

Research article

Home advantage in high-level volleyball varies according to set number

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Abstract

The aim of the present study was to identify the probability of winning each Volleyball set according to game location (home, away). Archival data was obtained from 275 sets in the 2005 Men's Senior World League and 65,949 actions were analysed. Set result (win, loss), game location (home, away), set number (first, second, third, fourth and fifth) and performance indicators (serve, reception, set, attack, dig and block) were the variables considered in this study. In a first moment, performance indicators were used in a logistic model of set result, by binary logistic regression analysis. After finding the adjusted logistic model, the log-odds of winning the set were analysed according to game location and set number. The results showed that winning a set is significantly related to performance indicators ($\chi^2_{(18)}=660.97$, $p<0.01$). Analyses of log-odds of winning a set demonstrate that home teams always have more probability of winning the game than away teams, regardless of the set number. Home teams have more advantage at the beginning of the game (first set) and in the two last sets of the game (fourth and fifth sets), probably due to facilities familiarity and crowd effects. Different game actions explain these advantages and showed that to win the first set is more important to take risk, through a better performance in the attack and block, and to win the final set is important to manage the risk through a better performance on the reception. These results may suggest intra-game variation in home advantage and can be most useful to better prepare and direct the competition.

Key words: Performance indicators, binary logistic regression, game analysis, team sport.

Introduction

Home advantage has always been a phenomenon of scientific interest and is very consolidated in the literature (Carron, et al., 2005; Courneya and Carron, 1992; Marcelino, et al., 2008; Nevill and Holder, 1999; Pollard, 2006; 2008). This advantage refers to the fact that home teams regularly win more than 50% of games within a balanced home and away competitive schedule (Courneya and Carron, 1992). This effect is probably caused by crowd effects, facilities familiarity, travel factors, and rules (Loughead, et al., 2003; Wallace, et al., 2005).

Theoretical background for home advantage was attempted by several approaches such as biological-based theories of territoriality, social psychology drive theories, social cognitive theories and sociological theories of community celebration (for reviews see Carron et al., 2005; Courneya and Carron, 1992; Nevill and Holder, 1999). However, there is really no sufficient evidence to

support strongly any theoretical explanation over another, probably because the likely causes of home advantage will be operating together, each interacting with the other in ways that will be difficult to investigate, isolate and quantify (Pollard, 2008; Pollard and Pollard, 2005; Sampaio et al., 2008).

Curiously, despite the importance and popularity of the Volleyball game (see Tillman et al., 2004) there is no research regarding home advantage specifically in this net ball team sport. One interesting question to investigate is the variation of home advantage across the sets played within a Volleyball game. In a way, Early Success Models state that strong initial performances increase the psychological momentum and may lead the teams to the final victory (Burke and Houseworth 1995; Richardson et al., 1988). On the other hand, there is also research stating the importance of performing well in the last moments of the sets (Bar-Eli and Tenenbaum, 1989; Sampaio et al., 2004). There is no consensual research regarding the hierarchical importance of these game periods, however, there is sufficient evidence to support the idea that some game periods are more important than others. Additionally, the nature of team sports implies a dynamic interaction process probably with effects on home advantage (Lames, 2006). However, little research has investigated if home advantage varies in different game periods. Jones (2007) compared the home advantage according to basketball game quarter's and from the analysis of 1189 NBA games concluded that home teams had home advantage in all quarters, but with more relevance in the first one. This kind of information could be a starting point to help isolating and quantifying the causes of home advantage. For example, it is likely that facility familiarity affects the players in a more pronounced way in the first set of the Volleyball game. Thus, the present study aims to investigate the variation in the probability to win each set for home and away teams, providing new insights to understanding home advantage and volleyball performance.

Methods

Samples and variables

Archival data was obtained from 275 sets in the 2005 Men's Senior World League and 65,949 actions were analysed (12,434 serves, 10,129 receptions, 13,513 sets, 14,111 attacks, 7,200 blocks, and 8,562 digs). The analysed variables were the following: set result (win, lost), game location (home, away), set number (first, second, third, fourth and fifth) and performance indicators. The performance indicators were measured by the efficacy of

Table 1. Performance coefficient along the five sets of game.

		1 st set	2 nd set	3 rd set	4 th set	5 th set	Total
Home	Serve	1.74	1.71	1.76	1.75 *	1.77	1.74 *
	Reception	2.24	2.26	2.27 *	2.21	2.40 *	2.26 *
	Set	1.91	1.91	1.87	1.88	1.88	1.89 *
	Attack	2.70 *	2.67	2.66	2.68	2.63	2.67 *
	Block	1.70 *	1.50	1.51	1.51	1.58	1.56
	Dig	1.40	1.41	1.43	1.45	1.65	1.43
Away	Serve	1.70	1.73	1.70	1.67 *	1.74	1.71 *
	Reception	2.20	2.15	2.13 *	2.14	2.14 *	2.16 *
	Set	1.85	1.82	1.84	1.79	1.87	1.83 *
	Attack	2.59 *	2.58	2.64	2.60	2.62	2.60 *
	Block	1.49 *	1.48	1.53	1.54	1.31	1.49
	Dig	1.40	1.38	1.47	1.45	1.54	1.43

* Differences between home and away performances (p < 0.05).

the serve, reception, set, attack, block, and dig and according to their effect on the rally (point or excellent, continuity, and error) (FIVB, 2000). Also, a performance coefficient was computed to serve, spike and block actions [$Coefficient = ((4x Points Attempts) + (2x Continuity Attempts) + (0x Errors Attempts))/(Total Attempts)$] and reception, set, and dig continuity actions [$Coefficient = ((3x Excellent Attempts) + (1,5x Continuity Attempts) + (0x Errors Attempts))/(Total Attempts)$] (Coleman, 2002).

Data was obtained through official FIVB software "Volleyball Information System". To test the reliability, an independent observer analyzed 34 sets, corresponding to 12.36% of the sample. Cohen's Kappa values were all above 0.80, stating a inter-observer reliability.

Statistical analysis

Data was analysed through descriptive (means, standard deviations) and inferential procedures. Independent student t-test was used to identify the differences in all performance coefficients between each team's home and away games. Performance indicators (number of points by attack, block, serve; number of excellent actions of set, dig and reception; number of actions with continuity of attack, block, serve, set, dig and reception; number of errors by attack, block, serve, set, dig and reception) were used in a logistic model of set outcome by binary logistic regression analysis (method used: Enter) (Landau and Everitt, 2004). After finding out the adjusted logistic model, the log-odds of winning sets were analysed according to game location and set number. The winning set probabilities are presented on the log-odds scale since the logistic model assumes additive effects of the explanatory variables on this scale.

There is a large time gap between home and away games against the same opponents that usually changes

substantially both teams, such as players' injuries, fitness levels, and coaches' decisions. These difficulties in controlling each team home and away game conditions lead us to perform an independent measures model. Conversely, Volleyball game sets are score independent and each new set does not accumulates any prior score. Therefore, an excellent performance resulting in an unbalanced favorable set score may be immediately followed by an unfavorable performance and set score. Additionally, in each of the Volleyball rallies there seems to be a mixed dependent and independent effects, because a team receives the ball from the opponents, but has the opportunity to play the second ball touch without opponents participation and plays the final ball touch with opponent interaction. Therefore, the presented reasons lead us to consider independence between the Volleyball sets. Statistical significance was set at 5% and all analyses were performed in SPSS 16.0 (SPSS Inc, USA).

Results

Results identified differences in performance indicators between the five sets of the Volleyball game (see Tables 1, 2, and 3). The home teams presented higher values of efficacy in some of technical actions. An independent-sample t test analysis was significant for attack ($t_{548} = 2.49, p = 0.01$), serve ($t_{548} = 2.18, p = 0.03$), set ($t_{548} = 2.47, p = 0.01$) and reception ($t_{548} = 3.45, p < 0.001$) in the total of the sets. Analyzing by sets, t test show differences in attack ($t_{142} = 2.06, p = 0.04$) and block coefficients ($t_{142} = 2.61, p = 0.01$) in the first set, in reception coefficient in the third ($t_{142} = 2.28, p = 0.02$) and in the fifth set ($t_{34} = 2.37, p = 0.02$) and serve in the fourth set ($t_{80} = 2.21, p = 0.03$). In all these differences were in favor for the home teams.

Table 2. Means of points, continuity (cont) and errors of serve, attack and block along the five sets of game.

		1 st set		2 nd set		3 rd set		4 th set		5 th set	
		home	away	home	away	home	away	home	away	home	away
Serve	Point	1.0	1.1	1.1	1.2	1.3	1.0	1.1	1.0	.8	.3
	Cont	18.8	17.4	17.7	17.7	17.8	17.6	18.6	17.1	11.9	12.1
	Error	4.0	4.4	4.4	4.2	4.1	4.3	3.9	4.5	2.6	2.1
Attack	Point	12.6	12.7	12.6	12.1	12.6	12.7	12.5	12.7	8.8	8.7
	Cont	9.2	9.6	8.8	9.1	9.3	9.4	9.2	9.1	6.8	6.6
	Error	4.0	4.8	4.2	4.8	4.1	4.4	4.1	5.0	2.9	3.1
Block	Point	2.8	2.2	2.2	2.3	2.5	2.5	2.6	2.5	1.4	1.2
	Cont	5.9	5.3	5.5	4.9	5.6	5.4	5.4	5.5	3.6	3.2
	Error	5.2	5.3	5.4	5.6	5.7	5.6	5.9	5.6	3.9	4.2

Table 3. Means of excellent (exc), continuity (cont) and errors of receptions set and dig along the five sets of game.

		1 st set		2 nd set		3 rd set		4 th set		5 th set	
		home	away	home	away	home	away	home	away	home	away
Reception	Exc	10.3	10.2	10.8	9.2	10.4	9.4	9.5	9.3	7.8	6.6
	Cont	6.9	8.4	6.8	8.4	7.1	8.4	7.4	9.0	4.3	5.3
	Errors	1.3	1.1	1.2	1.2	1.1	1.1	1.0	1.1	.2	.8
Set	Exc	6.6	6.2	6.7	5.3	6.3	5.6	5.4	5.2	3.9	3.7
	Cont	18	19.2	17.5	19.3	18.6	19.4	18.5	20.4	13.6	3.6
	Errors	.3	.4	.3	.3	.2	.2	.2	.4	.1	.1
Dig	Exc	4.8	4.9	4.6	4.1	4.6	5.3	5.0	4.5	4.3	4.1
	Cont	5.5	4.9	5	5.8	6	4.7	5.2	5.4	3.1	3.6
	Errors	6.4	6.2	6	5.5	5.9	5.9	5.6	5.1	3.1	3.7

The results also showed that winning a set was significantly related to performance indicators (Logistic Regression: $\chi^2_{(18)}=660.97$, $p < 0.01$; percentage of correct classification= 95,5%). The analysis of log-odds of a winning set by extrapolated curves values (Figure 1) demonstrated that home teams had always more probability to win sets than the away teams. However, differences between winning set probabilities between home and away teams varied with the set number. The home teams seem to have more advantage in the first and in the fourth and fifth sets.

Discussion

The purpose of this study was to investigate the variation in the probability to win each set for home and away teams. The Volleyball game ends when one of the teams wins three sets. As in each of these sets there is always a winning team, it is suggested that a volleyball game is composed of three, four or five almost independent games (sets). Therefore, it might be probable to find different winning set probabilities reflecting the home advantage

phenomenon.

The fact that perception of social support contributes to reduce negative effects of stress (Pearlin et al., 1981) and anxiety levels in home teams (Zimet et al., 1988) can explain the higher probability of winning sets in the critical moments of the game (first and last sets). These results, specifically concerning the higher home advantage in the first set of the game, confirms early findings of Jones (2007). In Volleyball and Basketball high level male teams, both researches seem to suggest higher home advantages in the initial moments of the games. It will be interesting to replicate these studies in other sports and in other competitions levels. Specifically in Volleyball, it is a fact that in the first set teams need to adjust themselves to situational variables, like the crowd, the referees, the court colors, dimensions and lighting. Therefore, because home teams may be more familiar with all these factors this might have consequence in higher first set winning probabilities. Additionally, more social support is correlated to a lower preoccupation for the competition (Pallarés and Rosel, 2001), helping to avoid a negative environment effect on the players.

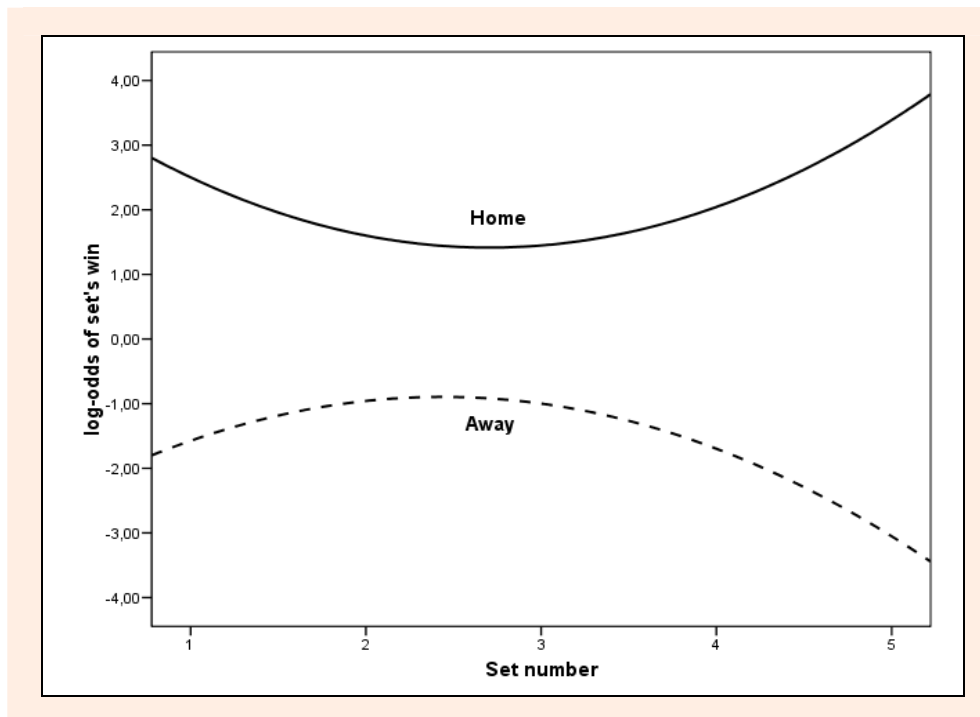


Figure 1. Log-odds of set's win predicted by final logistic model by set number; number of points by attack, block, serve; number of excellent actions of set, dig and reception; number of actions with continuity of attack, block, serve, set, dig and reception; number of errors by attack, block, serve, set, dig and reception.

One interesting result is the fact that home teams had better performances in the first set in attack and block, game actions that imply a high risk of error (Coleman, 2002), and show a correlation with set outcome (Eom and Schutz, 1992; Marcelino et al., 2008; Palao et al., 2004). Since that in the first set, home teams have great conditions to take risk (social support and familiarity with the place of the game) this could be a great help in gaining advantage over the opponent.

Another result that deserves relevance is the best performance of the reception on the third and fifth sets. Being the third set the first opportunity to winning the game and the fifth set the last change to achieve this aim, present study highlights the relevance of the reception to differentiate winners and losers. As Zimet, et al., (1988) claims in these situations, the informal support network for teams established by the public contributed to the maximization of home teams performance. Particularly, being the fifth set the only that is inexorably the last one and the one that in its beginning is known to determine the game winner, the error management assumes great importance. Moreover, due to the fact that this set finishes when one team wins 15 points (in contrast to 25 points in the other four sets), there are less possibilities to recover from a disadvantage, which reclaims a better performance on the actions (e.g. reception), that are the basis to guarantee the game flow of the own team (Marcelino et al. 2008). These results seem to confirm the hypothesis presented by Bar-Eli and Tenenbaum (1989) stating that players have a greater emotional vulnerability in the second part of the games. In this sense, the advantage associated to playing at home (mainly public and familiarity factors), is maximized in the most critical moments of the game, and thus justifying the higher probability of winning the fifth set.

Conclusion

Home teams have more advantage in the beginning of the game (first set) and in the two last sets of the game (fourth and fifth set), probably due to facilities familiarity and crowd effects.

Different game actions explain these advantages and showed that to win the set, in the first set is more important to take risk, through a better performance in the attack and block, and in the final set, namely in the fifth set, to manage the risk through a better performance on the reception.

In essence, these results suggest intra-game variation in home advantage that should be further investigated in other studies and can be most useful to better prepare and direct the Volleyball competitions.

Acknowledgments

This work is supported by the Portuguese Science and Technology Foundation (SFRH/BD/36302/2007) and Operational program for Science and Innovation 2010 (POCI 2010) co-financed by Social European Found (FEDER).

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Key points

- Home teams always have more probability of winning the game than away teams.
- Home teams have higher performance in reception, set and attack in the total of the sets.
- The advantage of home teams is more pronounced at the beginning of the game (first set) and in two last sets of the game (fourth and fifth sets) suggesting intra-game variation in home advantage.
- Analysis by sets showed that home teams have a better performance in the attack and block in the first set and in the reception in the third and fifth sets.

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