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PERFORMANCE ANALYSIS OF THE MALAYSIAN ELITE YOUTH SQUASH PLAYERS

J. F. L. Low*, M. Sankaravel , N. M. Rasyid and R. Y. Tengah

Faculty of Sports Science and Coaching, Universiti Pendidikan Sultan Idris,
35900 Tanjung Malim, Perak, Malaysia

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ABSTRACT

This study analysed the frequencies and court locations of squash strokes performed by elite Malaysian youth players before and during a national tournament. One hundred and seventy nine matches participated by six players (three men and three women) were analysed. Data collected via video recordings and coded post match using Studiocode® analysis software. The straight and cross court drives were the most frequent strokes used by both genders, with more on the backhand side. The drop shot and straight drives contributed to most winners for the men and women respectively. Most winners were produced by the players when they occupied the middle areas of the court. The areas that resulted most errors were the four corners of the court for the men whilst the women was on their backhand side areas. Objective feedback on the performance prior to a major competition provided some positive results.

Author Correspondence, e-mail: jeffrey@fsskj.upsi.edu.my

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1. INTRODUCTION

Objective feedback is essential to elicit modification of behaviour, especially in the context of sport skill acquisition. Augmented feedback complements the intrinsic information (i.e., sensory organs) obtained within the individual on the outcomes of their performance [1]. Information provided to athletes about their own performance is one of the most important variables affecting skill learning. Schmidt [2] stressed that knowledge about the proficiency on performing a particular skill is critical to the learning process, as failure to do so or to the extent of providing irrelevant feedback may prevent learning from taking place. Magill and Anderson [3] further expounded that precise and task-relevant information provided at the correct time would yield significantly more benefits to the individual than information that is imprecise, general in nature and scheduled inconsistently. The advancement of technology has improved the provision of such information, particularly in sport. Play back through video recordings of performance and subsequent systematic observation and analysis tools are essential methods that could provide effective feedback. Notational or performance analysis is the process of recording and analyzing the techniques, tactics and patterns of play of an event [4]. Computerised performance analysis systems have enabled coaches and athletes to analyse not only the athletes' own performance but the opponents' techniques and tactics and in 'real time' as well [5]. The advantages of this system are they enable large sets of data collected to be processed very quickly and effortlessly. The interfacing of computers with video television has enabled coaches to analyse the data with graphics and then editing the video for the viewing benefits of relevant parts or actions to both coaches and athletes. Team and individual sports like rugby, hockey, cricket and squash have the potential to benefit immensely from the development of such technology [6].

The first publication of a comprehensive racquet sport analysis was by Downey in 1970 when he developed a real time analysis of tennis matches [7]. Each stroke was recorded as the game progresses. A complete and detailed record of a match was written down and can then presented before the player and studied immediately. Downey concluded that notation and the subsequent analysis could provide valuable information about a player's strokes and deep insight into his movement behavior. Subsequently, Sanderson and Way [8] developed a notation system for squash. The researchers hand notated 17 different strokes played as well as court positions of the players during matches. However, the process took almost seven hours to analyze the data of a single match. Hughes [9] improved Sanderson and Way's method by developing a computerized analysis system. Data of strokes and players' positions were keyed into computer before producing detailed analyses of the distribution of winners and errors of the players.

The effects of the scoring changes in squash (traditional English system to the current 'point-per-rally') on players' performance were examined using performance analysis [10]. As a result, the rallies were slightly longer, although not significant, and more winners were produced compared to errors. Researchers began to use performance analysis tools to predict performance of players against identified opponents. McGarry and Franks [11] found that squash players produced the same patterns of responses when the players played same opponents but their patterns changed when faced with different opponents. The study concluded that such analysis can be used to prescribe strategies to the players for future competitions.

Researchers have utilized data from the analysis of performance to provide feedback to the squash players [12]. Results from the study showed the players improved their performance, reduced errors and increased winners in their subsequent matches. Technological advancement in performance analysis has enabled huge databases of performance profiles of players, which includes tactical evaluation, technical evaluation, movement analysis and modelling [13]. The main purpose of scientific analysis of sport performance is to advance the understanding of human behaviour via objective methods. Intriguing behaviours of players in different context (easy versus hard matches, preliminary versus finals) could be examined [14]. Study comparing British junior tennis players against their European and American counterparts showed the British players played more strokes at the net and committed more unforced errors at the back of the court than others [15]. In squash, the study comparing elite U-17 and U-19 male squash players, the older age group matches showed to be more physically demanding in stamina and endurance than the younger counterparts, which were caused by greater maturity and patience [16]. The study also revealed that shots per match increases through the three groups, the cross drive was used economically producing high winner to error ratios, the U-19 utilized the drop negatively while the U-17 drop was irregular, lob and volley boast showed to be most negative shots [16]. Recently, a study by Ghani and Zainuddin [17] compared the stroke frequencies of three differing levels of Malaysian squash players showed the professional elite players had recorded significantly more forehand shots (n=2250) during games followed by the intermediate (n=1357) and the beginners (n=1139).

Performance analysis in racket sports has advanced using computerised systems in recent years [e.g., 17-19]. For example, tactical factors such as dominating the T area by international players has been examined [19, 20]. However, data from most of the studies were collected during tournaments. The performance of some players may not provide substantial data due to early eliminations. Furthermore, the performance data were not used to provide feedback to the players. Provision of quantitative feedback has been proposed to improve significant performance in motor skills [3]. Therefore, utilising technology in sport via performance analysis to address the issue is warranted. To the best of the authors' knowledge, only one study has attempted to analyse the performance of Malaysian squash players [17, 21]. However, only the senior women's matches were analysed and the study was limited to analysing the forehand strokes, thus eluding a more complete picture of the Malaysian squash players' performance.

The main aim of this study was to analyse the performance of elite youth squash players in lead up matches prior to their participation in a major tournament and during the main tournament. Descriptive data of the emerging players were used to chart their performance. It was hypothesised that the drives would be the most frequent strokes used, more winning shots would occur in the middle of the court and performance would improve after receiving objective feedback.

2.0 MATERIALS AND METHOD

2.1 Participants

The participants of this study were the Kuala Lumpur squash team[2] selected to play in the Malaysian Games (SUKMA) in July 2016. The tournament was held biennially and limited to under-21 years of age. The performance of three men (mean age 20.4; SD=.6) and three women (mean age 15.6; SD=1.4) of the team were recorded and analysed before (practice matches and other local tournaments) and during the SUKMA squash tournament. A total of 179 matches (men = 92 matches; women = 87 matches) were analysed. Ethics approval for the study were obtained from the university while consent for filming were procured from the team management and tournament organiser. Written consent and explanation of the study were obtained from the players observed. The study commenced six months before the actual tournament with 107 matches recorded and subsequently 82 matches during the tournament.

2.2 Apparatus and data processing

All matches were recorded using a digital video camera (Sony HDR-PJ820E, Japan). The camera was mounted on a tripod (Libec, Arizona, USA). The equipment was placed strategically behind the courts, elevated and unobstructed view of the players in action. All recorded matches were then be transferred to a desktop computer (Apple iMac, California, USA) and then analysed using the performance analysis software (Studiocode, Sportscode, NSW, Australia) installed in the computer.

2.3 Procedure

Two observers were involved during the notational analysis (a squash coach and a research assistant). The reliability of these observers was measured through inter-observer analysis to ensure the validity and reliability of the data. All analysed data before the SUKMA competition were presented to the coaches and the players as feedback to their performance. Subsequently, the players' performance were recorded and analysed during the main tournament.

2.4 Reliability

The reliability of the notated data from the two observers was analysed using Intraclass Correlation Coefficient (ICC). Nineteen matches (10% of the 179 matches) were chosen at random for the analysis. Results from the women's and men's types of strokes frequency showed the average measure of ICC was .98 with 95% CI (.96, .99); $F(63,63)=44.21$; $p<.001$ and ICC= .99 with 95% CI (.99, .99); $F(63,63)=196.1$; $p<.001$ respectively. Reliability analysis on the court areas for the women and men showed ICC=.87 with 95% CI(.79,.92); $F(63,63)=7.79$; $p<.001$ and ICC= .67 with 95% CI (.46, .80); $F(63,63)=3.04$; $p<.001$ respectively. The reliability analysis on the strokes that produced most winners and errors according to women and men were .86 with 95% CI (.81, .89); $F(191,191)=6.89$; $p<.001$ and ICC= .93 with 95% CI (.90 to .94); $F(191.191)=13.23$; $p<.001$ respectively. The overall reliability of the observed data was deemed acceptable for further analyses.

2.5 Data analysis

Performance variables analysed consisted of the frequencies and percentage of the forehand and backhand strokes (i.e., straight, cross court drives, volleys, boast, lob and drop shots) played, type of strokes and court areas that produced winners and errors in a match. Twenty eight strokes (14 forehand and 14 backhand) were identified as normally used in squash and agreed upon for analysis after consulting experienced squash coaches. These strokes were subsequently divided according to the forehand and backhand executed by the players. The court area was divided into 16 areas equally (see Figure 1). Each grid represented 1.6m breadth x 2.41m length on the actual squash court. This procedure replicated the method used in the study by Hughes and Robertson [22].The transparent template with the grids was placed over the computer screen to assist in the analysis. The areas where the players produced the winners or committed the errors were notated. Descriptive analyses of the variables were presented according to gender before separate analyses of variance were used to analyse the variables of the players' performance of matches before and during the main tournament. Wilcoxon signed rank tests were applied to analyse significant differences between the frequency of winners and errors produced before and during the main tournament. All significant levels were set at $P < .05$.

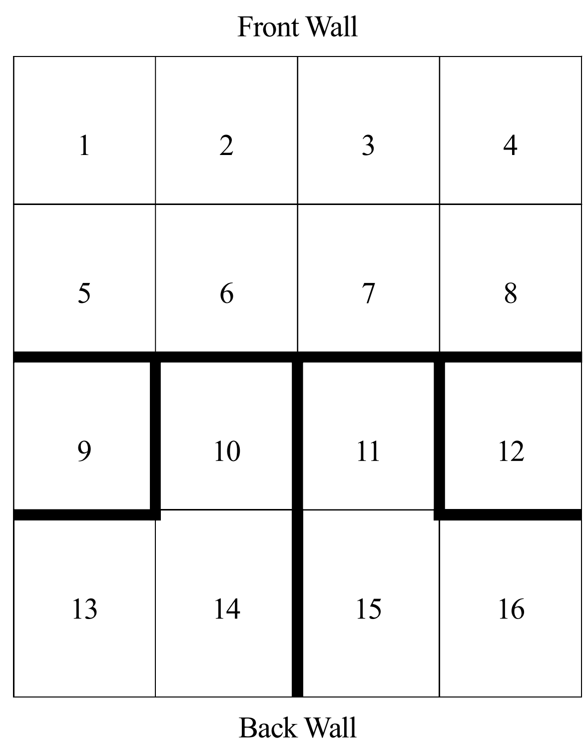

Fig.1. Schematic diagram of grids on the court area

3. RESULTS AND DISCUSSION

3.1 Frequency of Strokes

The frequency of the 14 strokes executed by the players according to gender in matches prior to and during the main tournament were tabulated. A total of 13,875 shots (9,124 for men; 4,751 for women) were notated from the 179 matches. The frequency of strokes was analysed according to the forehand and backhand executed by the players. The table below presents the three most and least used strokes[1] before and during the tournament. Percentage of the shots was calculated from the total frequency of all strokes according to the forehand and backhand respectively.

Most Frequent Strokes

Men						
Rank	Pre (total =2371)			During (total=3211)		
	Stroke	f	%	Stroke	f	%
1	BHXCD	701	21.8	FHD	580	36.3
2	BHD	618	19.2	BHD	545	27.9
3	BHDr	543	17.0	BHXCD	387	19.8

Women						
Rank	Pre (total=1228)			During (total=1653)		
	Stroke	f	%	Stroke	f	%
1	BHD	427	25.8	BHD	370	33.9
2	FHD	322	26.2	FHD	200	25.7
3	BHXCD	313	18.9	BHXCD	101	9.7

Least Frequent Strokes

Men

Rank	Pre (total =2371)			During (total=3211)		
	Stroke	f	%	Stroke	f	%
1	FHVB	3	0.1	BHXCL	1	0.1
2	BHBW	5	0.2	FHXCL	2	0.1
3	BHVB	14	0.4	BHVB	9	0.5

Women

Rank	Pre (total=1228)			During (total=1653)		
	Stroke	f	%	Stroke	f	%
1	BHBW	1	0.1	BHXCL	0	0
2	FHB	3	0.2	BHBW	1	0.1
3	FHL	4	0.3	FHBW	1	0.1

Strokes that produced most winners and unforced errors. A winner was defined as the player won a point using the stroke whilst an unforced error was defined as the player committed an error without any pressure from the opponent's return.

Strokes that Produced Most Winners

Men

Rank	Pre (total =184)			During (total=183)		
	Stroke	f	%	Stroke	f	%
1	FHD	35	19	FHDr	21	11.5
2	BHDr	25	13.6	FHD	18	9.8
3	BHD	20	10.9	BHVDr	18	9.8

Women

Rank	Pre (total=271)			During (total=183)		
	Stroke	f	%	Stroke	f	%
1	FHD	42	15.5	BHD	24	13.1
2	FHXCD	29	10.7	FHXCD	17	9.3
3	BHDr	28	10.3	FHDr	17	9.3

Strokes that Produced Most Unforced Errors

Men

Rank	Pre (total =201)			During (total=146)		
	Stroke	f	%	Stroke	f	%
1	BHDr	26	12.9	BHD	24	16.4
2	FHB	16	8.0	FHDr	15	10.3
3	BHB	16	8.0	FHD	10	6.8

Women

Rank	Pre (total=177)			During (total=102)		
	Stroke	f	%	Stroke	f	%
1	BHB	18	10.2	FHD	7	6.9
2	FHB	14	7.9	FHDr	7	6.9
3	FHD	10	4.0	BHD	7	6.9

[1] Abbreviation for the strokes:

FHB	Forehand Boast	BHBW	Backhand Back wall
FHBW	Forehand Back wall	BHD	Backhand Drive
FHD	Forehand Drive	BHVB	Backhand Volley Boast
FHL	Forehand Lob	BHXCD	Backhand Cross Court Drive
FHVB	Forehand Volley Boast	BHXCL	Backhand Cross Court Lob
FHXCD	Forehand Cross Court Drive		
FHXCL	Forehand Cross Court Lob		

Winners and Errors according to Court Area

The squash court was divided into 16 equal areas (refer to Figure 1) to identify the location of winners produced as well as errors committed by the players.

Court areas that produced most winners

Men

Rank	Pre (total=184)			During (total=183)		
	Area	f	%	Area	f	%
1	16	26	14.1	7,10,11	17	9.3

2	5	19	10.3	5	16	8.7
3	13	17	9.2	15	15	8.2

Women

Rank	Pre (total=271)			During (total =183)		
	Area	f	%	Area	f	%
1	16	33	12.2	11	24	13.1
2	13	24	8.9	10	21	11.5
3	5,10,11	22	8.1	13,14	20	10.9

Court areas that produced most errors

Men

Rank	Pre (total=201)			During (total=146)		
	Area	f	%	Area	f	%
1	16	34	16.9	16	22	15.1
2	13	25	12.4	13, 14	16	11.0
3	8, 9	18	9.0	5	13	8.9

Women

Rank	Pre (total=177)			During (total=102)		
	Area	f	%	Area	f	%
1	16	24	13.6	13	17	16.7
2	13	23	13	9	15	14.7
3	14	22	12.4	5, 12	11	10.8

A Wilcoxon signed-rank test showed that the percentage of winners (Z = -.171, P = .865); errors (Z = .000, P = 1.00) occurred according to court areas for the men and (Z = -.233, P = .816); errors (Z = .026, P = .979) for the women did not produce statistically significant difference before and during the main competition.

Percentage of strokes performed by both men and women in this study showed that the most frequent strokes used were the forehand and backhand drives. Both drives combined to more than half of the total strokes performed. This finding supported previous studies [17, 19]. The backhand strokes were more frequently used than the forehand strokes by both men and women. This is not surprising as in a typical squash match, players tend to play more to the apparent weaker side of their opponents. The volley boasts, lob and hitting off the back wall were the least frequent used strokes. Again, the result were similar to the findings from the women's matches [21]. However, it contradicted findings from the men's matches [20]. The elite men's matches used the lob frequently as to reduce pressure and to enable them to return to better position [20]. The low frequency of the lob, volley boast and back wall shots found in this study suggest that the players could be in better positions and dominated their matches, thus not required to perform the defensive strokes.

Analyses on the strokes that produced most winners and unforced errors among the players showed the drop shots used by the male players produced the most winners whilst it was the straight drives for the women. However, the same strokes produced the most errors among the men as well. This finding was similar to Ghani et. al's [21] study. The drop shot is considered as an attacking stroke with low margin of error. Players would attempt to hit the ball softly just above the 'tin' (43cm from the floor for men). Balls hit too low will hit the tin whereas if too high would be easily attacked by the opponent. The women players committed most unforced errors when performing the boasts during the lead up matches. However, the strokes were not ranked among the most unforced errors in the main tournament. It could be suggested that the players would have rectified the problem from the feedback provided prior to the main tournament.

Although analyses comparing the court areas where winners and errors occurred before and during the tournament did not yield significant statistical differences, descriptive data showed the men produced more winners in the back corners (area 13 and 16) during the lead up matches but more winners at the 'T'(area 7,10 and 11) which is the middle of the court. This findings concurred Vučković et al.'s [20] study where players occupying the T more often were able to hit more variety of winners as they were strategically placed and could force their opponents to cover further distance and eventually lose the point. Similar results were shown with the women's performance during the tournament. The men committed most errors at the back corners in the pre-tournament matches and subsequently included the front corners during the main tournament. This result correlated with the stroke that produced most errors, namely the drop shot. Similar pattern was found among the women although they committed more errors in the backhand side (area 5, 9 and 13).

4. CONCLUSION

The findings from this study provide empirical evidence on the strokes utilised in squash, their percentage of producing winners and errors and the players' coverage of the court areas. Although many factors influence the performance of the players, such as opponents and match situations (tight or easy), this study attempted to provide objective information to the players and coaches on their performance and to a certain extent, contributed to the achievement of the team. The small size of samples are acknowledged as limitation as only a few players were selected to represent the contingent. We acknowledged that shots preceding the final stroke (winner or error) were not analysed. Future studies could attempt to analyse such strokes as it may provide more in depth information on the ending stroke. Researchers could also attempt to compare with emerging players of various ages with the adults.

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