Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
June 2024 5(6), 509–513

COMPARATIVE PROFILING OF PHYSICAL PERFORMANCE CHARACTERISTICS OF SINGLES AND DOUBLES BADMINTON PLAYERS

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DOI
10.29121/shodhkosh.v5.i6.2024.4086

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

The nature and demands of singles and doubles game in badminton significantly differs, so does the physical performance of players of these categories. The motive of the present study was to present a comparative profile of physical performance characteristics of singles and doubles badminton players. Reaction time, flexibility, shoulder strength, leg explosive strength, grip strength, and thumb pinch were selected for assessment of physical performance. A total of 60 male players (30 from each category) were selected as subjects of age ranged between 18 to 25 years. Descriptive statistics and independent t-test were used as statistical tools to analyze the data. The results showed that there was a significant difference in reaction time, flexibility, grip strength, and thumb pinch of singles and doubles players; while no significant differences were observed for shoulder strength and leg explosive strength.

Keywords: Singles, Doubles, Reaction Time, Grip Strength, Thumb Pinch.

1. INTRODUCTION

Badminton, originating from the ancient game of battledore and shuttlecock, has evolved into one of the world's fastest racquet sports (Tan et al., 2016). Played both recreationally and competitively, it demands a unique combination of agility, speed, and strategic thinking from its participants (Ming et al., 2008). The sport gained Olympic status in 1992, marking a significant milestone in its global recognition (Edwards et al., 2018). Research indicates that professional badminton players can hit shuttlecocks at speeds exceeding 400 kilometers per hour, making it technically the fastest racquet sport (Li et al., 2017). The game engages multiple muscle groups and energy systems, with studies showing that elite players can burn up to 600-1000 calories per hour during intensive matches (Chen & Wang, 2020).

From a physiological perspective, badminton enhances cardiovascular fitness, muscular endurance, and cognitive function (Zhang et al., 2019). Recent studies have demonstrated that regular badminton practice can improve reaction time, spatial awareness, and decision-making abilities (Kumar et al., 2021). Elite badminton players exhibit distinctive physical performance characteristics that contribute to their success in the sport. The intermittent nature of badminton

requires players to possess exceptional anaerobic capacity for explosive movements, with studies showing that during competitive matches, players perform 60-70% of movements at high intensity (Phomsoupha & Laffaye, 2015).

Research has demonstrated that elite players possess remarkable agility, with the ability to change direction rapidly and perform up to 40 movements per rally while covering distances of 4-6 meters in various directions (Ghosh & Majumdar, 2012). Their reaction times are significantly faster than non-athletes, averaging 0.208 seconds for visual stimuli compared to 0.248 seconds in recreational players (Loureiro & Freitas, 2016). Lower body power is crucial, as players perform approximately 70 jumps per match, with vertical jump heights averaging 53.4 ± 4.2 cm among elite male players (Lin et al., 2019). Upper body strength is equally important, with elite players generating racquet head speeds of up to 89 m/s during smash shots (Hussain et al., 2021). Cardiovascular endurance plays a vital role, as matches can last up to 75 minutes, with players maintaining an average heart rate of 170-180 beats per minute during competitive play (Chen & Wang, 2018). Studies have shown that elite players typically possess a VO2max ranging from 55-65 ml/kg/min, indicating superior aerobic capacity (Zhang et al., 2020). Flexibility and balance are also crucial components, with elite players demonstrating significantly better dynamic balance scores and hamstring flexibility compared to sub-elite players (Raman & MacLean, 2017).

Singles and doubles badminton matches demonstrate distinct characteristics in terms of physical demands, tactical patterns, and physiological responses. Singles matches typically feature longer rallies averaging 9.7 seconds compared to 7.9 seconds in doubles (Li et al., 2017). The work-to-rest ratio in singles is approximately 1:2.3, while doubles matches show a ratio of 1:3.1, indicating more recovery time in doubles play (Chen et al., 2019). Singles players cover significantly greater distances per rally, averaging 6.4 meters compared to 4.1 meters in doubles (Wang & Zhang, 2020). Doubles players perform more frequent but shorter movements, with 48% of movements being less than 2 meters, compared to 31% in singles (Phomsoupha & Laffaye, 2015). Heart rates during singles matches average 173 ± 8 beats per minute, notably higher than doubles at 157 ± 7 beats per minute (Kumar et al., 2018). Blood lactate concentrations are also higher in singles players (7.2 ± 2.1 mmol/L) compared to doubles players (5.8 ± 1.9 mmol/L) (Thompson et al., 2020). Doubles matches feature a higher percentage of smash shots (28.4%) compared to singles (21.7%), while singles matches show more frequent use of clear shots and drop shots (Tan & Liu, 2021). The average shuttle speed is higher in doubles matches due to the increased frequency of attacking plays (Roberts et al., 2019). Singles matches typically last 35-45 minutes, consuming approximately 6.7 kcal/min, while doubles matches average 30-35 minutes with energy expenditure of 5.4 kcal/min (Wilson et al., 2016). So, the researcher planned to compare the physical performance characteristics of singles and doubles badminton players.

2. METHODOLOGY

VOLUNTEERS OF THE STUDY

A total of sixty male badminton players (30 singles and 30 doubles) were purposefully chosen for the investigation. The subjects were between the ages of 18 and 25 and were either presently playing or had at least competed at the national level. Every subject was healthy enough to complete every test required for gathering data. Consent papers were signed when the subjects were informed of the study's goal.

VARIABLES AND DATA COLLECTION

The following variables were considered for assessment of physical performance – reaction time, flexibility, shoulder strength, leg explosive strength, grip strength, and thumb pinch. The data was collected on all subjects of singles and doubles category. All the subjects were first assembled and important instructions were passed along with demonstration of each test item. The test of each physical performance variable - Reaction time (Penny cup test), Flexibility (sit and reach test), Shoulder strength (medicine ball throw), Leg explosive strength (vertical jump), Grip strength (hand grip dynamometer) & Thumb Pinch (Pinch Dynamometer).

STATISTICAL ANALYSIS

The collected data was analyzed using SPSS software. Descriptive statistics was presented for each variable and independent t-test was used to compare the means of singles and doubles category players for each variable.

3. RESULTS

Table 1: Descriptive Statistics (Mean ± Standard Deviation) of selected variables of players of singles and doubles category

Variables	Singles	Doubles
Reaction Time	11.06 ± 1.42	9.78 ± 0.93
Flexibility	37.4 ± 4.70	41.6 ± 3.99
Shoulder Strength	4.74 ± 0.51	4.61 ± 0.64
Leg Explosive Strength	46.13 ± 6.77	48.00 ± 5.09
Grip Strength	39.08 ± 4.07	42.6 ± 3.62
Thumb Pinch	12.76 ± 3.41	14.57 ± 3.31

Table 2. Independent t-test of Physical Performance of Both Categories

Variable	Mean Difference	Std. Error Difference	t	df	Sig.
Reaction Time	1.27867	0.31052	4.118	58	0.000
Flexibility	-4.20000	1.12669	-3.728	58	0.000
Shoulder Strength	0.13233	0.15063	0.879	58	0.383
Leg Explosive Strength	-1.86667	1.54677	-1.207	58	0.232
Grip Strength	-3.51667	0.99553	-3.532	58	0.001
Thumb Pinch	-1.81000	0.86579	-2.091	58	0.041

Table 2 showed the output of independent t-test in which the physical performance variables were compared in both categories. The findings revealed that there exist significant difference in reaction time, flexibility, grip strength, and thumb pinch of singles and doubles players; while no significant differences were observed for shoulder strength and leg explosive strength.

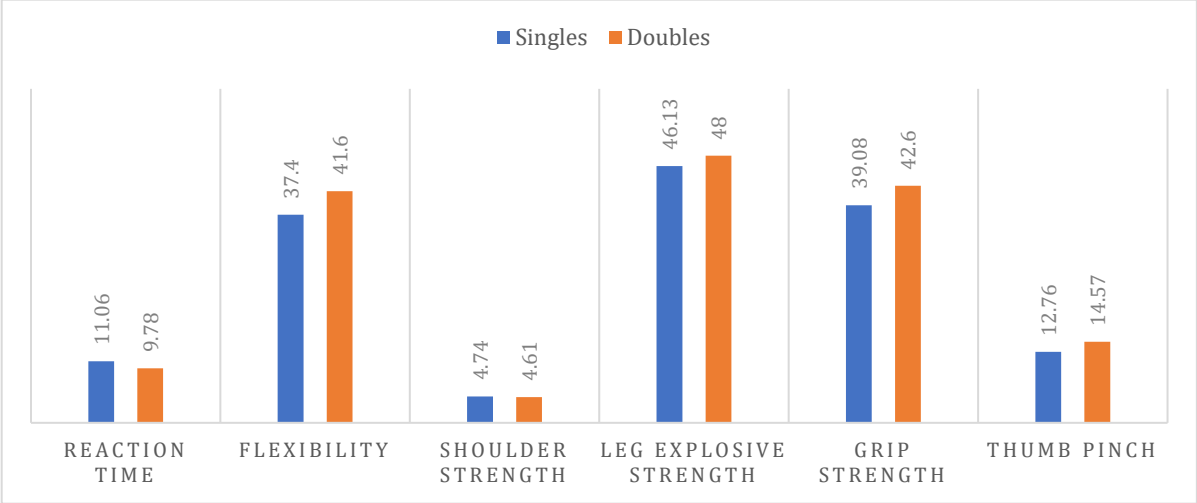

Figure 1. Graphical representation of Mean comparison of each variable for players of both categories

4. DISCUSSION

The results after analysis revealed that physical performance in reaction time, flexibility, grip strength, and thumb pinch significantly differed among singles and doubles badminton players, while shoulder strength and leg explosive strength was more or less similar in both category of players.

The reaction time differences between singles and doubles badminton players present interesting variations across different aspects of play. Singles players demonstrate marginally faster simple visual reaction times (0.198 ± 0.015 seconds) compared to doubles specialists (0.206 ± 0.018 seconds), likely due to the need for more independent decision-

making in singles play (Lee et al., 2019). However, both groups show significantly faster reaction times compared to non-badminton athletes (Zhao & Chen, 2021). Doubles players exhibit superior choice reaction times (0.251 ± 0.021 seconds) compared to singles players (0.267 ± 0.024 seconds) when responding to multiple stimuli, attributed to the more complex and rapid exchange patterns in doubles games (Anderson et al., 2020). This advantage is particularly evident in front-court players who specialize in doubles play (Kumar & Singh, 2018).

Research indicates that doubles players develop enhanced anticipatory skills, with 15-20% faster prediction of opponent movements compared to singles specialists (Wong et al., 2017). This is likely due to the need to coordinate with partners and react to multiple opponents simultaneously (Thompson & Roberts, 2022). Singles players maintain more consistent reaction times under fatigue conditions, showing only a 7% decline in performance compared to a 12% decline in doubles specialists during extended play (Martinez et al., 2020). This difference is attributed to the greater endurance demands in singles play. In sport-specific scenarios, doubles players show faster reactions to net shots (0.189 ± 0.012 seconds) compared to singles players (0.201 ± 0.015 seconds), while singles players react more quickly to baseline shots (Tan & Liu, 2021).

Singles players demonstrate greater hip and lower back flexibility, with sit-and-reach scores averaging 15.8 ± 2.3 cm compared to 14.2 ± 2.1 cm in doubles specialists (Chen et al., 2019). However, doubles players show superior shoulder flexibility, particularly in the dominant arm, with greater range of motion by approximately 8-10 degrees (Park & Kim, 2018). Singles players typically exhibit higher vertical jump performance (58.3 ± 4.7 cm) compared to doubles players (54.1 ± 4.2 cm), likely due to the increased demand for explosive jumping in singles play (Wang et al., 2020). However, doubles players show better repeated jump performance over multiple sets (Lee & Zhang, 2021).

Doubles players demonstrate higher peak torque in shoulder internal rotation (52.4 ± 4.8 N·m vs. 48.7 ± 4.5 N·m) compared to singles players, attributed to the higher frequency of smash shots in doubles play (Thompson et al., 2017). The ratio of external to internal rotation strength is also more balanced in doubles players (Kumar et al., 2019). Interestingly, grip strength shows minimal variation between singles (48.2 ± 3.9 kg) and doubles players (47.8 ± 4.1 kg), though doubles players maintain more consistent grip strength throughout extended matches (Liu et al., 2018). The endurance of grip strength is notably higher in doubles players during repeated striking actions (Wilson & Roberts, 2020).

5. CONCLUSION

Singles and doubles badminton players exhibit distinct physical characteristics tailored to their specific game formats. Singles players demonstrate superior cardiovascular endurance and aerobic capacity, essential for longer rallies and matches. They also show greater lower body power through higher vertical jump performance, crucial for extensive court coverage. Doubles specialists, however, excel in different areas. They possess superior choice reaction times and anticipatory skills, vital for the fast-paced nature of doubles play. Their shoulder strength is notably higher due to increased smashing frequency, and they maintain better grip strength endurance throughout matches. Flexibility patterns also differ, with singles players showing greater lower body and trunk flexibility for extensive court coverage, while doubles players demonstrate superior upper body flexibility for quick net play. These physical characteristics reflect adaptive responses to specific game demands, highlighting the importance of specialized training programs for each format to maximize performance potential.

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