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Comparison of performance for winning and losing beach volleyball teams on different court dimensions.

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Abstract

The purpose of this study was to investigate and compare the performance between winning and losing teams in Beach Volleyball (BV) matches on courts of new (8x8m) and old dimensions (9x9m) at the side out phase. Side out in BV means the change of the right to serve Nine semifinals and seven finals of the Hellenic BV Championship taking place at an 8x8m and 9x9m court were video-recorded using a camera. 34 sets and 1466 phases were recorded and the following technical skills were analyzed: a) serve b) reception c) attack. In addition, attack was divided into two categories according to the type of the attack: a) spikes and b) shots. The term effectiveness was established by the ratio determining the total kills minus total errors divided by total attempts. Independent samples t-test was used in order to compare the above mentioned parameters between the winning (?) and losing (?) teams at these two different court dimensions (8x8, 9x9). Significant differences were found, $t_{(16)} = 3.06$, $p < .01$), in the attack efficiency ($M_{?\,8x8} = .476$, $SD = .086$, $M_{H8x8} = .315$, $SD = .131$), ($t_{(18)} = 2.44$, $p < .05$), in the spike efficiency ($M_{?\,8x8} = .479$, $SD = .162$, $M_{H8x8} = .254$, $SD = .236$), in the percentage of errors ($M_{?\,8x8} = .139$, $SD = .052$, $M_{H8x8} = .204$, $SD = .077$), ($t_{(18)} = 2.21$, $p < .05$), in the percentage of receptions errors ($M_{?\,9x9} = .09$, $SD = .043$, $M_{?\,9x9} = .032$, $SD = .029$), $t_{(10)} = 2.73$, $p < .05$) and in reception (? $_{?\,9x9} = 0.96$, $SD = 0.03$, ? $_{?\,9x9} = 0.90$, $SD = 0.05$), ($t_{(10)} = 2.74$, $p < 0.05$). Winning and losing teams used the spikes and shots at approximately the same rate. In conclusion, different skills performance contributed to winning the match after the reduction in court dimensions. On the 8x8, the winners had better attack efficiency and fewer errors, while on the 9x9 they had better reception.

Keywords: Beach Volleyball, team performance, rally scoring, side out.

1 Introduction

After the 2000 Sydney Olympic Games the *Federation Internationale de Volleyball* (FIVB, 2001) changed radically the Beach Volleyball (BV) regulations. The main changes were the change from the non Rally Score System (nRS) to the Rally Point Score System (RS). In the nRS when the receiving team wins the rally, it has the right to serve without scoring a point, while in the RS every winning rally scores a point. The second important change in the regulations was the fact that court dimensions reduced from 9x9m to 8x8m. Another change, which occurred due to the use of the RS, was that the winning sets increased to two while in the nRS a 15-point set led to victory.

Giatsis and Zetou (in press) compared the different court dimensions and the scoring systems on FIVB Word Tour and Hellenic Championship BV matches in 2000 and 2001. It was found that 59% of the matches using RS had a set with minimum difference of 2 points. On the contrary, in the nRS the minimum difference in points was at 12.8%. The increase in the percentage of matches with a minimum difference means that in most matches the final outcome depended on the details of the final match rallies.

BV, like Indoor Volleyball (IV), is divided into two main phases: the Side-Out (SO), where a team tries to win the right to serve and the defense, where a team tries to score a point after the service (FIVB, 2001; Hare & Sanderson, 1997; Selinger & Ackermann-Blount, 1986). Three to four consecutive technical skills are involved in each phase. The SO phase includes three basic technical skills in the following order: service reception, setting and attack.

Eom and Schutz (1992a) in the research they carried out in order to evaluate the parameters relating to IV efficiency and success concluded that the main differences were observed in the block and attack technical skills. The aforementioned researchers (Eom & Schutz, 1992b) in another research they found an important correlation between reception-set, set-attack and reception-attack technical skills.

In BV due to the fact that only two players participate, the specialization of the players is limited only to the defense phase that is the block and the defense. During the SO phase both players should have mastered the reception and set skills so as to play successfully. The importance of the reception and set technical skills in BV is stressed by a great number of authors, since these skills provide the conditions for higher attack efficiency (Hare & Sanderson, 1997; Homberg & Papageorgiou, 1995; Kilary & Shewman, 1999; Stevenson & Obstfeld, 1989).

In BV the players use the shot apart from the spike in their attack tactics due to the uncovered space in the opponent (Kiraly, 1993 June; Smith, 1994 August). Homberg and Papageorgiou (1994) report the statistical data from the distribution of the attack skills of BV teams of the Association Volleyball Professionals (AVP) and the German Championship according to which spikes correspond to 65.5% and 52.8% respectively. The literature review shows that no research was carried out regarding the comparative evaluation of performance in the technical skills that determine the winning outcome in a BV match.

The purpose of this study was to compare the differences in the quality of service and serve reception technical skills, the attack efficiency index and the total SO performance observed between BV winning and losing teams. Also, the types of the attack and their efficiency index were studied and evaluated. In conclusion, it was studied whether there is a difference in the performance of the technical skills between winning and losing teams on both court dimensions.

2 Methods

2.1 Sample

The data used for the analysis of the technical skills were taken from the top competition of the Hellenic BV Championship in 2000 and 2001. In 2000 the matches took place at a 9x9 m court, while in 2001 at an 8x8 m court. RS was used in both 2000 and 2001 matches. The matches were video-recorded using a camera situated at the back side of the court so that it would be possible to check the quality of the serve reception technical skill. The investigation sample included 3 semifinals and 3 finals from 2000, 5 semifinals and 4 finals from 2001. 15 matches, 30 teams, 33 sets and 1466 points were analyzed in total.

2.2 Measure Procedure

The following data were recorded for serves per game: a) attempts, b) errors, c) aces and for the serve reception a) attempts, b) good receptions within the target, c) poor serve receptions outside the target, d) serve reception errors. In addition, total attack attempts, total kills, attack errors and their efficiency index were recorded (efficiency index was defined as the total kills minus the errors divided by the total attempts for each skill). Finally, the type of attack (spike or shot) was recorded, their distribution percentage, the percentage of kills and their efficiency index. All the above data were recorded only during the SO phase. The quality and the efficiency index of the technical skills when the game continued after the opponent's defense were not recorded. The total performance of the teams and not of the individual players was recorded.

2.3 Definitions for Quality and Efficiency

2.31 Index of Technical Skills

Good reception was defined as the reception landing within the target (Hare & Sanderson, 1997; Homberg & Papageorgiou, 1995; Kilary & Shewman, 1999; Stevenson & Obstfeld, 1989). The target area was defined as the distance, five meters long, starting from the net up to the end line and two meters wide starting from the centre of the net up to the sidelines. For evaluating each technical skill a three-grade scale was used. (Gozansky, 2001; Homberg & Papageorgiou, 1995; NCAA, 2002):

The grading of the technical skills was carried out as follows:

Serve. Score (+): Ace scoring a point. *Score (0)*: Serve kept in play. *Score (-)*: Service error scoring a point for the opponent.

Reception. Score (+): Good reception. It means that the ball lands within the target. *Score* (0): Poor reception. The ball lands outside the target but it is possible to set up an attack. *Score (-)*: Reception error which is either an ace or the team is forced to return the ball to the opponent without setting up an attack (free ball).

Reception performance percentage. Good and poor receptions divided by total reception attempts.

Attack. Score (+): Kill scoring a point. *Score 0*: the attack lead to the continuation of the rally (zero attack). *Score (-)*: Attack error scoring a point for the opponent.

Service Efficiency (index). Total aces minus service error divided by total services.

Attack Efficiency (Index). Total kills minus attack errors divided by total attacks.

Kills Percentage. Total kills divided by total attacks.

Performance Percentage at SO. Total points won divided by the opponents' total services.

Error Percentage at SO. Total reception, attack, setting errors divided by total opponents' services.

Also, attack was divided according to the type of the hit into a) spike and b) shot (when the "pokie" hit used or when the ball is returned to the opponent by means of setting or reception and scores a point were included on shot attack) (Kiraly, 1993 June; Smith, 1994 August; Timmons, 1993 July). The same procedure as that in the attack was used for evaluating the spikes and shots.

To ensure that the measurement was reliable a pilot recording of the data from two matches (79 phases) was carried out and the procedure was repeated after three months. The *Pearson Correlation* was used for the pilot recording and according to the results a statistically significant correlation between the two measurements was found: reception, ($r_{(79)} = .919$, $p < .001$) and attack, ($r_{(79)} = 1.000$, $p < .001$).

2.4 Statistical Analysis

An *Independent Samples t-test* was used in order to compare the differences in the quality of the reception, the setting and the attack efficiency both in total and in its individual parts between the winning and losing teams. Significance level was set at $p < 0.05$.

3 Results

From a total of 15 matches, 10 matches finished 2-0 and five matches 2-1. The mean duration of matches was (M = 44.1, *SD* = 6.3 min) on the 8x8 court and (M = 49.3, *SD* = 8.4 min) on the 9x9 court. The mean number of rallies per match was (M = 87.7, *SD* = 13.8 phases) on the 8x8 court and (M = 99.2, *SD* = 15.5 phases) on the 9x9 court. Table 1 illustrates means and standard deviations of attacks, spikes, and shots.

The mean of aces was (? ? 8x8 = 1.2, *SD* = 1.4, M? 8x8 = 0.9, *SD* = 1.3) on 8x8, while on 9x9 it was (M? 9x9 = 4.5, *SD* = 2, M? 9x9 = 1.5, *SD* = 1.2). Mean total errors were higher for the losers on both courts. On 8x8 the winners committed 4.3 errors less than the losers (M? 8x8 = 5.6, *SD* = 2.2, M? 8x8 = 9.9, *SD* = 3.5). Respectively, on 9x9 the winners committed 2.2 errors less than the losers (M? 9x9 = 8.5, *SD* = 3.4, M? 9x9 = 10.7, *SD* = 3.4). Table 2 illustrates means and standard deviations of services, receptions and total errors of the winning and losing teams on both court sizes.

3.1 Comparison of Performance Parameters on the 8x8 Court.

There was no significant difference ($t_{(16)} = .33$, $p > .05$) in the reception performance between the 8x8 winners (? = .975, *SD* = .029) and the 8x8 losers (? = .970, *SD* = .036). A significant difference was found ($t_{(16)} = 1.98$, $p > .05$) in the kills percentage ($M_{N8x8} = .596$, *SD* = .083, $M_{H8x8} = .517$, *SD* = .086). Also, there was no significant difference ($t_{(16)} = .34$, $p > .05$) in the use of spikes between the winners (? = .490, *SD* = .158) and the losers (? = .469, *SD* = .093). There was no significant difference ($t_{(16)} = .94$, $p > .05$) in the successful side-out between the winners (M = .595, *SD* = .058) and the losers (M = .564, *SD* = .078). There was no significant difference ($t_{(16)} = 2.35$, $p <$

.05) in the total errors percentage at the side-out between the winners (M = .157, *SD* = .068) and the losers (M = .243, *SD* = .087).

3.2 Comparison of Performance Parameters on the 9x9 Court

Table 1. Means and standard deviations of performance parameters of attack on 8x8m and 9x9m BV Courts.

Parameters	8x8m				9x9m			
	Winners		Losers		Winners		Losers	
	M	*SD*	M	*SD*	M	*SD*	M	*SD*
Attack								
Kills	20.4	3.9	20.2	5.1	22.9	5.5	23	6.9
Zero Attacks	14.6	5.4	18.4	3.4	10.5	4.5	11.5	4.4
Errors	4.1	2.0	7.7	1.9	6.8	2.8	5.7	2.2
Total Attempts	35.0	8.5	38.6	5.7	40.2	8.7	40.2	8.7
Spikes								
Kills	11.1	5.3	9.6	3.4	12	5	13.3	5.8
Zero Spikes	4.1	3.2	2.0	1.7	4	2.9	4.7	1.6
Errors	3.0	2.3	6.0	1.0	4.7	1.6	3.8	1.3
Total Attempts	17.7	7.9	17.9	3.4	20.7	6.7	21.8	7.2
Shots								
Kills	9.3	3.8	10.6	5.3	10.8	4	9.7	5.5
Zero Shots	7.4	3.7	7.6	2.6	7	3.6	6.8	4.3
Errors	1.1	2.1	1.2	1.5	1.7	0.5	1.8	1.2
Total Attempts	17.3	5.3	20.7	5.6	19.5	7.4	18.3	6.2
Over on two Attacks	2.3	2.0	4.1	3.4	0.5	0.6	1.3	1.2

A significant difference was found ($t_{(10)}$ = 2.74, p < .05) in the mean reception performance of the winners (? = .963, *SD* = .031) and the losers (? = .898, *SD* = .049). Also, a significant difference was found ($t_{(10)}$ = 2.68, p < .05) in reception errors percentage between the winners (M = .033, *SD* = .028) and the losers (M = .089, *SD* = .043). There was no significant difference ($t_{(10)}$ = .34, p > .05) in the use of spikes ($M_{? 9x9}$ = .520, *SD* = .127, $M_{? 9x9}$ = .543, *SD* = .112). There was no significant difference ($t_{(10)}$ = .96, p > .05) in the side-out performance ($M_{? 9x9}$ = .600, *SD* = .038, $M_{? 9x9}$ = .568,

SD = .074). Table 3 shows the performance percentages (‰) in reception, attack skills and side-out on both court sizes.

Table 2. Means and standard deviations of performance parameters of service and reception on 8x8m and 9x9m BV Courts.

	8x8m				9x9m			
	Winners		Losers		Winners		Losers	
Parameters	M	*SD*	M	*SD*	M	*SD*	M	*SD*
Service								
Aces	1.2	1.4	0.9	1.3	4.5	2	1.5	1.2
Errors	4.3	1.7	5.3	2.5	6.3	2	5.2	1.9
Successful	40.8	5.7	36.4	8.5	44.8	6.8	41.8	10.2
Total	45.1	6.5	41.8	8.1	51.2	6.7	47	9.4
Reception								
Good	23.7	4.6	28.1	5.6	21	12.7	23.7	8.8
Poor	11.9	5.0	11.4	5.2	19.3	8.3	16.8	4.5
Errors	0.9	1.3	1.2	1.4	1.5	1.2	4.5	2
Total	36.4	8.5	40.8	5.7	41.8	10.2	44.8	6.8
Setting Errors	.6	.7	1.0	.9	0.2	0.4	0.5	0.8
Total Errors	5.6	2.2	9.9	3.5	8.5	3.4	10.7	3.4

3.3 Skills Efficiency on the 8x8 Court

Table 4 shows the service, attack, spike and shot efficiency index on both court sizes. There was a significant difference ($t_{(16)} = 3.06$, $p < .01$) in the attack efficiency ($M_{? 8x8} = .476$, $SD = .086$, $M_{? 8x8} = .315$, $SD = .131$). There was a significant difference ($t_{(16)} = 3.43$, $p < .01$) in the spike efficiency between the 8x8 winners (? = .491, $SD = .165$) and the 8x8 losers (? = .178, $SD = .343$).

3.4 Skills Efficiency on the 9x9 Court

There was no significant difference ($t_{(10)} = 1.26$, $p > 0.05$) in the service efficiency ($M_{? 9x9} = -.036$, $SD = .162$, $M_{H9x9} = -.083$, $SD = .068$). There was no significant difference ($t_{(10)} = .61$, $p > .05$) in the attack efficiency ($M_{? 9x9} = .402$, $SD = .082$, $M_{? 9x9} = .428$, $SD = .066$). The skills efficiencies presented in Table 4.

Table 3. Comparisons between the means and standard deviations of the BV skill performance percentage (%).

Skill	8x8						9x9					
	Winners		Losers				Winners		Losers			
	M	*SD*	M	*SD*	*t*	*p*	M	*SD*	M	*SD*	*t*	*p*
Reception												
Performance	.975	.29	.970	.036	.333	.744	.963	.031	.898	.049	2.74	.021*
Good	.660	.089	.694	.126	.651	.524	.482	.187	.517	.128	.37	.720
Playable	.315	.087	.267	.109	.832	.417	.481	.203	.381	.146	.97	.353
Errors	.025	.029	.030	.036	.333	.744	.033	.028	.089	.043	2.68	.023*
Attack												
Kills	.596	.083	.517	.086	1.984	.065	.571	.069	.568	.083	.05	.963
On second attack	.069	.061	.110	.097	1.068	.301	.034	.083	.014	.025	1.0	.342
Spikes/Attacks	.490	.158	.469	.093	.345	.735	.520	.127	.543	.112	.34	.743
Shots/ Attacks	.510	.158	531	.093	.345	.735	.480	.127	.457	.112	.34	.743
Side-out												
Performance	.595	.058	.564	.078	.945	.359	.600	.038	568.	.074	.96	.361
Errors	.157	.068	.243	.087	.2.353	.032*	.179	.048	.210	.068	.92	.379

Note. * $p < .05$

4 Discussion

According to the results of this study it is evident that the winners had a better performance in certain performance parameters which may determine the final outcome of BV matches. However, these parameters were different on both court sizes. The parameters which were different on the 8x8 court between the winners and the losers were the error percentage and the attack efficiency. The winning teams on the new smaller-sized court had higher attack performance mainly due to higher spike efficiency. Another significant parameter, which affected the side-out performance on

the 8x8 court, was the greater number of errors observed in the losers. The difference in the errors between the winners and the losers was mainly due to the attack and in particular to the spikes. The importance of the errors was demonstrated by the fact that while there was no difference in the kills percentage, there was a difference in the efficiency relating to the errors. Using RS a great number of sets finished with the minimum difference of two points (Giatsis & Zetou, in press) and as result the small difference (5.5%) in total errors was a determining factor. This showed how important the spike is in Beach Volleyball as in Indoor Volleyball (Eom & Schutz, 1992a). Contrary to the spikes, there was no significant different in the shots. There was no significant different in the reception performance on the 8x8 court.

Table 4. Means of the Index and Standard Deviations of BV Skill Efficiency

	8x8						9x9					
	Winners		Losers				Winners		Losers			
Skill	M	*SD*	M	*SD*	t	p	M	*SD*	M	*SD*	*t*	*p*
Service	-.111	.076	-.067	.052	1.40	.180	-.036	.062	-.083	.068	1.26	.237
Attack	.476	.086	.315	.131	3.06	.007**	.402	.082	.428	.066	.61	.557
Spike	.491	.165	.178	.218	3.43	.003**	.342	.133	.421	.108	1.15	.280
Shot	.473	.150	.389	.139	1.02	.324	.464	.085	.405	.129	.96	.365

*Note. *p<.05, **p<.01.*

In the large court dimensions the serve reception and the service played a determining role in the winning result. The winners had higher performance in the serve reception. Also, the winners' more difficult service accounted for the higher serve reception error percentage of the losers. Although the winners had better service efficiency, they had a negative value, like the losers, due to the great number of service errors.

There was no difference in the attack tactics of the winners and the losers depending on the type of the attack. On the 8x8 court the losers used the shots to a slightly greater degree, while on the 9x9 court they used the spikes to a slightly greater degree. The above percentage on the 9x9 court was the same as that of the German Championship, but it was lower by 13% in relation to AVP (Homberg & Papageorgiou, 1994).

Overall, the higher attack efficiency, which derived from the spikes and the smaller number of attack errors, helped the winners on the 8x8 court to win the match. Smaller dimensions made it harder for the attackers to score a point, while the limited number of spikes and the increase observed in the digs (Cook, 2002 December) reduced their efficiency. The teams which managed to have higher spike efficiency won the matches as well. The winners and the losers had nearly the same reception and service percentages, a fact that shows the weakness of the teams to perform a difficult service in the smaller-sized court. The winners committed fewer attack errors, which seems to have affected the final outcome.

Contrary to the 8x8 court, some other performance parameters are differentiated on the 9x9 court, which may have led to the winning outcome. The better reception performance and the higher ace percentage seem to have given an advantage to the winners. There was no difference in the attack efficiency between winners and losers.

On the smaller-sized court the teams in order to have more chances to win a match should pay more attention to other performance parameters in relation to those on the bigger-sized court. Attack efficiency and mainly spike efficiency should improve. Better reception and the smaller distance between the players and the net offer the opportunity for more complex attack tactics, such as the use of over on two attacks (Walsh, 2002 November; Youngs, 2002 September) and the use of attack with a fast set (Masakayan & Rock, 1997 July). Such attacks may catch the opponent's defense disorganized and provide solutions which will increase the attack efficiency (Youngs, 2002 September). Furthermore, the teams should reduce the number of errors, especially service and setting errors in order to be able to set up more attacks.

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