RICYDE. Revista Internacional de Ciencias del Deporte
doi:10.5232/ricyde

Rev. int. cienc. deporte

RICYDE. Revista Internacional de Ciencias del Deporte
VOLUME XIV - YEAR XIV
Pages:71-83 ISSN:1885-3137
Issue: 51 - January - 2018

https://doi.org/10.5232/ricyde2018.05106

Effects of game location, quality of opposition and players' exclusions on performance in elite male handball

Efecto de la localización del partido, la calidad del adversario y las exclusiones de los jugadores sobre el rendimiento en balonmano masculino de alto nivel

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Abstract

Based on the territoriality concept, the aim of this study was to investigate the influence of game location, quality of opposition, and players' exclusions on team performance (score differential). The sample consisted of 364 games (182 during each regular season 2014-2015 and 2015-16) from the French male professional league (LNH). In contrast to the territoriality theory, the results did not show that home teams were more sanctioned than visiting teams. Furthermore, using Analysis of Variance, the findings highlighted the fact that the quality of the opponent overcomes the home advantage effect and the existence of an interaction effect of [game location] x [quality of opposition] x [players'exclusions difference] on the score differential. Indeed, home teams with strong opposition perform better when they are more sanctioned (M = -2.26; SD = 3.53) than when they are less sanctioned (M = -4.9; SD = 4.69). Concerning visiting teams, faced with strong opposition, they perform better when they are less sanctioned (M = -2.8; SD = 4.5) than when they are more sanctioned (M = -5.4; SD =3.5) or when players' exclusions are balanced (M = -5.7; SD = 5.4); also, faced with balanced opposition they perform better when they are more sanctioned (M = 0.03; SD = 4.85) than when players' exclusions are balanced (M = -2.1; SD = 4.34). These results can contribute to a better understanding of the situational determining factors of elite handball performance, helping coaches to prepare their own team accordingly.

Key Words: home advantage; territoriality; players' aggressiveness; performance analysis; situational variables; social modeling.

Resumen

Este estudio se apoya sobre el concepto de territorialidad. Su objectivo es investigar la influencia del lugar del partido, de la calidad del adversario y de la exclusiones de los jugadores sobre el record. La muestra constituye 364 partidos (182 de cada una de las temporadas deportistas 2014-2015 y 2015-2016) de la Liga Francesa profesional del balonmano (LNH). Al contrario de las previsiones resultante de la teoria de la territorilidad, los resultados no han demostrado que los equipos jugando a domicilio eran más sancionados que los equipos visitantes. Sin embargo, utilizando el análisis de varianza, los resultados han demostrado sin duda alguna que la calidad del adversario tenía más efecto sobre el resultado final que el lugar del partido, y que existe un efecto de interacion ([lugar del partido] x (calidad del adversario) x (diferencia de la candidad de jugadores excluidos 2 minutos, entre los equipos)], sobre del tanteo. De hecho, los equipos de casa con una fuerte oposición tienen mejores resultados cuando son más sancionados (M = -2.26; SD = 3,53) que cuando son menos sancionados (M = -4,9; SD = 4,69). En cuanto a los equipos visitantes, enfrentados a una fuerte oposición, se comportan mejor cuando son menos sancionados (M = -2,8, SD = 4,5) que cuando son más sancionados (M = -5.4, SD = 3,5) o cuando las suspensiones de los jugadores son equilibradas (M = -5,7; SD = 5,4); también, frente a una oposición equilibrada, se comportan mejor cuando son más sancionados (M = 0,03; SD = 4,85) que cuando las suspensiones de los jugadores son equilibradas (M = -2,1; SD = 4,34). Estos resultados pueden contribuir a una mejor comprension de variables situacionales en el balonmano de alto nivel, y ayudar los entrenadores a preparar las estrategias de su equipo.

Palabras clave: ventaja de campo; territorialidad; agresividad de los jugadores; variables situacionales; análisis de rendimiento; modelado social.

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Received: April 29, 2017; Accepted: October 3, 2017

Introduction

Situational variables, defined as the different game and situational conditions that may influence performance at a behavioral level (Gómez, Lago-Peñas, & Pollard, 2013), are one of the topics of great interest to sport performance analysis. Many authors supported an in-depth analysis of situational variables, that is to say the effect of a combination of situational variables in order to gain a better understanding of their influence in team sports (Gómez et al., 2013; Taylor, Mellalieu, James, & Shearer, 2008; Lago & Martin, 2007). Indeed, the knowledge of the situational variables describing team sport performance seems to be a determining aspect for coaches' decision making when planning trainings and during competitions (Gómez et al. 2016; Marcelino et al., 2012).

Within this research framework the home advantage phenomenon in team sport has been widely analyzed (Pollard & Gómez, 2015). It is the term used to describe the consistent finding that home teams in sport competitions win over 50% of the games played under a balanced home and away schedule (Courneya & Carron, 1992). This robust phenomenon was highlighted for the first time by Schwartz and Barsky (1977), and since that first formal study, it has been widely analyzed in different team and individual sports (Jamieson, 2010). For example, in team handball, many authors (Meletakos & Bayios, 2010; Pollard & Gómez, 2012; Strauß & Bierschwale, 2008) studied home advantage in different European countries and found results ranged from 57% to 72%. However, many studies (e.g., Gómez, Lago-Peñas, Viaño, & González-Garcia 2014; Debanne & Laffaye, 2017; Pollard & Gómez, 2009) highlighted the fact that the quality of the opponent overcomes the home advantage (if the best ranked team plays at home against the last ranked team, the home team is expected to win, but as an effect of quality rather than an effect of location). Next to other factors (e.g., familiarity, referee bias, crowd noise, travel fatigue, psychological factors), territoriality, defined as the protective response to an invasion of one's perceived territory (Neave & Wolfson, 2003), seems to be one of the major determining factors of home advantage (Carron, Loughhead, & Bray 2005). Indeed, the home team tries to keep the visiting team far away from the goal in defense and then tries to expel them from the court by scoring goals in offense. The protective response of home players can be identified in biological variables as testosterone (Neave & Wolfson, 2003). This idea was confirmed by some studies highlighting the fact that home players had significantly higher pre-game testosterone levels when playing in their home venue than when playing in their opponents' venue (Neave & Wolfson, 2003; Carré, Muir, Belanger, & Putnam, 2006). Higher testosterone levels have been associated with dominant and assertive behavior (Mazur & Booth, 1998) vigor and activation (Dabbs, Strong, & Milun, 1997; O'Connor, Archer, Hair, & Wu, 2002). Hence, the protective response of home players can be identified in game behaviors as defensive assertiveness (Mazur & Booth, 1998; Bray, Jones, & Owen, 2002).

Courneya and Carron (1992) highlighted the necessity of examining the various behavioral states associated with game location to better understand the mechanisms responsible for home advantage. Given the link between territoriality and aggressiveness, aggressiveness can be considered as a possible behavioral mediator of the game location-game outcome relationship (e.g., Schwartz & Barsky, 1977). Psychologists have often categorized human aggression as hostile and instrumental (Buschman & Anderson, 2001). For these authors, hostile aggression is an impulsive behavior motivated by the desire to hurt someone, whereas instrumental aggression is a premeditated behavior used as a means to some other end.

Authors in sport sciences defined aggression slightly differentely. They defined instrumental aggression as a sport specific strategy aimed at the reward of winning the game (i.e. non-aggressive goal), while hostile aggression which usually involves anger has harm or injury as its primary goal (Husman & Silva, 1984).

Given that handball is an aggressive sport with forceful body contact (Karcher & Buchheit, 2014) the concept of territorial protection might be more important than in other sports like basketball or soccer. In this sport, the rule allows players to use bent arms to make body contact with an opponent, and to use one's trunk to block the opponent, in a struggle for positions. But the rule does not allow players to block the opponent with arms, hands, legs, or to use any part of the body to displace him or push him away. To ensure the safety of players, referees can call players' exclusions (i.e. exclusion or disqualification) mainly when fouls are committed with high intensity (IHF 2015). An exclusion is always for a playing time of 2 minutes, and the disqualification of a player or a team official, on or off the court, during the playing time, always carries with it a 2-minute exclusion for the team. In a longitudinal study of elite handball players, Stornes (2001) showed that it was quite common among coaches and players to resort to rational, instrumental aggression as an efficient winning strategy. Thus, there seems to exist a consensual perception among all handball players that justifies such conduct. Especially, occasions decisive for the final outcome could easily generate aggressive and violent acts despite the consequences of breaking the rules intentionally (professional foul). The players argued that this was a rational thing to do. A similar propensity to perceive aggressive behavior as fair and acceptable conduct was found in an investigation of adolescent handball players (Stornes & Bru, 2002.). The results of the two studies (Stornes, 2001; Stornes & Bru, 2002), showed a predominant aggressive competitive atmosphere in handball, justified among the players by referring to aggressiveness as an integral component of the contest. Also, these behaviors concerning this aggressive competitive atmosphere have been highlighted in other aggressive sports with forceful body contact, like ice hockey (e.g., Smith, 1979).

Studying home advantage in elite handball according to the quality of opponent, the game periods where the teams scored more goals, and the game statistics associated, Oliveira, Gómez, and Sampaio (2012) highlighted the fact that territorial behaviors seemed stronger against similarly ranked teams and stronger at the end of each half of the game, as long as the game final outcome was uncertain. Furthermore, studying the effects of numerical difference between the teams on team performance, Prieto, Gómez and Sampaio (2015) showed that when exclusions were sanctioned, the opponents took advantage of their numerical superiority and improved their scoring performance. However, the scoring increments were smaller than might be expected from a 2-minute numerical playing superiority, and this trend was not affected by game location or quality of opposition.

To the best of our knowledge, most studies that have examined ball players' aggressiveness and team performance have mainly done so without cross situational variables. Thus, the main goal of the current study is to investigate the effects of players' aggressiveness and other situational variable influence, such as game location and quality of opposition, on match outcome. According to this literature review, it is hypothesized that (a) home teams use more instrumental aggressions than their opponents, and (b) team performance is influenced by match location, quality of opposition and instrumental aggressions.

Method

The study received approval from the university's ethics committee.

Participants

The study focused on regular season 2014-2015 and regular season 2015-16 men's French Professional Handball League (LNH) in which 364 games were played (182 during each regular season). Archival data were obtained from the open-access official websites of French Handball Professional League (http://www.lnh.fr).

Variables

Concerning the first hypothesis, the dependent variable was the players' exclusion difference between the teams, and the independent variable was the game location (Home vs. Away).

Concerning the second hypothesis the dependent variable was the home advantage, defined as the difference in goals scored by the home and visiting team (i.e. *goals scored by the home team minus goals scored by the visiting team*) (Unkelbach and Memmert, 2010). The independent variables were (a) the game location (Home vs. Away), (b) the quality of opposition (according to Debanne and Laffaye [2017], this variable was identified from difference end-of-previous season goal-average ranking), and (c) the players' exclusion difference between the teams (i.e. when a team A plays against a team B, concerning the team A, the players' exclusion difference is defined as *the 2-minute exclusions' number of team A minus the 2-minute exclusions' number of team B*).

Procedure

All data (2497 exclusions, $M = 5.86$; $SD = 3.13$) were gathered by professional technicians of the League. However a data reliability test (kappa coefficients), carried out by three coders (two men and one woman, respectively aged 54, 48 and 42, teaching handball at the Faculty of Sport Science of the University), was assessed on fourteen games randomly selected (5% of the sample). Fleiss' Kappa index (k) represents the normalized proportion of inter-observer agreement in excess of what would be expected on the basis of chance or random assignments. We used the MacKappa software (Watkinson, 2002) which calculates both general and conditional coefficients and tests the statistical significance of agreement among many observers assigning objects to nominal scales as based on Fleiss' (Fleiss, 1971) computational formulae. The results of the kappa test showed coefficients of agreement of 1.0 for exclusions received for both teams in each game.

Studying elite team handball, Prieto et al. (2015) have associated players' agressiveness and players' exclusions (2-minute exclusions and disqualification). They seemed to consider that hostile aggressions and unsportsmanlike conducts at elite level were very rare. From this sample of fourteen games, in order to ensure the assertion of Prieto et al. (2015), the three coders assessed each player's exclusion ($N = 89$) in hostile and instrumental aggression. The coders assessed players' exclusions from works of Rascle and colleagues (Rascle, Coulomb, & Pfister, 1998; Rascle & Coulomb, 2003) which distinguished between instrumental and hostile aggression through eight behavioral aggression categories: 4 instrumental (occurs during play): repelling, retaining, hitting, and cheating (behaviors such as stalling game, violating distance code, hindering opponent, etc.) and four hostile (occurs when the ball is not in play): insulting, threatening, making obscene gestures, or shoving, against opponents, referees, teammates, and others (public, object, oneself, etc.). Among 89 players' exclusionexclusions, 81 (91.01%) were assessed as instrumental (repelling [n=58], retaining [n=4], hitting [n=6], and cheating [n=13]). Only eight were assessed as hostile (8.99%). The

overall Kappa revealed a high rate of agreement among the different coders (k = 0.94; SE = 0.05; 95%CI = 0.92 to 0.99, see Table I). Hence, players' exclusionexclusions appeared as a good indicator to identify instrumental aggressions.

Table 1: Inter-rater agrement (Fleiss' Kappa results)

Category	Kappa index	z	p
Instrumental	.934	15.26	<.001
Hostile	.915	14.95	<.001
Unsportmanlike	1	16.34	<.001
Total	.936	18.43	<.001

We associated each game with quality of opposition and 2-minute exclusions difference, using *k*-means cluster analysis to identify a cut-off value of quality of opposition and 2-minute exclusion difference. This algorithm aims to classify objects based on attributes into a K number of groups. The grouping is done by minimizing the sum of squares of distances between data and the corresponding cluster centroid, which represents the arithmetic mean for each dimension separately over all the points in the cluster. The results identified three clusters as follows:

- Quality of opposition, weak (-133.7±50.2; n=195, range [-316] – [-66]), balanced (of 2.7±38.0; n=352, range [-64] – [67]) and strong (goal-average difference of 137.8±48.5; n=181, range [69] – [316]);
- 2-minute exclusion difference, more punished (exclusion difference of 2.8±1.1; n=174, range [2] – [8]), punished as (exclusion difference of 0±0.8; n=380, range [-1] – [1]), less punished (exclusion difference of -2.8±1.1; n=174, range [-8] – [-2]).

Data Analysis

The statistical software used was STATISTICA 13.0 for Windows (Maisons-Alfort, France). Statistical significance was set at p<.05. Concerning the first hypothesis, in order to determine the game location effect on players' exclusions, unpaired student t-tests were performed. Concerning the second hypothesis, a 2 (locate: HOME vs. AWAY) × 3 (quality of opposition: STRONG vs. BALANCED vs. WEAK) × 3 (players' exclusions difference: MORE vs. IDENTICAL vs. LESS) × Analysis of Variance (ANOVA) was performed to determine the effects of game location, quality of opposition and exclusion difference on home advantage. Also, we indicated the size of each effect measured by eta-squared, defined as large (≥0.14), medium (≥0.06) and small (≥0.01) (Cohen, 1988).

Results

Game Location Effect on Players' Exclusions

The student t-tests revealed no significant effect ($t_{(726)}$=0.10, p=.91) of game location on players' exclusions. Home teams are not more sanctioned (M = 0.01; SD = 2.18) than visiting teams (M = -0.01; SD = 2.18).

Situational Variables Effects on Team Performance

ANOVA 2 (locate) × 3 (quality of opposition) × 3 (players' exclusion difference) revealed two main effects and two interaction effects on the score differential. These results are summarized in table II.

Table 2: Situational Variables Effects on Team Performance

Independent Variables			**Dependent Variable: Score differential**				
			N	*M*	*SD*	*F*	*p*
Quality of Opposition						$F_{(2, 710)} = 129.39$	<.0001
Weak			183	4.22	4.82		
Balanced			350	0.05	4.63		
Strong			195	-4.05	5.58		
Game Location						$F_{(2, 710)} = 13.72$	<.001
Home			364	1.02	5.49		
Away			364	-1.02	5.49		
Exclusions Difference						$F_{(2, 710)} = 0.45$	.64
Opponent more sanctioned			174	-0.20	5.12		
ExclusionExclusions balanced			380	0	5.97		
Own team more sanctioned			174	0.20	5.12		
[Game Location] x [Exclusions Difference]						$F_{(2, 710)} = 3.97$	.02
Home	Opponent more sanctioned		84	0.25	5.79		
	ExclusionExclusions balanced		190	1.55	5.78		
	Own team more sanctioned		90	0.62	4.41		
Away	Opponent more sanctioned		90	-0.62	4.41		
	Exclusions balanced		190	-1.55	5.78		
	Own team more sanctioned		84	-0.25	5.79		
[Exclusions Difference] x [Game Location] x [Quality of Opposition]						$F_{(4, 710)} = 3.47$	.008
Opponent more sanctioned	Home	Balanced	29	0.10	4.74		
		Strong	9	-6.67	5.63		
		Weak	16	6.06	3.70		
	Away	Balanced	34	-1.06	3.97		
		Strong	22	-2.82	4.55		
		Weak	19	2.26	3.53		
Exclusions balanced	Home	Balanced	71	1.56	4.30		
		Strong	39	-3.77	4.61		
		Weak	32	7.25	5.17		
	Away	Balanced	71	-1.56	4.30		
		Strong	32	-7.25	5.17		
		Weak	39	3.77	4.61		
Own team more sanctioned	Home	Balanced	34	1.06	3.97		
		Strong	19	-2.26	3.53		
		Weak	22	2.82	4.55		
	Away	Balanced	29	-0.10	4.74		
		Strong	16	-6.06	3.70		
		Weak	9	6.67	5.63		

Note: *N* = number of observations, *M* = mean, *SD* = standard deviation, Statistical significance was set at $p<.05$.

Main effects

The ANOVA revealed a large significant main effect of the quality of opposition on the score differential, $F(2, 710) = 129.39$, $p < .0001$; $\eta^2 = .26$. Fischer LSD post hoc comparisons showed that when the quality of opposition was weak, the team performance was significantly better ($M = 4.22$; $SD = 4.82$, $ps < .0001$) than when the quality of opposition was balanced ($M = 0.05$; $SD = 4.63$) and strong ($M = -4.05$; $SD = 5.58$). Morever, when the quality of opposition was balanced a team performance was significantly better ($M = 0.05$; $SD = 4.63$, $p < .0001$) than when the quality of opposition was weak ($M = -4.05$; $SD = 5.58$).

Moreover, ANOVA revealed a small significant main effect of the game location on the score differential, $F(1, 710) = 13.72$, $p < .001$; $\eta^2 = .02$. A Home team performance was significantly better ($M = 1.02$; $SD = 5.49$) than the visiting team ($M = -1.02$; $SD = 5.49$). Furthermore, the ANOVA did not reveal any main effect of players' exclusion difference on score differential ($F(2, 710) = 0.45$, $p = .64$).

Interaction effects

Firstly, the ANOVA revealed a small significant interaction effect of [game location] x [exclusions difference] on the score differential, $F(2, 710) = 3.97$, $p = .02$; $\eta^2 = .01$ (see figure 1). Fischer LSD post hoc comparisons showed that (a) when a team played at home, the team performance was significantly better when the players' exclusions were balanced ($M = 1.5$; $SD = 5.8$) than when the team was less sanctioned ($M = 0.2$; $SD = 5.8$; $p = .03$) ; (b) when a team played away, the team performance was significantly better when the team was more sanctioned ($M = -0.2$; $SD = 5.8$, $p = .03$) than when the players' exclusions were balanced ($M = -1.5$; $SD = 5.8$).

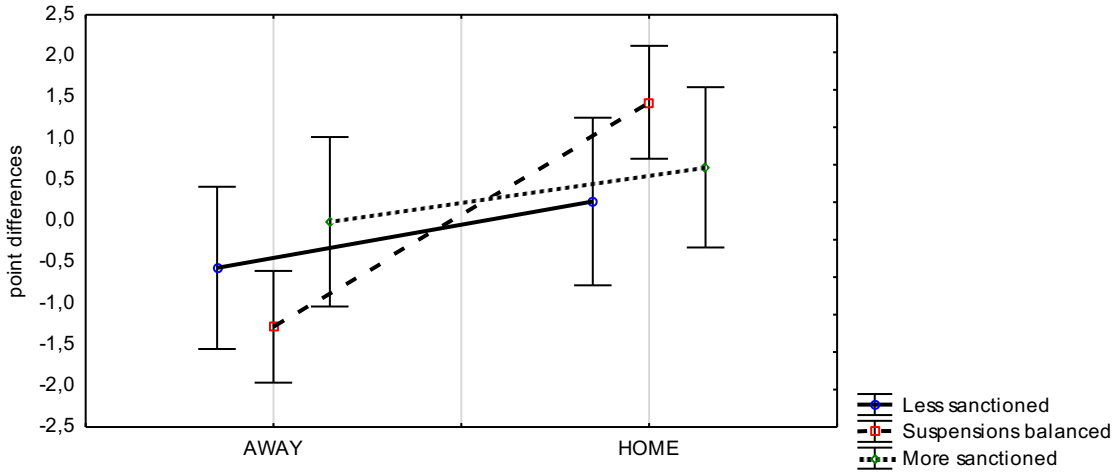

Figure 1: Interacton effects of [game location] x [exclusions difference] on score differential

Secondly and more interesting, the ANOVA revealed a small significant interaction effect of [game location] x [quality of opposition] (see figure 2). Fischer LSD post hoc comparisons showed that (a) when a team played at home and the quality of opposition was strong, the team performance was significantly better when the team was more sanctioned ($M = -2.26$; $SD = 3.53$) than when the team was less sanctioned ($M = -4.9$; $SD = 4.69$; $p = .049$) ; (b) when a team played at home and the quality of oppositionwas weak, there was a team performance trend effect, the team performance was worse when the team was more sanctioned ($M = 2.8$; $SD = 4.48$) than when the team was less sanctioned ($M = 5.1$; $SD = 3.60$; $p = .07$) or when the players' exclusions were balanced ($M = 4.9$; $SD = 5.43$; $p = .08$) ; (c) when a team played away and the quality of opposition was strong, the team performance was significantly better when the team was less sanctioned ($M = -2.8$; $SD = 4.5$) than when the players' exclusions were balanced ($M = -5.7$; $SD = 5.4$, $p = .01$), or than when the team was more sanctioned ($M = -5.4$; $SD = 3.5$, $p = .05$) ; (d) when a team played away and the quality of opposition was balanced, the team performance was significantly better when the team was more sanctioned ($M = 0.03$; $SD = 4.85$) than when the players' exclusions were balanced ($M = -2.1$; $SD = 4.34$, $p = .02$).

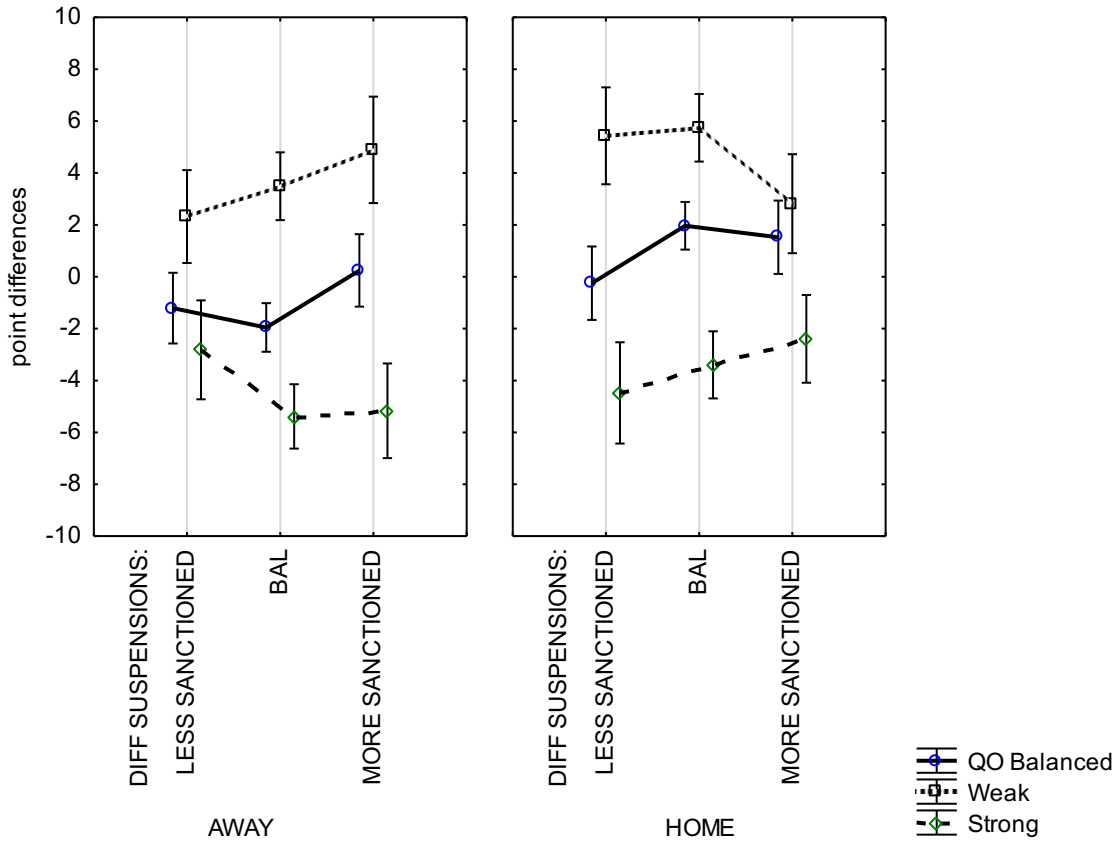

Figure 2: Interaction effects of [Game Location] x [Quality of Opposition] x [Exclusion Difference] on score differential

Discussion

The aim of this study was to investigate the influence of game location, quality of opposition, and players' exclusion difference on team performance. Based on the territoriality concept, it was hypothesized that home teams were more aggressive than visiting teams, and team performances were influenced by match location, quality of opposition and players' exclusions (considered as a reliable indicator of instrumental aggressions).

The results of the present study did not confirm the first hypothesis. Home teams are not more sanctioned than visiting teams. This finding is consistent with early studies using extensive data set (e.g., Jones, Bray, & Olivier, 2005; McGuire, Courneya, Widmeyer, & Carron, 1992; Russell, 1983) and with more recent studies conducted either in handball (Lago-Peñas et al., 2013; Prieto et al., 2015), or in Spanish soccer (García-García, Martínez, & González-Gómez, 2017). Among the possible reasons explaining why home teams did not display higher levels of aggression than away teams, the main one is that home team players may choose not to aggress because such behavior is likely to be penalized by referees, with a significant consequence on team performance (Widmeyer, Dorsch, Bray, & McGuire, 2002). Furthermore, the suggestion that athletes may display greater aggression at home is also at odds with the Terry's and colleagues study (Terry, Walrond, & Carron, 1998) that assessed the psychological state of rugby players before home and away games. They found that players reported higher levels of anger when competing away from home than when competing at home. Given that levels of anger are typically associated with levels of aggression (Berkowitz, 1993), it can be inferred that away teams will behave more aggressively. However, in this study, participants were male university and club level rugby

players, while in our study participants are high level players. Insofar as instrumental aggressions would progressively be integrated as performance tools (Coulomb-Cabagno & Rascle, 2006), the players' level could impact the use of instrumental aggressive behaviors.

Concerning the second hypothesis, (team performance is influenced by match location, quality of opposition and players' exclusions), the results of the current study highlighted the fact that the quality of opposition is the key variable explaining 26% of the variance. The stronger is the quality of opposition, the lower is the team prformance, and conversely. The game location variable explains only 2% of the variance. Therefore, in accordance with previous studies (Lago-Peñas et al., 2013; Pollard & Gómez, 2009), the findings of the current study support the idea that the quality of the opponent overcomes the home advantage effect. Moreover, the finding that there was no main effect of players' exclusion difference on score differential fails to support the relationship between increased aggression and success (Widmeyer & Birch, 1984). This relationship appears more complex and this is the reason why previous research suggested the necessity to include situational and contextual factors in a study of aggressive behavior (e.g., McGuire, 1990; Widmeyer & McGuire, 1997). In line with this, the results of the present study revealed significant interaction effects of [game location] x [players' exclusion difference] on score differential. When a team plays at home, the team's performance is better when the players' exclusions are balanced than when the team is less sanctioned. And, when a team plays away, the team's performance is better when the team is more sanctioned than when the players' exclusions are balanced.

Although the effect size of this interaction on score differential is small, we can suggest that one strategy of the home team in team handball is to adapt its physically aggressive style of play to the visiting team using similar aggressiveness. Concerning the visiting team, it seems useful to be more aggressive than the opponent. This interaction effect crossing game location and aggression has already been highlighted by McGuire et al. (1992) showing that games with a high level of aggression favor home teams whereas games with low level of aggression favor visiting teams. However, these current results are not consistent with those of other studies (Jones et al, 2005; Garcia-Garcia et al, 2017). Indeed, examining the relationship between aggression and game location in the English rugby league, Jones et al. (2005) found that away teams engaged in substantially more aggressive behaviors in games they lost compared with games they won. In the same way, in soccer, Garcia-Garcia et al. (2017) found that an increase in instrumental aggressions by the home team is associated with a lower probability of scoring and the same applies to the away team and their chance of getting a goal. These inconsistent results can be explained by the fact that aggressive behaviors are sanctioned differently in these different team sports (ice hockey: 2 ; 5 or 10 minutes; team handball: 2 minutes ; rugby: 10 minutes). Furthermore, in rugby, a penality is associated with each aggressive behavior. Each penality can allow to score three points. Hence, according to Coulomb-Cabagno and Rascle (2006), players' aggressive behaviors seem to be affected by the socialization process because it is primarily a learned behavior, reinforced through social modeling (Bandura, 1973).

Practical Applications

Interesting practical applications might be highlighted from the interaction effect of [game location] x [quality of opposition] x [players'exclusion difference] on score differential. When a home team is faced with strong opposition, or when a visiting team is faced with weak opposition, to be more sanctioned than the opponent allows a better performance, so coaches should encourage their players to have a more aggressive behavior. These results are in line with studies that have shown a home advantage for an animal when its territory is threatened or attacked, even when the defender is smaller than the rival, suggesting an

important motivational incentive in territorial defense (Alcock, 1998). Also, these results are consistent with those of Debanne and Fontayne (2009) that carried out a case study with a two-time world champion handball coach, using a videocuing recall-stimulated interview (Lyle, 2003). They highlighted a hierarchical organization of the coach's concerns in which physical involvement is somewhat of a prerequisite before any intervention. As the team is stronger than its opponent, it is very important to be physically involved. Hence, in these two contexts, we suggest coaches should use a very agressive defensive strategy, in order to show that players are ready to fight.

Lastly, when a visiting team is faced with strong opposition, to be less sanctioned than the opponent allows a better performance. Indeed, away and with strong opposition, the good strategy does not seem to consist in using aggressive behaviors, but in playing with man-advantage more often in order to compensate for the quality of opposition. To do so, we recommend for example to play with two pivots, and to use duals which are known to create 2-minute exclusions.

To conclude, coaching strategies could take into account situational variables such as quality of opposition and game location. These results can contribute to a better understanding of the situational determining factors of elite handball performance, helping coaches to prepare their players accordingly.

References

Alcock J. (1998). *Animal behaviour: An evolutionary approach*. Sunderland (MA): Sinaur Associates.

Bandura, A. (1973). *Aggression: A social learning analysis*. Englewood Cliffs: Prentice-Hall.

Bray, S. R.; Jones, M. V., & Owen, S. (2002). The influence of competition location on individual sport athletes' performance and psychological states. *Journal of Sport Behavior*, *25*(3), 231-242.

Bushman, B. J., & Anderson, C. A. (2001). Is it time to pull the plug on the hostile versus instrumental aggression dichotomy? *Psychological Review*, *108*, 273-279. https://doi.org/10.1037/0033-295X.108.1.273

Carré, J.; Muir, C.; Belanger, J., & Putnam, S. K. (2006). Pre-competition hormonal and psychological levels of elite hockey players: Relationship to the 'home advantage'. *Physiology & Behavior*, *89*(3), 392-398. https://doi.org/10.1016/j.physbeh.2006.07.011

Carron, A.; Loughhead, T., & Bray, S. (2005). The home advantage in sport competitions: Courneya & Carron's (1992) conceptual framework a decade later. *Journal of Sports Sciences*, *23*(4), 395-407. https://doi.org/10.1080/02640410400021542

Cohen, J. (1988). S*tatistical power analysis for the behavior sciences.* Lawrence. Hillsdale.

Coulomb-Cabagno, G., & Rascle, O. (2006). Team sports players' observed aggresion as a function of gender, competitive level, and sport type. *Journal of Applied Social Psychology*, *36*(8), 1980–2000. https://doi.org/10.1111/j.0021-9029.2006.00090.x

Courneya, K. S. & Carron, A. (1992). The home advantage in sport competitions: A literature review. *Journal of Sport and Exercise Psychology*, *14*(1), 13-27. https://doi.org/10.1123/jsep.14.1.13

Dabbs, J. M.; Strong, R., & Milun, R. (1997). Exploring the mind of testosterone: A beeper study. *Journal of Research Personality*, *31*(4), 577–587. https://doi.org/10.1006/jrpe.1997.2203

Debanne T. & Fontayne P. (2009). A study of a successful experienced elite handball coach's cognitive processes in competition situations. *International Journal of Sports Science and Coaching*, *4*(1), 1–15. https://doi.org/10.1260/1747-9541.4.1.1

Debanne, T. & Laffaye, G. (2017). Effects of game location, quality of opposition, number of foreign players and anthropometric factors in elite handball games. *Kinesiology*, *49*(2), xx-xx. (completar) http://hrcak.srce.hr/ojs/index.php/kinesiology/article/view/5261/2890

Edwards, J. & Archambault, D. (1989). The homefield advantage. In J. H. Goldstein (Ed.), *Sports, games and play: Social and psychological viewpoints* (2nd edn., pp. 333 – 370). Hillsdale, NJ: Lawrence Erlbaum Associates.

Fleiss, J. L. (1971). Measuring Nominal Scale Agreement Among Many Raters, *Psychological Bulletin, 76*, 378-382. https://doi.org/10.1037/h0031619

García García, P. A.; Martínez, J. A., & González-Gómez, F. J. (2017). Influencia de la agresividad sobre el rendimiento de equipos de fútbol en España [The influence of aggressiveness on the performance of football teams in Spain]. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, *17*(2), 317-334.

Gómez, M. A.; Lago-Peñas, C.; Viaño, J., & González-Garcia, I. (2014). Effects of game location, team quality and final outcome on game-related statistics in professional handball close games. *Kinesiology*, *46*(2), 249-257.

Gómez, M. A.; Lago-Peñas, C., & Pollard, R. (2013), Situational variables. In T. McGarry, P. O'Donoghue, and J. Sampaio (eds), *Routledge Handbook of Performance Analysis in Sport* (pp. 259-269). London and New York: Routledge.

Gómez, M. A.; Pollard, R., & Luis-Pascual, JC. (2011). Comparison of the home advantage in nine different professional sports team in Spain. *Perceptual and Motor Skills*, *113*, 1-7. https://doi.org/10.2466/05.PMS.113.4.150-156

Gómez, M. A.; Dela Serna, A.; Lupo, C., & Sampaio, J. (2016). Effects of game location, quality of opposition, and starting quarter score in the outcome of elite water poloquarters. *Journal of Strength an Conditioning Research*, *30*(4), 1014-1020. https://doi.org/10.1519/JSC.0b013e3182aa5f59

IHF (2015). Rules of the game. Retrieved september 2th 2015 from: http://www.ihf.info/upload/PDF- Download/rules_english.pdf

Jamieson, J. P. (2010). Home field advantage in athletics: A meta-analysis. *Journal of Applied Social Psychology, 40*(7)*,* 1819-1848. https://doi.org/10.1111/j.1559-1816.2010.00641.x

Jones, M. V.; Bray, S. R., & Olivier S. (2005). Game location and aggression in rugby league. *Journal of Sports Sciences*, *23*(4), 387 – 393. https://doi.org/10.1080/02640410400021617

Karcher, C., & Buchheit, M. (2014). On-court demands of elite handball, with special reference to playing positions. *Sports Medicine*, *44*(6), 797-814. https://doi.org/10.1007/s40279-014-0164-z

Lago-Peñas, C., & Martin, R. (2007). Determinants of possession of the ball in soccer. *Journal of Sports Sciences, 25*(9), 969-974. https://doi.org/10.1080/02640410600944626

Lago-Peñas, C.; Gómez, M. A.; Viaño, J.; González-García, I., & Fernández-Villarino, M. A. (2013). Home advantage in elite handball: The impact of the quality of opposition on team performance. *International Journal of Performance Analysis in Sport*, *13*, 724-733.

Lyle, J. (2003). Stimulated Recall: A report on its use in naturalistic research. *British Educational Research Journal*, *29*(6), 861-878. https://doi.org/10.1080/0141192032000137349

Marcelino, R.; Sampaio, J.; Mesquita, I. (2012). Attack and serve performances according to the match period and quality of opposition in elite volleyball matches. *Journal of Strength and Conditionning Resarch*, *26*, 3385-3391. https://doi.org/10.1519/JSC.0b013e3182474269

Mazur A. & Booth A. (1998). Testosterone and dominance in men. *Behavioral and BrainSciences*, *21*(3), 353–363. https://doi.org/10.1017/S0140525X98001228

McGuire, E. J.; Courneya, R. S.; Widmeyer, W.N., & Carron, A. V. (1992). Aggression as a potential mediator of the home advantage in professional ice hockey. *Journal of Sport and Exercise Psychology, 14*(2), 148–158. https://doi.org/10.1123/jsep.14.2.148

Meletakos, P., & Bayios, I. (2010). General trends in European Men's Handball: A longitudinal study. *International Journal of Performance Analysis in Sport, 10*(3), 221-228.

Neave, N., & Wolfson, S. (2003). Testosterone, territoriality, and the 'home advantage'. *Physiology and Behavior, 78*(2), 269-275. https://doi.org/10.1016/S0031-9384(02)00969-1

O'Connor, D. B.; Archer, J.; Hair, W. M., & Wu, F. C. (2002). Exogenous testosterone, aggression and mood in eugonadal and hypogonadal men. *Physiology and Behavior*, *75*(4), 557–566. https://doi.org/10.1016/S0031-9384(02)00647-9

Oliveira, T.; Gómez, M., & Sampaio, J. (2012). Effects of game location, period, and quality of opposition in elite handball performances. *Perceptual and Motor Skills*, *114*(3), 783-794. https://doi.org/10.2466/30.06.PMS.114.3.783-794

Pollard, R., & Gómez, M. A. (2009). Home advantage in football in South-West Europe: Long term trends, regional variation, and team differences. *European Journal of Sports Science, 9*(6), 341-352. https://doi.org/10.1080/17461390903009133

Pollard, R., & Gómez, M. A. (2012). Reassessment of home advantage in Spanish handball: Comment on Guttierez et al. *Perceptual an Motor skills*, *115*(3), 937-943. https://doi.org/10.2466/06.05.PMS.115.6.937-943

Pollard, R., & Gómez, M. A. (2015). Validity of the established method of quantifying home advantage in soccer. *Journal of Human Kinetics, 45*(1), 7-8. https://doi.org/10.1515/hukin-2015-0001

Prieto, J.; Gómez, M. A., & Sampaio, J. (2015). Players' exclusions effects on elite handball teams' scoring performance during close games. *International Journal of Performance Analysis in Sport*, *15*(3), 983-996. https://doi.org/10.1080/24748668.2015.11868845

Rascle, O.; Coulomb, G., & Pfister, R. (1998). Aggression and goal orientations in handball: Influence of institutional sport context. *Perceptual and Motor Skills*, *86*(3 Pt 2), 1347-1360. https://doi.org/10.2466/pms.1998.86.3c.1347

Rascle, O., & Coulomb, G. (2003). Aggression in youth handball: Relationships between goal orientations and induced motivational context. *Social Behavior and Personality*, *31*(1), 21–34. https://doi.org/10.2224/sbp.2003.31.1.21

Russell, G. W. (1983). Crowd size and density in relation to athletic aggression and performance. *Social Behavior and Personality*, *11*(1), 9−15. https://doi.org/10.2224/sbp.1983.11.1.9

Schwartz, B., & Barsky, S. (1977). The home advantage. *Social Forces, 55*(3), 641-661. https://doi.org/10.1093/sf/55.3.641

Stornes, T. (2001). Sportspersonship in Elite Sports. On the effects of personal and environmental factors on sportspersonship behaviour in handball. *The European Physical Education Review*, *7*(3), 283-305. https://doi.org/10.1177/1356336X010073004

Stornes T., & Bru, E. (2002). Sportspersonship and perceptions of leadership. An investigation of adolescent handball players' perceptions of sportspersonship and relations with perceived leadership. *European Journal of Sport Science*, *2*(6), 1-15. https://doi.org/10.1080/17461391.2002.10142577

Strauβ, B., & Bierschwale, J. (2008). Spectators and the home advantage in the German national handball league**.** *Zeitschrift fur sportpsychologie*, *15*(3), 96-101. https://doi.org/10.1026/1612-5010.15.3.96

Taylor, J. B.; Mellalieu, S. D.; James, N., & Shearer, D. A. (2008). The influence of match location, quality of opposition, and match status on technical performance in professional association football. *Journal of Sports Sciences*, *26*(9), 885-895. https://doi.org/10.1080/02640410701836887

Terry, P. C.; Walrond, N., & Carron, A. V. (1998). The influence of game location on athletes' psychological states. *Journal of Science and Medicine in Sport*, *1*(1), 29-37. https://doi.org/10.1016/S1440-2440(98)80006-6

Unkelbach, C., & Memmert, D. (2010). Crowd noise as a cue in referee decisions contributes to the home advantage. *Journal of Sport & Exercise Psychology*, *32*(4), 483-498. https://doi.org/10.1123/jsep.32.4.483

Widmeyer, W. N., & Birch, J. S. (1984). Aggression in professional ice hockey: A strategy for success or reaction to failure? *Journal of Psychology*, *117*(1), 77-84. https://doi.org/10.1080/00223980.1984.9923661

Widmeyer, W. N., & McGuire, E. J. (1997). Frequency of competition and aggression in professional ice hockey. *International Journal of Sport Psychology*, *28*(1), 57-66.

Widmeyer, W. N.; Dorsch, K. D.; Bray, S. R., & McGuire, E. J. (2002). The nature, prevalence, and consequences of aggression in sport. In J. M. Silva and D. E. Stevens (Eds.), *Psychological foundations of sport* (2nd edn., pp. 328 – 351). Boston, MA: Allyn & Bacon.