PERFORMANCE CONTRIBUTING MATCH AND GAME VARIABLES IN ELITE AND YOUTH BADMINTON PLAYERS

By

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ABSTRACT

The aim of this study was to investigate the difference of the game structure and playing pattern between the Elite Level and Youth Level badminton players. A total of 14 matches including Semi-finals and Finals of International tournaments were selected.

The game structure variables selected for this study included match duration, game duration, rallies per game, shots per rally, rally length, rest time between rallies, ball in play in seconds, ball in play in percentage and work to rest ratio. Shots type and shot outcome were chosen for performance indicators of playing pattern.

Independent Sample T-test was used for the comparison of all variables between the Elite Level and Youth Level categories. There were statistically significant differences among the categories in match duration, game duration, shots per rally, ball in play in seconds, rally length, and rest time between rallies (p<0.05).

There were significant differences in mean distribution of lift shot, net shot, drop shot, lob shot and smash shot between the Elite Level and Youth Level categories (p<0.05).

In shot outcome, smash shot is the most successful shot with the highest number of winners while net shot ended up with the highest number of errors. Youth Level category had more winners and also errors compared to Elite Level but not significantly different.

In conclusion, there were differences in the game structure between the Elite Level and Youth Level categories of players. The information can help in improving the technical and tactical skills of the badminton players up to the international level.

ABSTRAK

Kajian ini dijalankan untuk menentukan perbezaan struktur dan corak permainan badminton dalam kalangan pemain bertaraf dunia antara kategori Tahap Elit dan Tahap Remaja. 14 perlawanan terdiri daripada peringkat separuh akhir dan akhir yang berlangsung di pertandingan antarabangsa telah dipilih untuk kajian ini.

Variabel bagi struktur permainan badminton termasuklah tempoh masa perlawanan, tempoh masa permainan, jumlah rally dalam setiap permainan, jumlah pukulan dalam setiap rally, tempoh masa setiap rally, masa rehat antara dua rally, masa permainan sebenar, peratusan masa permainan sebenar, dan nisbah jeda kerja kepada jeda rehat. Jenis pukulan dan hasil pukulan telah dipilih sebagai penunjuk prestasi untuk corak permainan badminton.

Independent Sample T-test telah digunakan untuk membandingkan semua varibel antara kategori Tahap Elit dan Tahap Remaja. Hasil analisis Independent Sample T-test menunjukkan bahawa wujudnya perbezaan yang signifikan bagi tempoh masa perlawanan. tempoh masa permainan, jumlah pukulan untuk setiap rally, tempoh masa setiap rally, masa rehat antara dua rally dan masa permainan sebenar (p < 0.05) antara kedua-dua kategori.

Selain itu, terdapat juga perbezaan yang signifikan dalam bilangan min pukulan antara kedua-dua kategori (p<0.05), antaranya adalah lift shot, net shot. drop shot, lob shot dan smash shot.

Pukulan smash shot merupakan pukulan yang paling banyak menyumbangkan mata, manakala pukulan net shot menghasilkan bilangan kesilapan yang terbanyak. Katgori Tahap Remaja memenangi lebih banyak markah dan juga membuat lebih kesilapan berbanding dengan kategori Tahap Elit tapi perbezaan tersebut tidak signifikan.

Kesimpulan, terdapat perbezaan struktur permainan badminton antara kategori Tahap Elit dan Tahap Remaja. Maklumat ini dapat memberi bantuan kepada pemaiin badminton bertaraf antarabangsa dari nsegi kemahiran teknikal dan taktikal.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Badminton is one of the most widely-played sports around the world. especially in Asian Region. The Badminton World Federation (BWF) founded in 1934 has now grown to over 172 member nations around the world. Since 1992 Barcelona Olympics, badminton had been included in the Summer Olympic Games program. Badminton is played in various categories according to gender and age group e.g., Men, Women. Junior Men, Junior Women and Veteran age group categories. Since badminton has increased its popularity after being included as official sport in Olympic Games only after 1992 Barcelona Olympic Games, research toward performance capacity of badminton players is still scarce. Besides that, the introduction of the new scoring system (21 point system) by BWF in 2006 had made the badminton game more interesting and shortened the playing time of the match, making it more intense. The gap in the standard among the players had been narrowed due to the new scoring system as stated by Roslim Hashim (former badminton player) in 2006.

Notational analysis is an objective way of feedback in which the performance is recorded so that the key elements of the performance can be analyzed in a valid and consistent manner (Hughes and Franks, 2008). Hughes (1998) had defined the application of notation analysis into 5 different areas which are tactical evaluation, technical evaluation.

analysis of movement, development of a database and modelling and for the educational use with both coaches and players. Tactical evaluation, technical evaluation and analysis of movement will be the main focus of this study.

The comparison of playing patterns of the players in the competition can be used for the tactical evaluation for the purpose to find out the difference between the winner and loser. The winners and errors are powerful indicators of technical competence and have always been used in research for the technical indicators in notational analysis of racket sports (Hughes, 2004). The movement of the player inside the court during competition or the pattern of movement concerned with the serve and volley tactics can be considered as the indicator of movement analysis. Besides that, movement analysis is not restricted to on ball timing, it also included work time, rest time, work to rest ratio and all the activities performed during the competition. Movement analysis plays an important role in order to help the junior players who are finding transition from junior game to senior sport difficult due to the greater physicality of the senior game (Hughes & Bartlett, 2002), so that they can achieve their performance in the elite level.

In addition, this study also can provide information regarding the playing pattern of the elite players and the junior players during the competition. The comparison between the winner and loser during the match can be done through the technical evaluation and also the effort of player put toward the game which can be well seen.

1.2 Problem Statement

The statistical information for the badminton match that is being live broadcasted in the TV channels does not carry much information related to the technical evaluation. Normally, the statistical information that has been shown is game time and score point, and sometime includes the shuttle speed. This information does not help the audience much to have more understanding of the game. Compared with other racket sports such as tennis, statistical information like serving percentage and unforced errors are always shown during the live broadcasting of the match. This statistical information could help the audience to realize more towards the performance of the players as compared with watching the scored points.

Notational analysis had been used by the coaches to help them analyse the performance of the players during the match. Nowadays, with the rapid development of the computer technology and the video technology, the demand toward notational analysis had been rising and those technologies can help the analysis to be done in a faster and more objective manner. In near future, detailed objective analysis of competition and the instantaneous presentation of the the important aspect of actions can be done easily through the integration of these technological development.

However, performance analysis is typically targeting more of the elite players as compared with their junior counterparts. The comparison between the game structure and playing pattern between the elite and junior players can help the juniors to improve their weaknesses and can help them to adapt themselves with the game through modifications of the training programme in order to rectify the observed weaknesses.

In the history of BWF World Junior Championship Men Singles event, only 3 out of 15 players eventually managed to win the BWF World Championship Men Singles. Lin Dan, the strongest badminton player in Men Singles event have never won the World Junior Championship but had managed to win 5 times in BWF World Championship Men Singles. This shows that the playing patterns and game structure in elite level and junior level might have some important differences.

Therefore, notational analysis is important to apply to the sport of badminton. With the results from the notational analysis, the coaches can help the players to progress from age group category to open category of the game.

1.3 Research Objectives

1.3.1 General Objectives

1) To determine and quantify the game structure of men's single badminton players

2) To determine and quantify the playing pattern of men's single badminton players in terms of preferred strokes and winner to error ratio.

1.3.2 Specific Objectives

 To determine the game structure of Elite level men's singles badminton players and Youth level men's singles badminton players

2) To determine the difference in the game structure between the two categories of men's singles badminton player if any

3) To determine the playing pattern of Elite level men's singles badminton player and Youth level men's singles badminton players

4) To determine the difference in the playing pattern between the two categories of men's singles badminton player if any

1.4 Research Hypothesis

1) (H₀): There would be no significant difference in the game structure between two different categories of world men's singles badminton players

(H_A): There would be significant difference in the game structure between two different categories of world men's singles badminton players

2) (H₀): There would be no significant differences in the playing pattern between two different categories of world men's singles badminton players

 (H_A) : There would be significant differences in the playing pattern between two different categories of world men's singles badminton players

1.5 Significance of the Study

This study helps to provide the quantitative data on match performance structure and playing pattern of badminton players, in general and for categories, namely Top Level Elite category and Youth category, to the coaches and scientists. The findings of the study can be useful and significant to the coaches and players for the training process and competitions. The results can be very useful when coaches are planning tactics and strategies on how their players might play in the upcoming matches.

CHAPTER 2

LITERATURE REVIEW

2.1 Notational Analysis

Scientific research and analysis of the performance toward the racket sport has been increased in the past few decades. This is due to the racket sport becoming more commercialized with more people starting to play and watch the racket sports competitions. The purpose of the research and analysis of performance is to help to improve the players' skills and performance during the game so that the game becomes more interesting and attract more people to watch it and play it.

Currently many researchers and performance analyst use a method known as notational analysis to do performance analysis for the players. Notational analysis is a method that helps recording the match performance and analyzing the movements of the players during the game. This method provides large amounts of data which is related to the movement, action, outcome, game time of the player during the game.

Traditional system of notational analysis was concerned with the statistical analysis of the event and used to be performed manually. Downey (1973) published the first publication on comprehensive sport notation in Britain which is related to lawn tennis. (Ridley, 2003). Downey (1973) notational method which was quite intricate had managed to record the variables such as shot used, position and also catered for type of spin used in particular shot (Ridley, 2003). Downey (1973) notation method has become the useful base for the development of analysis system for other racket sports. The hand notational analysis system did have some disadvantage as it took long time to learn and to use the system. Secondly, it takes long time for the analysing part.

With the advance development of the computer technology, the analyses process became more detailed and related to the large amount of data. With the aid of the computer system, database can be created in the ways that all the analysis data is being stored in the computer and can be retrieved when needed (Ridley, 2003).

According to Hughes (2004), the application of the notational analysis have been defined as to be used for the purpose of:

- Tactical evaluation
- Technical evaluation
- Analysis of movement
- Development of database and modelling
- Educational use with both coaches and players

2.2 Badminton

Badminton is one of the major racket sports in the world played by either two opposing player or two opposing pairs in the court with the width of 20 feet for double, 17 feet for singles and the length of 44 feet. The scoring system in badminton nowadays is the 21 point system which has been introduced in year 2006 by the BWF organization. Player scored the point by landing the shuttlecock to their opposition court in where their opponent cannot return the shuttlecock back. Badminton had been considered as the faster racket sport in the world with the higher speed of the shuttle can reach 421km/h, the Guinness Record for the faster smash by Tan Boon Heong at year 2009 during racket testing while the official record in the BWF is 332km/h by Fu Haifeng during 2005 Sudirman Cup (Micheal, 2009).

Badminton has likely originated in India and was known as "Poona" in India that time. During the 19th century. India was colonized by British, the game then brought to United Kingdom of Britain. The game then spread to other countries which were under colonization of the British including Malaysia. In the year 1898, the oldest badminton competition All England Badminton Open Championship had been held at Buckingham Gate. England. In 1934, the International Badminton Federation was founded with nine member nations. In 2006, International Badminton Federation changed the name to the Badminton World Federation (BWF). The member nations increased and now it got total 176 member nations. The top achievement in badminton will be the Thomas Cup and Uber Cup for the team event, while for individual event those will be the Olympic Badminton title and World Championship title.

In the year 2007, BWF implement the BWF Super Series, a series of elite badminton tournaments. There are 12 tournaments around the world in the season of Super Series, including 5 Premier Series (introduced in year 2011). The top 8 standing in the ranking will be invited to join the Super Series Masters Finals in the end of the year. There are other tournaments around the world such as Grand Prix Gold and International Challenge.

2.3 Game Structure of Badminton

Read and Edwards (1992) classified formal games into three categories: Net and wall games, invasion games, and striking and fielding games. Each of the categories above has their own specific rules. The rules determine the ending point of each category. Due to the different rules of the each categories, the performance indicator for each category are also different.



Figure 2.1. Game classification (Read& Edward, 1992)

Racket sport is under net and wall games category. Net games have 3 sub-categories which is no volley games, bounce and volley games and no bounce games, while wall games just consist of one category, that is bounce and volley games (Hughes & Bartlett, 2002). Badminton belongs to the no bounce games category. Compared with other racket sports, badminton is different with others as badminton doesn't allow the bounce movement of the ball. As the shuttle fall on the court, the players will lose the point. Badminton player needs to have faster movement and high agility so that they can return the ball back before the shuttle fall down on the court.



Figure 2.2. Sub-categorization of net and wall games, with some common examples (Hughes & Bartlett, 2002.)

Performance indicator is the key element that used by the performance analysts to analyse the performance of the player. Different sports use different performance indicators. For example, in badminton singles event, placement of the shuttle play more important role compared to the smashing power of the player in comparison with the doubles event. The game outcome, however is not only dependent on the performance indicators, it also depends on many other factors.



Figure 2.3. Some factors that contribute to success or improved performance in net and wall games (Hughes & Bartlett, 2002)

2.4 Playing Pattern in Badminton

Notational analysis had been widely used to analyse the playing pattern of the sports. Badminton has been considered as the fastest racket sports in the world and is a dynamic sport which requires the player to move around the court.

In order to win a badminton match, an offensive strategy must be implemented by the player. In the research(Hong & Tong, 2000), it is stated that male badminton singles player prefers to serve low-short shots and also forecourt shots in order to play offensive. Smash shots were the most frequently used shots to kill and win the rally, but it is not the most effective shot as compared to net (Hong & Tong, 2000).

CHAPTER 3

METHODOLOGY

3.1 Sample Size

The video recordings of the matches in BWF International events were collected throughout the year 2014. Only the matches from Semi Finals and Final were taken into consideration for further analysis. Video recordings of the total of 14 matches were collected with total 34 games eventually analysed. The games were inclusive Elite Level and Youth Level. The study was delimited to only male badminton players.

3.2 Procedure

Analyses of all the games were done using Elite Sport Analysis-FOCUS-X2 PRO software in the post-match mode. The software allows the user to view the video and also record the "events" (actions) that they are interested in by using the Category Set facility in the software. The researcher views video of a game performance and then records the actions using the Category Set that the researcher himself creates.

After that, the data of events (actions) were extracted from the matrix and exported to spreadsheet in Microsoft Excel. It was followed by the calculation of the game structure and shots type variables for each game and match.

3.3 Game Structure Variables

Nine game structure variables were selected for this study including match duration, game duration, rallies per set, shots per rally, rally length, rest time between rallies, ball in play, ball in play (%) and work to rest ratio.

Since one game represents the enclosed unit of the play and is not related to other games in the match neither by duration nor by results (Vuckovic et al, 2005), all variables were studied on the game level except match duration.

Hence. game duration, rallies per game, shots per rally, rally length, rest time between rallies, ball in play, ball in play in percentage, placement of the ball, ball placement percentage and work to rest ratio are game derived variables (per game data/collected from each game), whereas match duration is match related variable (per match data/collected from each match).

3.4 Terms and Definitions

Description of the variables has been shown as below:

- Match duration (s): the total duration of every game in a match. The resting time between sets was not taken into consideration for analysis. Match duration depends on the number of games the players played and can vary from two to three games in a match.
- Game duration (s): the duration of the particular game. Started during the beginning of the game when the first player starts to serve until the last point end in a game.
- Rallies per game: number of rallies in a game.
- Shots per rally: number of shots in a rally.
- Rally length: duration of a rally from the beginning of the rally started until the rally ends.
- Ball in play (s): real playing time in a game presented in seconds. It is the cumulative of the rally time in a game.
- Ball in play (%): real playing presented in percentage. It is the ratio of total real playing time to game duration in percentage.

Ball in play (%) = (total rallies time per game / game duration) x 100%

• Work to rest ratio: ratio of playing time to resting time in a game.

Work to rest ratio = total rallies time per game/ total rest time per game

3.5 Stroke Type Variables

The following stroke type categories were used to analyse the actions of the player during the game:

- Service: the player serves the ball to start the rally.
- Lift shot: a defensive shot to lift the shuttle to the opponent backcourt area in the own frontcourt or midcourt area.
- Drop shot: an attacking shot that lands in the opponent frontcourt area, as close to the net as possible with the intension to move the opponent to the frontcourt and creating space in the midcourt and rear court area.
- Drive shot: an attacking shot when the shuttle has fallen too low for it to be returned with a smash. The height of the shuttle should be between the shoulder and knee height.
- Smash shot: an attacking shot to hit the shuttle down hard and fast with the intention to end a rally.
- Net shot: a shot is played around net area back to opponent net area.
- Lob shot: a shot to return the shuttle to the backcourt of the opponent.

3.6 Shots Outcome Variables

Shot outcomes were divided into three categories:

- Winner: a rally ending shot where the shuttle landed the opponent court area and not hit by the opponent.
- Error: a rally ending shot where the shuttle landed outside the opponent court or goes into net.
- Winner to error ratio: ratio of number of winners to number of errors in a game
 Winner to error ratio= total number of winners per game/ total number of errors
 per game

3.7 Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 21.0 software was used to analyse the data collected in this study. The result of variables for each match and game were exported from spreadsheets in Microsoft Excel to SPSS for analysis.

Descriptive statistics were used to report the mean and standard deviation for each variable. The descriptive statistics were reported the mean and standard deviation for each variable for Elite Level and Youth Level respectively. Independent Sample T-test was used for the comparison of variables between two categories to determine if there were any significant differences between Elite Level and Youth Level. A level of significance at p<0.05 was used for all the statistical analyses.

CHAPTER 4

RESULTS

4.1 Game Structure Analysis

4.1.1 Game Structure for Elite Level Category

A total of 20 games out of 8 matches in Elite Level (EL) category were analysed. The results are presented in Table 4.1.

Variables	М	SD	Skewness	Kurtosis	Min	Max
Game ^a						
Game duration (s)	1449.20	435.65	0.60	- 0.24	920.00	2472.00
Rallies per game	35.15	5.15	0.25	- 0.34	26.00	46.00
Shots per rally	12.34	8.65	1.31	2.06	1.00	52.00
Ball in play (s)	418.90	102.72	0.10	- 0.97	264.00	601.00
Ball in play (%)	29.52	3.24	- 0.05	0.14	23.36	36.39
Rally length (s)	11.92	8.04	1.38	2.25	1.00	50.00
Rest time between rallies						
(s)	1030.30	406.94	0.42	- 0.81	394.00	1871.00
Work-rest ratio	0.42	0.07	0.22	0.40	0.30	0.57
Match ^b						
Match duration (s)	3623.00	943.58	- 1.17	0.21	1906.00	4551.00

Table 4.1 Game variables descriptive statistics in Elite Players

Note: ${}^{a}n=20$. ${}^{b}n=8$

For Elite Level, the mean for the game duration is 1449.20s (SD = 436.65) or

equivalent to 24.15 ± 7.25 min, 35.15 (SD = 5.15) rallies per game, 12.34 (SD = 8.65) shots per rally, ball in play of 418.90s (SD = 102.72) or equivalent to 6.98 ± 1.71 min, or 29.52% (SD = 3.24) of game duration per game, rally length of 11.92s (SD = 8.04), rest time between rallies of 1030.30s (SD = 406.94) or equivalent to 17.17 ± 6.78 min. work-rest ratio was 0.42 (SD = 0.07) and match duration of 3623s(SD=943.58) or equal to 60.38 ± 15.72 min.

4.1.2 Game structure for Youth Level category

A total 14 games out of 6 matches in Youth Level category were analyzed. The results are presented in the Table 4.2.

Variables	M	SD	Skewness	Kurtosis	Min	Max
Game ^a						
Game duration (s)	1066.29	152.00	0.63	0.39	841.00	1387.00
Rallies per game	37.71	3.60	0.39	1.42	31.00	46.00
Shots per rally	8.25	5.87	1.42	2.18	1.00	33.00
Ball in play (s)	306.71	62.72	- 0.48	- 0.64	197.00	397.00
Ball in play (%)	29.08	6.29	- 0.15	- 1.17	18.77	38.23
Rally length (s)	8.13	5.35	1.54	2.78	1.00	32.00
Rest time between						
rally	759.57	144.63	0.22	0.17	530.00	1058.00
Work-rest ratio	0.42	0.13	0.08	- 1.18	0.23	0.62
Match ^b Match duration (s)	2488.00	705.73	1.28	0.14	1971.00	3679.00

Table 4.2 Game variables descriptive statistics in Youth Players

Note: ${}^{a}n=14$. ${}^{b}n=6$

For Youth Level (YL), the mean for the game duration is 1066.29s (SD = 152.00) or equivalent to 17.77 ± 2.53 min, 37.71 (SD = 3.60) rallies per game, 8.25 (SD = 5.87) shots per rally, ball in play of 306.71s (SD = 62.72) or equivalent to 5.11 ± 1.04 min, or 29.08% (SD = 6.29) of game duration per game, rally length of 8.13s (SD = 5.35), rest time between rallies of 759.57s (SD = 144.63) or equivalent to 12.66 ± 2.41 min, work-rest ratio was 0.42 (SD = 0.13) and match duration of 2488s (SD=705.73) or equal to 41.47 ± 11.76 min.

4.1.3 Comparison of Game Structure between Elite Level and Youth Level Categories

According to (Kim, 2013), the z- scores of skewness or kurtosis larger than 1.96 when sample size (n<50), the null hypothesis of normality is rejected. Since the z-score of skewness or kurtosis for most game and match variables are within 1.96, therefore null hypothesis of normality failed to be rejected. There was homogeneity of variance as assessed by Levene's Test for Equality of variances.

Variables	Elite level		Youth level		Mean	1640	0
	M	SD	М	SD	(95% CI)	1147	ľ
Game Game duration (s)	1449.20	434.65	1066.29	152.00	382.91 (166.01.599.8 2)	3.63(25.10)	.001**
Rallies per game	35.15	5.15	37.71	3.60	-2.56 (-5.82.0.69)	-1.60(32)	.119
Shots per rally	12.34	8.65	8.25	5.87	4.09 (3.28.4.90)	9.87(1217.14)	<.001***
Ball in play (s)	419.90	101.94	306.71	62.72	113.16 (55.52.170.85)	4.00(31.60)	<.001***
Ball in play (%)	29.51	3.24	29.08	6.29	0.44 (-3.40,4.29)	0.24(17.86)	.811
Rally length (s)	11.92	8.04	8.13	5.35	3.79 (3.04.4.54)	9.91(1212.38	<.001***
Rest time between rallies (s)	1029.45	343.19	759.57	144.63	269.88 (93.67.446.09)	3.141(27.296)	.004**
Work to rest ratio	0.42	0.07	0.42	0.13	0.00139 (-0.08.0.08)	0.038(18.005)	.97
Match Match duration	3263.00	943.58	2488.00	705.73	1135.00 (131.78.2138. 22)	2.465(12)	.03*

Table 4.3 Comparative statistics of the variables in Elite and Youth players

Note.*p<0.05. **p<0.01. ***p<0.001