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study"** is a bonafide research work done by Vishal Pramod Deep in partial fulfilment of the requirement for the degree of **MPT - Master of Physiotherapy**.

Date:

Place:

Signature of the Guide

Name

ENDORSEMENT BY THE PRINCIPAL

This is to certify that the dissertation entitled ***"Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study"*** is a bonafide research work done by ***Vishal Pramod Deep*** under the guidance of **Prof Joseph Oliver Raj, Dean, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneshwar.**

Seal & Signature of the HOD

Name

Date :

Place:

Seal & Signature of the Principal

Name

Date :

Place:

ENDORSEMENT BY THE DEAN

This is to certify that the dissertation entitled *"**Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study** "* is a bonafide research work done by ***Vishal Pramod Deep*** under the guidance of **Prof Joseph Oliver Raj, Dean, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneshwar.**

Date **Seal & Signature of the Dean**

Place

Copyright form

COPYRIGHT

Declaration by the Candidate

I Vishal Pramod Deep of Abhinav Bindra Sports Medicine & Research Institute Odisha, Bhubaneswar hereby declare that the Utkal University, and Abhinav Bindra Sports Medicine & Research Institute Odisha, Bhubaneswar shall have the perpetual rights to preserve, use and disseminate this dissertation / thesis in print or electronic format for academic / research purpose.

Date: Signature of the Candidate

Place: Name

Utkal University, Odisha, Bhubaneswar

ACKNOWLEDGMENT

I am profoundly grateful and humbled as I stand at the culmination of this postgraduate dissertation. This endeavor would not have been possible without the unwavering support, guidance, and encouragement from numerous individuals who have contributed to my academic growth.

First and foremost, I extend my heartfelt gratitude to Guide, Prof Joseph Oliver Raj, Dean, Abhinav Bindra Sports Medicine and Research Institute, Bhubaneshwar. Your expertise, mentorship, and patience have been invaluable throughout this journey. Your insightful feedback and constructive criticism have continuously pushed me to excel and refine my research.

I am also indebted to Dr Chinmaya Kumar Patra, Principal, Abhinav Bindra Sports Medicine and Research Institute Bhubaneshwar and the faculty members of Abhinav Bindra Sports Medicine and Research Institute, Bhubaneshwar, whose dedication to education and passion for their respective fields have enriched my learning experience. Their willingness to share knowledge and engage in thought-provoking discussions has been truly inspiring.

My sincere appreciation goes to my friends and colleagues who have supported me during this demanding period. Their camaraderie, encouragement, and willingness to lend a helping hand have been a source of motivation and comfort.

I must also acknowledge the contribution of my family. Their love, understanding, and belief in my abilities have been unwavering, providing me with the strength to overcome obstacles and pursue my academic aspirations.

I am deeply grateful to all the participants who volunteered their time and cooperation, making the data collection process possible for this research.

Lastly, I wish to express my gratitude to the countless authors, researchers, and scholars whose works have been a foundation for my study. Their insights and discoveries have been instrumental in shaping the direction of my research.

To each person who has played a role in this journey, no matter how big or small, I offer my sincerest thanks. Your support has been the cornerstone of this dissertation's success.

With heartfelt appreciation,

Date: Signature of the Candidate

Place: Name

LIST OF ABBREVIATIONS USED
(In alphabetical order)

CRT- Choice Reaction Time
SRT- Simple Reaction Time

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

ABSTRACT

Title: Visual Reaction Time, Movement Speed and Hand Eye Coordination in Badminton and Para Badminton Players: An Observational Study

Background & Objectives: Badminton and Para-Badminton both are very popular sports. Badminton is a fast-paced racquet sport that requires players to have good hand-eye coordination, agility, speed, and reaction time. Para-badminton, on the other hand, is an adapted version of badminton for players with physical disabilities. This study aimed to examine and compare Visual Reaction Time, movement speed and Hand-eye coordination in Badminton and Para-Badminton Players.

Methods: Skilled badminton players and para-badminton athletes were included based on the inclusion criteria and were divided into 2 groups i.e., Group A (Badminton Players) and Group B (Para-Badminton Players). Deary Liewald reaction time tester was used to gauge visual reaction time, Alternate Hand Wall toss test was used to gauge hand-eye coordination, and Plate Tap test was used to gauge movement speed.

Results: Data was collected from various Badminton Academies. Data was analyzed using SPSS 29 Software. Both Badminton and Para-Badminton Players showed better Reaction time, Movement Speed and Hand Eye Coordination.

Conclusion: Both Badminton and Para-Badminton Players showed better Reaction time, Movement Speed and Hand Eye Coordination. But when compared Badminton players showed better Reaction time, Movement Speed and Hand Eye Coordination than Para-Badminton Players.

Keywords: Badminton; Para-badminton; Visual reaction time; Hand-eye coordination; Movement speed; Physical disabilities; Physical Fitness; Athletic Performance; Sports for Persons with Disabilities

INTRODUCTION

Today, Badminton is one of the most popular and most played sports in India and Worldwide at different levels. Among the indoor games, badminton can be played both as an Individual and as well as a team sport. It is a complex physically enduring sport which requires very strong core strength as well as upper and lower body strength to produce the required strokes, powerful smashes, agility, good balance, and coordination during rapid postural movement around the court.[1]

Para-Badminton is basically badminton adapted for persons with certain kinds of physical disabilities. These athletes have varying levels of physical health problems differing in functional levels. Depending on their levels of physical disabilities they are divided into 6 categories i.e.,

1. Wheelchair (WH1, WH2),
2. Standing players (SL3, SL4, SU5), and
3. Short Stature players (SS6). [(2)]

In badminton sport, where there is no touch to rival, quick arm movements, and fast veers. Particularly the unbelievable speed of the shuttlecock leaves too little time to react and move fast thus badminton players should decide quickly and accurately during the game.[2] According to research, a defender only has 0.1 seconds to respond to an attack from the opposition.[3] Due to the quick pace of badminton, the ever-changing conditions on the court, and the complexity and accuracy of players' actions, speed and all of its components, i.e.

1. Reaction time (simple and complex, choice and differential)
2. Speed of an individual movement.
3. Frequency of movements .[7]

Reaction time can be defined as the period of time between the initiation of a stimulus and the initiation of the movement. It involves the perception of the stimuli by the sense organ, the transmission of the information through the nerve to the brain and back from the brain to the muscle contraction, and the movement of the muscle.[3] Visual reaction time is the time taken by an individual to react to a visual stimulus. The rate at which sensory impulses are processed by the central nervous system and translated into a motor response is accurately determined by reaction time.[3] It determines the alertness of a person because how quickly a person responds to a stimulus depends on his reaction time.[3]

Movement Time can be defined as the time to complete a discreet, predefined motor task.[4] A skill-orientated ability underlying tasks, such as rapid badminton strokes, for which a limb must be moved from one position to another very rapidly. A fast movement speed helps the player get ready for the next stroke as in fast rallies or in continuous defense against an attacking opponent.

Coordination is the capability to perform a sequence of movements rhythmically smoothly and accurately. A badminton player needs exceptional coordination to produce appealing and rhythmic movements. The movement does not seem stiff and uninterrupted. But it is organized and done sequentially well as it should be. Therefore, coordination means

the ability to string some movements to be aligned and in accordance with the purpose of movements. [5] The better the coordination from some movement elements, the better the movement released. It implies that good coordination is required to master a good technique of movement.[6]

Young Para-athletes were drawn to para-badminton as a result of the sport's growing popularity in the sports world and its inclusion in the Paralympic Games schedule. Paralympics is a developing sport and needs further studies for its development. There are many previous studies done on both badminton and para-badminton players separately. However, it seems that still relatively less emphasis has been put especially on the para-athletes and their integration into normal athletes. Also, there is a lack of information on para-badminton players, an updated study on these players is needed and is crucial as many competitions will be held in preparation for their 2023 Paralympics appearance in Croatia. This study will help to compare the parameters of badminton and para-badminton players so that both the games can develop in a professional manner as required. Also, it will help in understanding existing possibilities for improvement and/or cooperation, and awareness between the badminton and para-badminton players, coaches, and admirers of the game. Hence this study aimed to examine and compare Visual Reaction Time, movement speed and Hand-eye coordination in Badminton and Para-Badminton Players.

OBJECTIVES

1. To examine and Compare the Visual Reaction Time using Deary Liewald Reaction time Tester in Badminton and Para-badminton Players.
2. To examine and Compare the Upper Limb Movement speed using Plate Tap Test in Badminton and Para-badminton Players.
3. To examine and Compare Hand-eye Co-ordination using the Alternate Hand wall Toss test in Badminton and Para-badminton Players.

HYPOTHESIS

- **Null Hypothesis:** There will be no significant difference between Visual Reaction time, Movement speed and Hand-eye coordination in Badminton and Para-badminton Players.
- **Alternative Hypothesis:** There will be a significant difference between Visual Reaction time, Movement speed and Hand-eye coordination in Badminton and Para-badminton Players.

REVIEW OF LITERATURE

- **Mehmet Fatih YÜKSEL (2017)** aimed to determine the reaction times of physically disabled international badminton players, and to analyze the effects of badminton on their reaction times. A total of 60 international players from Turkey, France, Spain, Russia, Poland, Thailand, India, Bulgaria, and England participated in this study. Visual-auditory reaction time was assessed by the New-Test 2000 measurement device. it was observed that male players had better reaction times compared to the female players. Furthermore, male and female badminton players' average visual and visual/auditory reactions were statistically significantly greater than those of control groups.[2]

- **ZIEMOWIT BAŃKOSZ, HENRYK NAWARA, MARCIN OCIEPA(2013)** Aimed to compare differences between badminton players and controls to determine the simple reaction times among male and female players. Subjects were divided into four groups: two groups of top-level junior players (10 boys and 6 girls); 26 non-playing boys and 6 non-playing girls. Reaction time was calculated using MRK 80 reaction meter. The study concluded that Badminton players display shorter reaction times than non-players.[7]

- **Sushil P Dube, Shree Chakradhar U Mungal, Mukund B Kulkarni (2015)** aimed to compare visual reaction times of badminton players with those of age-matched controls. 50 male badminton players of 18–22 years age group who were practicing badminton for 2–3 h/day for a minimum of 2 years in experimental group and 50 non playing students of Dr SCGMC Nanded (Maharashtra, India) formed the control group. Reaction time was measured by visual reaction time recorder. according to the study's findings, Playing badminton can help in improving Hand - eye reaction time, muscle coordination, cognitive functions, concentration, and alertness.[3]

- **Ian J. Deary & David Liewald & Jack Nissan (2010)** aims to develop a freely available, user-friendly program that will make it possible to calculate means and standard deviations from simple and four-choice reaction times. 150 individuals, ranging in age from 18 to 80, along with other widely used tests.[9]

MATERIALS AND METHODOLOGY

- **Study Design** – Observational Comparative study.
- **Study Setting** – Badminton Academies in Bhubaneshwar.
- **Target Population** – Badminton and Para-Badminton Players.
- **Sample Size** – 48 (24 in each group).
- **Sampling Method** – Purposive Sampling.
- **Duration** – One year
- **Materials Required** – Laptop, Tennis ball, Stop watch, Plates, Inch tape.

OUTCOME MEASURES

1. **Visual Reaction Time:**

   Deary Liewald Reaction Time Software was used to assess the Simple and Choice Reaction Time. participants are typically presented with a visual stimulus, such as a light or a shape, and are instructed to respond as quickly as possible when they see the stimulus by pressing a button. The time it takes for the participant to react and press the button is recorded as their reaction time. Three trials were given and the best time was recorded.

2. **Movement Speed:**

   Plate Tap test was used to assess the movement speed of the participants. Participants were instructed to tap on a plate placed 60 cm apart with their hand as rapidly as they can to complete 25 number of taps (50 to and from) they complete during this time is recorded as their score.

3. **Hand-eye Coordination:**

   Alternate Hand wall toss test was used to assess Hand-eye coordination. Starting with the dominant hand, the athlete throws the ball towards the wall and catches the ball with the opposite hand and vice versa. The shooter must try to perform the maximum number of repetitions in 30 s

PROCEDURE

- Ethical approval was obtained from the institutional ethical committee.
- NOC was taken from different badminton academies across Bhubaneshwar.
- Players were screened for inclusion and exclusion criteria.
- Participants were explained about the study in their vernacular language.
- Informed consent form was obtained from the participants.
- Demographic data was obtained which included name, age, gender, address, years of playing badminton, any previous injuries, etc.
- Participants were allocated in Group A (Badminton Players) and Group B (Para-Badminton Players) by Purposive sampling method.
- Both Groups underwent warm-up and all the tests were explained verbally and demonstrated practically to the participants.
- The Participants performed the tests 3 times and the best response was recorded.
- All the data was recorded and was analysed and compared using the latest version of SPSS (version 29) software.

SAMPLE SIZE ESTIMATION

The Sample Size was calculated using the G*power software

With,

Effect size d **=** 0.9560031

α err prob **=** 0.05

Power (1-β err prob) **=** 0.90

Allocation ratio N2/N1 **=** 1

The Total Sample Size calculated was 48 i.e., 24 in each group

STATISTICAL ANALYSIS

The Data obtained from the tests was checked for normality using the Shapiro-Wilk test where the level of significance was set to $p > 0.05$. Descriptive Analysis was done using the independent t test where the level of significance was set to $p < 0.05$.

The statistical analysis was done using the SPSS software version 29.00.

RESULTS

	Participants	Mean	Std. Deviation	Minimum	Maximum
Age Badminton	24	20.83	2.239	18	25
Age Para Badminton	24	21.17	2.531	18	25
BMI Badminton	24	21.463	1.4237	19.2	24.5
BMI Para Badminton	24	21.675	1.1498	19.3	23.8

TABLE 1: NORMALITY OF AGE AND BMI

Group	Total	Male	Female	Percent
Badminton	24	12	12	50.0
Para Badminton	24	12	12	50.0

TABLE 2: NORMALITY ACCORDING TO GENDER

The age, gender and BMI in both the groups i.e., Group A- Badminton Players and Group B- Para Badminton Players was equally and normally distributed as selection of individuals was done very specifically.

	Shapiro-Wilk Test		
	Statistics	df	Sig.(p value)
SRT Badminton	0.928	24	0.089
SRT Para-Badminton	0.966	24	0.568
CRT Badminton	0.947	24	0.231
CRT Para-Badminton	0.947	24	0.231
Movement Speed Badminton	0.971	24	0.686
Movement Speed Para-Badminton	0.940	24	0.163
Hand-eye Coordination Badminton	0.917	24	0.050
Hand Eye Coordination Para-Badminton	0.937	24	0.138

TABLE 3: NORMALITY OF DATA

The Data obtained from the tests for both badminton and para-badminton players were assessed for normality using the Shapiro-wilk test. The level of significance was p value >0.05. The test showed p value >0.05 which interprets that the data is Normally distributed and Descriptive Statistics should be used (Table 1).

Simple Reaction Time	Size	Mean	Std. Deviation	Std. error mean	Significance p<0.05
Badminton	24	322.26	50.81	10.37	< .001
Para Badminton	24	780.26	69.61	14.21	< .001

TABLE 4: SIMPLE REACTION TIME

The Simple Reaction time data was obtained from the deary liewald reaction time tester software. The independent t test was used to calculate between the groups. The significance i.e., p value was set to <0.05. The results showed there was significant difference between the groups. The Group A i.e., Badminton Players group showed better simple reaction time than Group B i.e., Para-Badminton Players.

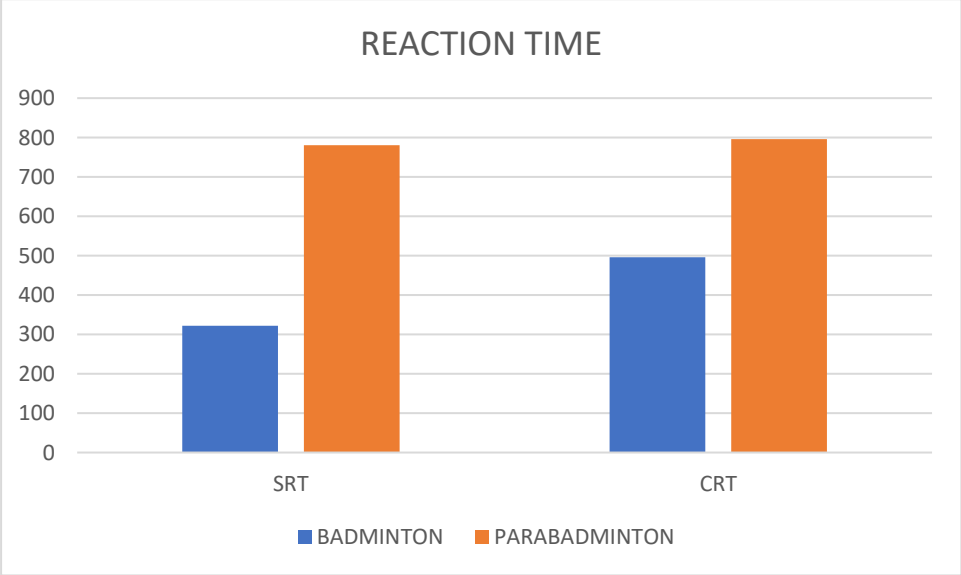

Figure 1: COMPARISION OF REACTION TIME

Choice Reaction Time	Size	Mean	Std. Deviation	Std. error mean	Significance p<0.05
Badminton	24	496.09	73.90	15.08	< .001
Para Badminton	24	796.09	73.90	15.08	< .001

TABLE 5: CHOICE REACTION TIME

The Choice Reaction time data was obtained from the deary liewald reaction time tester software. The independent t test was used to calculate between the groups. The significance i.e., p value was set to <0.05. The results showed there was significant difference between the groups. The Group A i.e., Badminton Players group showed better choice reaction time than Group B i.e., Para-Badminton Players.

Movement Speed	Size	Mean	Std. Deviation	Std. error mean	Significance p<0.05
Badminton	24	11.64	1.88	.38529	< .001
Para Badminton	24	22.00	3.00	.61325	< .001

TABLE 6: MOVEMENT SPEED ANALYSIS

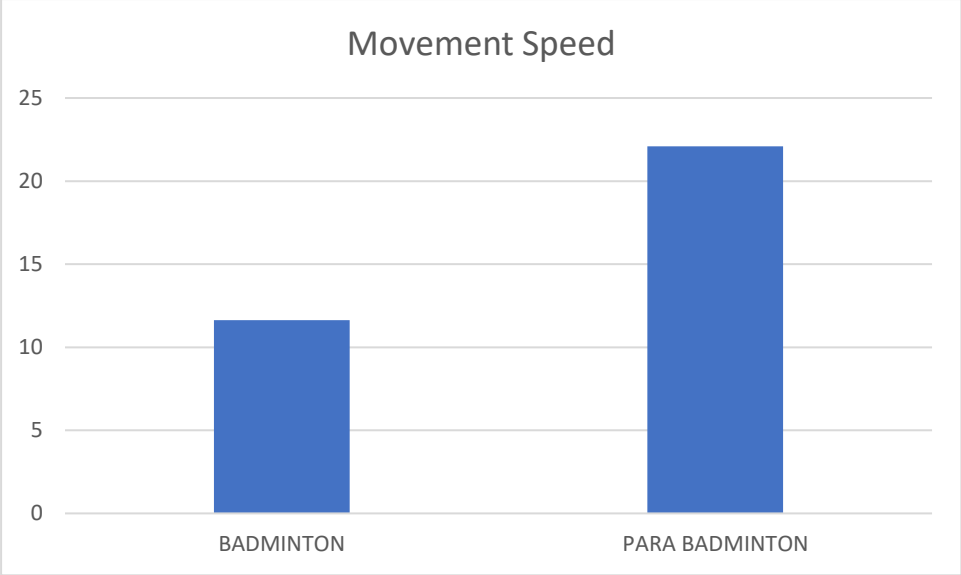

Figure 2: COMPARISION OF MOVEMENT SPEED

The Movement speed time data was obtained from the Plate tap test. The independent t test was used to calculate between the groups. The significance i.e., p value was set to <0.05. The results showed there was significant difference between the groups. The Group A i.e., Badminton Players group showed better Movement speed than Group B i.e., Para-Badminton Players.

Hand eye Coordination	Size	Mean	Std. Deviation	Std. error mean	Significance p<0.05
Badminton	24	19.67	2.944	.601	< .001
Para Badminton	24	13.71	3.250	.663	< .001

TABLE 7 :HAND EYE COORDINATION

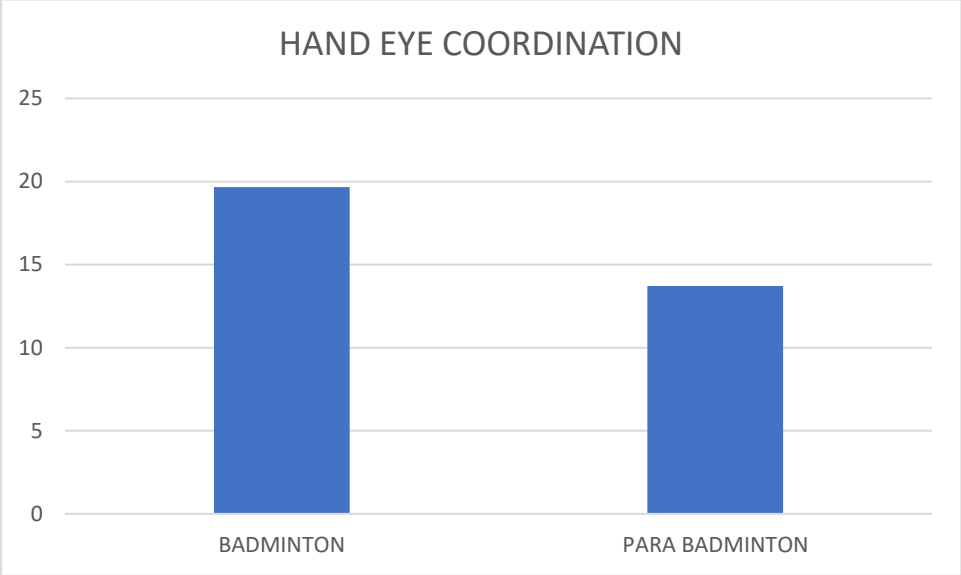

Figure 3: COMPARISION OF HAND EYE COORDINATION

The Hand eye coordination data was obtained from the Alternate hand wall toss test. The independent t test was used to calculate between the groups. The significance i.e., p value was set to <0.05. The results showed there was significant difference between the groups. The Group A i.e., Badminton Players group showed better hand eye coordination than Group B i.e., Para-Badminton Players.

DISCUSSION

The study aimed to examine and compare Visual Reaction Time, movement speed and Hand-eye coordination in Badminton and Para-Badminton Players. The results were highly significant i.e., The Badminton players had better Simple reaction time, choice reaction time, movement speed and hand eye coordination than the para-badminton players.

A study done by Sushil P Dube Et.al suggest that shorter reaction time in badminton players may result from regular training and its effects such as better muscular coordination, improved concentration, and alertness to external environment on their bodies.[13] One crucial way to examine someone's stimulus-to-response speed is through their reaction time, which incorporates both coordinated peripheral response and cerebral processing. Shuming Wang et al. tested the precision of movement as well as the reaction time and proved that badminton players displayed quicker and more precise reactions than normal individuals of their age.[12]

Many experts believe that speed and its variants, such as simple response time, are crucial in badminton and should be cultivated to the fullest extent. This is because of badminton's Continuous developments and regulation revisions, which have enhanced the game's pace, diversity, and training efficiency.

The hand-eye coordination means the integrated use of the eyes, arms, hands and fingers to perform hand movements directed towards the purpose.[20] The hand-eye coordination is especially important in individual

sports as well as in team sports in which the motor hand skills are used together. It has been proven that the hand skills are important in jobs, which require sensitivity and rough-muscle strength.[21]Good Hand-eye coordination increases the skills of the player to perform the complex movement, and to reply to the external stimuli in an efficient way.[22]

According to a study done by Varun Malhotra Et.al states that Physical Exercise Helps improve Cognitive function. It further says that they can be influenced by several factors such as age, gender, left vs right handedness, practice, exercise, etc.[23] In the present study it was observed that the Badminton players group i.e., group A was having more exercise hours per day compared to the Para-Badminton Players Group i.e., Group B. This might be one of the reasons for Badminton Players having better Movement Speed and Hand eye Coordination as compared to the Para-Badminton Players Although both had better Outcomes.

This study done is to asses and compare Visual Reaction Time, movement speed and Hand-eye coordination in Badminton and Para-Badminton Players which will help to improve the knowledge into the field of para-badminton and eventually para-sports. This will help to assess the parameters where the players i.e., both badminton players and para-badminton players need to improve. This will give feedback not just to the players but to the coaches, physiotherapist, strength and conditioning coaches, etc to plan and improve in the right direction. Hence improving the game of the players and taking the sport to the next level.

CONCLUSION

This Study concluded that the badminton players had better reaction time, movement speed and hand eye coordination than para-badminton players.

The findings of this study offer helpful information for badminton and para-badminton coaches, trainers, and sporting organisations. The results emphasise the need for specialised training plans and modifications catered to the particular requirements of para-badminton players. We can promote inclusivity and equality in sports, enabling para-badminton players to achieve at their best and take full advantage of the game by recognising and addressing the various difficulties and disadvantages they encounter.

CLINICAL IMPLICATION

Comparing the visual reaction time, hand-eye coordination, and movement speed of badminton and para-badminton players can provide insights into the field of para-sports also about the physical abilities and limitations of para-badminton players.

This research can help coaches and trainers to develop appropriate training programs and adaptations for para-badminton players to improve their performance. It can also promote inclusion and equality in sports by recognizing the skills and abilities of para-badminton players.

REFERENCE

1. Deep V, Patil AM. Effect of mat Pilates versus traditional plank on core muscle strength, balance and agility in elite badminton players: A randomised clinical trial. changes. 2020;3:5.
2. Akbari M, Dlis F, Widiastuti W. The Effect at Muscle Power Arm, Hand-Eye Coordination, Flexibility and Self Confidence Upon Badminton Smash Skill. Jipes-Journal of Indonesian Physical Education and Sport. 2018 Jul 30;4(1):57-64.
3. Deary IJ, Liewald D, Nissan J. A free, easy-to-use, computer-based simple and four-choice reaction time programme: the Deary-Liewald reaction time task. Behavior research methods. 2011 Mar;43(1):258-68.
4. Yüksel MF, Tunç GT. Examining the reaction times of international level badminton players under 15. Sports. 2018 Mar 5;6(1):20.
5. Mohd Jamali MN, Selvanayagam VS, A Hamid MS, Yusof A. Prevalence, patterns and factors associated with injury: comparison between elite Malaysian able-bodied and para-badminton players. The Physician and sportsmedicine. 2021 Jun 30:1-7.
6. Ak E, Koçak S. Coincidence-anticipation timing and reaction time in youth tennis and table tennis players. Perceptual and motor skills. 2010 Jun;110(3):879-87.
7. Kaipainen M. Integration of disabled and able-bodied sport activities in badminton: a case study of the Finnish para-badminton.
8. Vancampfort D, Hallgren M, Vandael H, Probst M, Stubbs B, Raymaekers S, Van Damme T. Test-retest reliability and clinical

correlates of the Eurofit test battery in people with alcohol use disorders. Psychiatry research. 2019 Jan 1;271:208-13.

9. Tsigilis N, Douda H, Tokmakidis SP. Test-retest reliability of the Eurofit test battery administered to university students. Perceptual and motor skills. 2002 Dec;95(3_suppl):1295-300.
10. Pratama F. The Correlation of Arm Muscle Explosive Power, Leg Muscle Explosive Power, and Hand-Eye Coordination Towards the Smash of Badminton Player. In1st International Conference of Physical Education (ICPE 2019) 2020 Aug 6 (pp. 135-139). Atlantis Press.
11. Elgendi M, Picon F, Magnenat-Thalmann N, Abbott D. Arm movement speed assessment via a Kinect camera: a preliminary study in healthy subjects. Biomedical engineering online. 2014 Dec;13(1):1-4.
12. Bańkosz Z, Nawara H, Ociepa M. Assessment of simple reaction time in badminton players.2013
13. Dube SP, Mungal SU, Kulkarni MB. Simple visual reaction time in badminton players: a comparative study. National Journal of Physiology, Pharmacy and Pharmacology. 1970 Jan 1;5(1):18-
14. Rasch PJ. Relationship of arm strength, weight, and length to speed of arm movement. Research Quarterly. American Association for Health, Physical Education and Recreation. 1954 Oct 1;25(3):328-32.

15. Senthil KB, Subbaiah S, Arun B, Alagesan J. Comparison of hand eye coordination on individuals with and without cervical radiating pain. Biomedicine. 2022 May 1;42(2):359-62.
16. Yüksel MF. Examination of the physical profiles of physically handicapped female badminton players. Turkish Journal of Sport and Exercise. 2018;20(1):1-8
17. KALRA S, Yadav J, Pawaria S. Effect of Pilates on Lower Limb Strength, Dynamic Balance, Agility and Coordination Skills in Aspiring State Level Badminton Players. Journal of Clinical & Diagnostic Research. 2019 Jul 1;13(7).
18. J.Y. Fang, T.L. Davis, in Reference Module in Neuroscience and Biobehavioral Psychology, 2017
19. Duble CS. Eye-Hand Coordination Ability and Reaction Time of Table Tennis and Badminton Players of RTM Nagpur University.
20. Tsang, William W.N. & Fong, Shirley & Cheng, Yoyo & Daswani, Dinisha & Lau, Hiu Yan & Lun, Carina & Ng, Shamay. (2014). The Effect of Vestibular Stimulation on Eye-Hand Coordination and Postural Control in Elite Basketball Players. American Journal of Sports Science. 2. 17. 10.11648/j.ajss.20140202.12.
21. Menevse A.Examination of the relationship between muscle palmaris longus and reaction time. World Applied Sciences Journal, 2011,12(1): 114-118
22. Paul, Maman & Biswas, Sandeep & Sandhu, Jaspal. (2011). ROLE OF SPORTS VISION AND EYE HAND COORDINATION TRAINING

IN PERFORMANCE OF TABLE TENNIS PLAYERS. Brazilian Journal of Biomotricity. 106-116.

23. Malhotra, Varun & Goel, Neera & Ushadhar, Ushadhar & Tripathi, Yogesh & Garg, Rinku. (2015). EXERCISE AND REACTION TIMES. Journal of Evolution of Medical and Dental Sciences. 4. 4277-4281. 10.14260/jemds/2015/618.

ANNEXURE

CONSENT FORM

I have been informed by Mr. Vishal Deep; pursuing MPT (Sports) conducting a scientific study guided by Prof. Joseph Oliver Raj, Dean, Department of Physiotherapy, ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR.

I have no objection and will be a part of that group. I also understand that the study does not negatively affect my health. I understand that the information produced by the study will become a part of the institute's record and will be utilized as per the institute's confidentiality regulations. I am also aware that the data might be used for medical literature and teaching purposes, but all my personal details will be kept confidential.

I am well informed to ask as many questions as I can to Mr. Vishal Deep during the study or later. I wish to discuss my participation and concerns regarding this study with a person not directly involved.

I understand that my assent is voluntary and I reserve the right to withdraw or discontinue participation in the study at any point of time during the study.

I have explained to Mr/Miss/Mrs_____ the purpose of the research, and the procedure required in the language he/she could understand to the best of my ability.

(Investigator) (Date)

I confirm that Mr. Vishal Deep (Investigator) has explained to me in the language I can understand, the purpose of the study and the procedure. Therefore, I agree to give my assent for participation as a subject in this study and I will be accountable for the decisions.

(Signature) (Date)

(Place)

Data collection sheet

Group:_____
Participant No:_____

Name:

Age:

Gender: Male ☐ Female☐ Other ☐

Dominance:

Address:

Contact number:

Duration of Playing Badminton:_____yrs

Max Level Played:

Outcome measures:

Test	Scores					
	Right			Left		
Reaction Time (msec)						
Plate Tap Test (no)						
Ball Toss and Catch Test (no)						

_____ _____

Name and Sign of Participant Sign of Investigator

Place:_____

Date:_____

Master Chart

Sr.no(Bad)	Age	Age Para	Gender	Gender Para	BMI	BMI Para	SRT	SRT Para	CRT	CRT Para	Movement Speed	Movement Speed Par	and-eye Coordinatio	and Eye Coordination Pa
1	19	23	0	0	22.6	22.4	311.9	641.28	561.785714	861.7857	12.35	17.5	18	10
2	20	19	0	0	21.3	21.9	337.5	837.35	607.153846	907.1538	15.11	20.18	17	14
3	21	20	0	0	23.1	23.3	264.3	674.13	397.733333	697.7333	8.61	21.46	19	18
4	18	22	0	0	24.5	22.1	267.1	777.11	410.076923	710.0769	9.24	23.12	26	15
5	23	18	0	1	22.1	20.8	312.2	892.62	499.071429	799.0714	9.98	18.27	23	12
6	20	18	1	0	19.2	23.8	322.7	782.67	400.230769	700.2308	12.05	26.4	21	13
7	21	25	1	0	20.1	21.5	427	827.76	670.571429	970.5714	13.06	24.05	16	17
8	19	20	1	0	20.7	22.7	282.7	782.57	515.153846	815.1538	12.2	19.53	17	11
9	25	19	0	0	20.8	21.4	270.7	770.87	482.6	782.6	9.23	27.22	23	9
10	22	24	0	0	21.9	23.2	282.1	782.41	471.375	771.375	9.9	18.48	20	16
11	18	21	1	0	19.8	22.3	317.6	817.76	469.285714	769.2857	11.2	20.59	23	19
12	23	25	1	0	21.5	21.1	246.4	746.64	415.3125	715.3125	8.43	22.14	26	10
13	19	18	0	0	23.4	22.5	332.3	832.53	514.75	814.75	12.39	25.36	19	14
14	25	23	1	1	20.3	22.2	328.6	728.46	442.733333	742.7333	11.99	21.05	19	12
15	22	19	1	1	21.9	19.9	375.7	775.77	448.307692	748.3077	10.69	19.17	17	9
16	20	20	1	1	19.6	21.8	299.1	899.31	579.733333	879.7333	10.83	26.58	16	13
17	19	22	1	1	20.9	20.6	329.4	729.44	473.1875	773.1875	13.42	23.45	18	17
18	24	18	1	1	19.4	19.7	267	667.56	501.133333	801.1333	10.86	18.59	22	11
19	18	25	1	1	21.1	22.5	282.8	682.38	542	842	12.51	20.37	17	16
20	20	20	0	1	22.2	20.4	342.6	742.56	431.571429	731.5714	10.6	22.3	16	18
21	21	19	1	1	20.5	21.3	423.12	823.42	601.12	901.12	15.23	27.1	19	15
22	24	24	0	1	21.6	19.3	411.88	811.88	577.546	877.546	14.22	19.42	19	19
23	18	21	0	1	22.9	22.1	321.21	821.41	414.744	714.744	12.22	24.51	21	10
24	21	25	0	1	23.7	21.4	378.33	878.53	478.986	778.986	13.1	21.2	20	11