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Situational variables in elite rink hockey: effect of match location, team level, scoring first and match status at halftime on the competitive outcome

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ABSTRACT

The main purpose of the present study was to build a parsimonious model to predict the probability of winning in rink hockey from different situational variables and evaluate each predictor's contribution to the match outcome. A sample of 238 matches played during the last season in the Spanish first division (*OkLiga*) was analysed. The best predictive logistic model for match outcome was selected through all possible regression methods. The entire model included five categorical predictor variables (*match location, team level, opponent level, scoring first*, and *match status at halftime*) and one binary outcome variable (*match outcome*). The final model selected excluded the scoring first predictor and had a sensitivity and specificity greater than 80% for a cut-off point of .413. This model was applied to predict winning a match in 32 frequent situations determined from a two-step cluster analysis. The predictor with the highest contribution to the match outcome was *match status at halftime*, followed by the *opponent's level, team level*, and *match location*. Our findings may help rink hockey coaches and practitioners to recognise the contribution of situational variables on the match outcome to tailor their game plans and design more aggressive game plans, improving game understanding.

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Match analysis; roller hockey; team sports; binary logistic regression; predictive model

1. Introduction

In the last years, the increasing interest in sports performance analysis has expanded the number of studies about match variables in different sports. Rink hockey, a collective sport where two teams of five players compete on a rectangular court (40 × 20 m) surrounded by a one-metre high barrier, is not an exception, and the number of studies about this topic has grown considerably (Ferraz et al., 2020). Like in other team sports, given the increasing professionalisation, match analysis appears to be widely accepted by players, coaches and sports scientists as an essential source of information to analyse and subsequently improve sports performance (Drust, 2010; H. Liu et al., 2016). In this

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regard, it seems especially helpful in providing objective reference knowledge about the strengths and weaknesses of the opponents (Sousa et al., 2021) or to contributes to developing the players' technical and tactical knowledge, critical thinking, decision-making and confidence (Almeida et al., 2019; Butterworth et al., 2012). Therefore, it seems necessary to identify the most relevant performance indicators in every sport.

One of these performance indicators is situational variables. This term includes the different game and situational conditions that may influence performance at a behavioural level (Lago-Peñas, 2012). Match location, match status, or match time have been proven as situational determinants of the performance in several team sports (Garcia-Rubio et al., 2015; Lago-Peñas & Dellal, 2010; Lago-Peñas et al., 2016). For instance, it has been reported that situational variables influence football team's game style (Gollan et al., 2020), players' decision-making in beach handball (Vázquez-Diz et al., 2019), or the regulation of physical effort according to the specific demands of individual matches and periods of the game in professional football (Redwood-Brown et al., 2018). Given that rink hockey, like many team sports, is dominated by strategic factors, it is reasonable to suggest that situational variables may somehow influence the teams' and players' performance (Lago-Peñas, 2012). Moreover, the particularities of rink hockey regulation, divided into two halves (each one 25 minutes long with the possibility of two times-out per team), allow modifying the tactics and strategies according to game constraints and situational variables.

Among the different situational variables, probably the most analysed in team sports has been match location (Pollard & Pollard, 2005; Pollard et al., 2017). This phenomenon, known as Home Advantage (HA), is defined as the advantage of teams competing at their home court compared with their performance abroad (Pollard, 1986) and can be quantified as the number of points won at home expressed as a percentage of all points gained. HA was first studied by Schwartz and Barsky (1977) in different team sports modalities, such as basketball, ice hockey, football, or baseball in the United States, and subsequently has been widely documented in a wide variety of sports (Legaz-Arrese et al., 2013). Although HA differently influence depending on sport, region, or competitive standard, it can be quantified around 60% (Jamieson, 2010). In rink hockey. Gómez et al. (2011) and Arboix-Alió and Aguilera-Castells (2019) reported a HA of 58.32% and 59.80% in Spanish League (*OkLiga*), respectively. Similarly, in the Portuguese League, Arboix-Alió et al. (2020) reported a value of 60.88%.

Another situational variable influencing teams' performance are the initial events and the score evolution. In this vein, scoring first has been proved as an important factor to explain the final outcome in futsal matches (Sampedro & Prieto, 2012). Likewise, wining at halftime has a positive effect in water polo (Ruano et al., 2016) or basketball (Martínez, 2014). In rink hockey, it has only been analysed the teams' probability of winning, drawing, or losing when scoring first (Arboix-Alió & Aguilera-Castells, 2018). Although not being a low-scoring sport like football, (Liu et al., 2021; Sampedro & Prieto, 2012), the effect of scoring the first goal has shown a value of 64.14% and 62.91% for the First and Second division Spanish leagues, respectively (Arboix-Alió & Aguilera-Castells, 2018).

However, all rink hockey studies mentioned above have analysed situational variables in isolation, not accounting for the possibility of interactions (e.g. playing at home plus winning at halftime). Furthermore, in no case, the level of teams was taken into account.

This fact has been proven as a determinant factor in many team sports since opposition ability and team ability have a strong impact on many technical performance variables (Gómez et al., 2014; Redwood-Brown et al., 2019). Moreover, teams' ability could be especially relevant in rink hockey because in most leagues exists an evident level of bias (Arboix-Alió et al., 2019), caused probably by the different budgets of teams competing in the same division (Arboix-Alió, Buscà et al., 2021). This issue causes more heterogeneity of level than in other team sports, with professional and semi-professional athletes in the same competitions. Indeed, in a recent study, Arboix-Alió, Trabal et al. (2021) revealed higher set-piece effectiveness of the best-ranked teams (*Euroleague* group: first to the fourth position) at the end of the Spanish league season. Moreover, the same authors reported that goalkeepers of the *Euroleague* group teams saved more set-pieces (72.81%) than the *Remained* (9th to 12th position) or *Relegation* (13th to 16th position) groups' teams (65.22% and 61.77%, respectively).

These situational variables should be analysed in-depth to understand their influence on rink hockey. Therefore, the primary aim of the present study was to build a parsimonious model to predict the probability of winning a match in rink hockey, using different situational variables and evaluating the contribution of each predictor on the match outcome.

2. Methods

2.1 Sample

The sample consisted of 238 matches during the last season in the Spanish first division (*OkLiga*). The *OkLiga* has a balanced schedule in which each team plays one game at home, followed by one game away. Data collection procedures were carried out using the information available about every match on the Spanish Rink Hockey Federation official website (www.fep.es).

2.2 Design and Procedures

A total of five categorical predictor variables and one binary outcome variable were recorded (Table 1).

2.3 Statistical analysis

A descriptive analysis (absolute and relative frequencies) and inferential analysis (confidence interval for a proportion calculated using the Wilson method) of the categorical variables were performed.

The method of all possible regressions (Hosmer et al., 1989; Lawless & Singhal, 1978) was used to select the best predictive logistic model for match outcome. The initial full model included five situational predictors (MatLoc, TeaLev, OppLev, ScoFir, and MatStaHal) and one binary outcome (MatOut). The multiplicative-term TeaLev×OppLev was not included because it caused collinearity problems (an increase of the mean-variance inflation factor or mean VIF from 1.51 to 4.85 when including this term). The selection criteria for the best predictive logistic model were as follows: (a) the parsimony principle (Ratkowsky, 1993); (b) a small value of Akaike information criterion (AIC) (Akaike, 1998); (c) a large value of the area under the ROC curve (AUC); (d) balanced sensitivity (Se) and specificity (Sp) for a cut-off point of .5; (e) a good fit in the

Table 1. Properties of the analysed variables.

Role	Variable (abbreviation)	Category (code)	Description
Outcome	Match outcome	Not won (0)	The analysed team lost or tied the match
	(MatOut)	Won (1)	The analysed team won the match
Predictor	Match location	Away (0)	The analysed team played away
	(MatLoc)	Home (1)	The analysed team played at home
	Team level	Relegation (1)	The analysed team finished between 14th to 16th position
	(TeaLev)	Remained (2)	The analysed team finished between 10th to 13th position
		CERS Cup (3)	The analysed team finished between 5th to 9th position
		Euroleague (4)	The analysed team finished between 1st to 4th position
	Opponent's level	Euroleague (1)	The opponent's team finished between 1st to 4th position
	(OppLev)	CERS Cup (2)	The opponent's team between 5th to 9th position
		Remained (3)	The opponent's team between 10th to 13th position
		Relegation (4)	The opponent's team between 14th to 16th position
	Scoring first	No (0)	The analysed team does not score the first goal of the match
	(ScoFir)	Yes (1)	The analysed team scores the first goal of the match
	Match status at halftime	Loses (1)	The analysed team loses at halftime
	(MatStaHal)	Draws (2)	The analysed team draws at halftime
		Wins 1 (3)	The analysed team wins by one goal at halftime
		Wins +1 (4)	The analysed team wins by more than one goal at halftime

Note. Within each variable, the category with the lowest numerical code (e. g., the category not won in match outcome variable) was considered as the reference category in the logistic regression model.

Hosmer–Lemeshow test (p > .10) (Hosmer & Lemesbow, 1980); (f) a non-significant difference between the ROC curve of the full model and the candidate sub-model (p > .05); and (g) a non-significant integrated discrimination improvement (IDI) and net reclassification improvement (NRI) between the full model and the candidate sub-model (p > .05) (Pencina et al., 2008).

Once the best predictive model was selected, its reliability was assessed through cross-validation. Then, it was checked whether this model met the following assumptions – the statistics used to examine these assumptions are specified in parentheses: (a) absence of influential observations (Delta-Beta influence statistic, ΔBeta >0.4; Delta chi-squared influence statistic, $\Delta\chi^2$ >3.84; and Delta-D influence statistic, ΔDev >3.84) (Hosmer et al., 1991); (b) absence of collinearity (variance inflation factor, VIF < 5); and (c) presence of equi-dispersion (residual mean deviance, RMD ≈ 1). The assumption of linearity between the predictors and the logit was not tested because all the predictors were categorical.

After checking the diagnostics of the selected model, its parameters were estimated, and its global goodness-of-fit was assessed using a likelihood-ratio test and several pseudo-R^2 indices (Cox-Snell, Nagelkerke, and adjusted McFadden). Then, the model equation was used to predict the probability of winning a match in 32 frequent situations (combinations of values of the predictor variables) determined from a two-step cluster analysis (number of fixed clusters: 2; distance measure: log-likelihood; clustering criterion: Schwarz's Bayesian criterion). Finally, the optimal cut-off point based on the ROC curve was computed to balance the sensitivity and specificity of the selected model as much as possible.

The two-step cluster analysis was performed in IBM SPSS Statistics version 20.0 software (SPSS Inc., Chicago, IL, USA). All other statistical analyses were performed in Stata/IC version 17.0 software (StataCorp, College Station, TX, USA) with the following commands: proportions (estimates proportions and calculates Wilson confidence intervals), all sets (finds the best subset for logistic regression and computes AIC, AUC, Se, Sp, and Hosmer-Lemeshow goodness-of-fit for each subset), roccomp (tests equality of ROC curves), idi (calculates IDI), nri1 (calculates NRI), crossfold (performs cross-validation), predict (calculates influence statistics), estat vif (calculates VIF), logit (reports coefficients of the logistic model), lrtest (performs likelihood-ratio test), fitstat (reports pseudo-R^2 indices), contract (calculates the frequency of each combination of predictor values), lincom (makes predictions and calculates confidence interval for each prediction), and dtroc (computes optimal cut-off point based on ROC curve).

3. Results

Table 2 shows the absolute and relative frequencies of the six categorical variables included in the entire model. The 95% confidence interval for a proportion (95% CI for π) was calculated using the Wilson method.

A total of 31 models were estimated from the method of all possible regressions. Table 3 lists the top five models according to the AIC criteria. The model with the lowest AIC (393.9) and highest AUC (.899) was the entire model, which included five situational predictors (MatLoc, TeaLev, OppLev, ScoFir, and MatStaHal). However, the second model in Table 3 was selected as the best predictive model for the following reasons: more parsimonious model than the first model by excluding the ScoFir predictor; second model with lower AIC (395.1) and higher AUC (.897); model with a balanced Se (71.9%) and Sp (86.1%) for the cut-off point $\pi = .5$; model with a good fit in the Hosmer–Lemeshow test ($p = .506$); and compared to the entire model, a non-significant loss of 0.23% in AUC ($p = .353$), a non-significant average loss of 0.56% in the correct prediction of events ($p = .088$), and a non-significant net loss of 2.58% in the prediction ($p = .098$). In contrast, the remaining models in Table 3 were discarded as the best predictive model because they did not meet some selection criteria (e.g. the third model had a significant IDI).

Table 2. Descriptive and inferential analysis of the categorical variables.

				95% CI for π	
Variable	Category	*n*	%	*LL*	*UL*
Match outcome	Not won	273	57.4	52.9	61.7
	Won	203	42.6	38.3	47.1
Match location	Away	238	50.0	45.5	54.5
	Home	238	50.0	45.5	54.5
Team level	Relegation	90	18.9	15.6	22.7
	Remained	117	24.6	20.9	28.6
	CERS Cup	149	31.3	27.3	35.6
	Euroleague	120	25.2	21.5	29.3
Opponent's level	Euroleague	120	25.2	21.5	29.3
	CERS Cup	149	31.3	27.3	35.6
	Remained	117	24.6	20.9	28.6
	Relegation	90	18.9	15.6	22.7
Scoring first	No	236	49.6	45.1	54.1
	Yes	240	50.4	45.9	54.9
Match status at halftime	Loses	185	38.9	34.6	43.3
	Draws	106	22.3	18.8	26.2
	Wins 1	96	20.2	16.8	24.0
	Wins +1	89	18.7	15.5	22.4

Note. *n* = number of observations; CI = confidence interval; *LL* = lower limit; *UL* = upper limit.

Table 3. Statistics and goodness-of-fit indices for the five models with the lowest AIC.

							Model comparison		
Model	Predictors	AIC	AUC	Se	Sp	p_{HL}	ROC	IDI	NRI
1	MatLoc, TeaLev, OppLev, ScoFir, MatStaHal	393.9	.899	73.4%	87.2%	.875	base	base	base
2	MatLoc, TeaLev, OppLev, MatStaHal	395.1	.897	71.9%	86.1%	.506	−0.23% (*p* = .353)	−0.56% (*p* = .088)	−2.58% (*p* = .098)
3	TeaLev, OppLev, ScoFir, MatStaHal	403.3	.892	71.9%	87.2%	.274	−0.74% (*p* = .118)	−1.60% (*p* = .008)	−1.48% (*p* = .431)
4	TeaLev, OppLev, MatStaHal	403.5	.891	72.4%	87.2%	.331	−0.83% (*p* = .103)	−2.02% (*p* = .002)	−0.99% (*p* = .611)
5	MatLoc, OppLev, ScoFir, MatStaHal	427.5	.874	67.5%	87.2%	.708	−2.53% (*p* = .002)	−5.81% (*p* < .001)	−5.91% (*p* = .052)

Note. AIC = Akaike's information criterion; AUC = area under the ROC curve; Se = sensitivity for cut-off point .5; Sp = specificity for cut-off point .5; p_{HL} = significance of the Hosmer–Lemeshow test; ROC = comparison of models with ROC curves (chi-squared test); IDI = comparison of models with the integrated discrimination improvement (Z-test); NRI = comparison of models with the net reclassification improvement (Z-test).

Regarding the reliability of the selected model, a pseudo-R^2_{Mean} = .448 and an AUC = .894 were obtained by cross-validation and bootstrap resampling, respectively. Both values indicated the true predictive power of the model when used with external samples. On the other hand, concerning the diagnostics of the selected model, only eight observations with high influence statistics were detected but were not removed from the model because they were correctly recorded; no collinearity was detected between the predictors (mean VIF = 1.58), and a slight infra-dispersion was found between the observed and expected variance (RMD = 0.80) and, consequently, the standard errors of the model coefficients were slightly overestimated, increasing the type II error (β).

Table 4 presents the selected model's parameters, showing their *b* coefficients, odds ratios (exponentials of the *b* coefficients), confidence intervals and *p*-values. The global likelihood-ratio test indicated that the set of parameters of the estimated model predicted the match outcome in a statistically significant way (χ^2_{LR} = 276.4, *df* = 10, *p* < .001). The pseudo-R^2 measures indicated that the estimated model explained between 39.2% and 59.2% of the uncertainty in the data ($R^2_{\text{Cox-Snell}}$ = 0.440, $R^2_{\text{Nagelkerke}}$ = 0.592, $R^2_{\text{adjMcFadden}}$ = 0.392). Odds ratios (ORs) showed that playing at home (relative to playing away), a high level of the analysed team (compared to a low level), a low level of the opposing team (compared a high level) and drawing or winning at halftime (compared to losing) increased the chances of winning the match. The predictor with the highest contribution on the match outcome was match status at halftime (χ^2_{LR} = 97.6, *df* = 3, *p* < .001), followed by opponent's level (χ^2_{LR} = 40.9, *df* = 3, *p* < .001), team level (χ^2_{LR} = 39.9, *df* = 3, *p* < .001), and match location (χ^2_{LR} = 10.3, *df* = 1, *p* = .001).

The following logistic regression equation was defined from the *b* coefficients in Table 4:

logit(MatOut =Won | MatLoc TeaLev OppLev MatStaHal) = – 4.679 + 0.837×MatLoc + 0.779×TeaLea2 + 1.592×TeaLev3 + 2.488×TeaLev4 + 1.087×OppLev2 + 1.335×OppLev3 + 2.710×OppLev4 + 1.073×MatStaHal2 + 2.062×MatStaHal3 + 3.844×MatStaHal4

Table 4. Parameters of the selected model to predict the match outcome.

Predictors	*b*	95% CI for β		*OR*	95% CI for OR		p_{Wald}	p_{LR}
		LL	*UL*		*LI*	*LS*		
Match location								.001
Away (base)								
Home	0.837	0.318	1.357	2.311	1.374	3.886	.002	
Team level								<.001
Relegation (base)								
Remained	0.779	−0.114	1.672	2.180	0.892	5.323	.087	
CERS Cup	1.592	0.738	2.447	4.916	2.091	11.558	<.001	
Euroleague	2.488	1.565	3.411	12.039	4.784	30.301	<.001	
Opponent's level								<.001
Euroleague (base)								
CERS Cup	1.087	0.350	1.824	2.965	1.419	6.194	0.004	
Remained	1.335	0.566	2.105	3.801	1.761	8.205	0.001	
Relegation	2.710	1.813	3.608	15.034	6.130	36.875	<.001	
Match status at halftime								<.001
Loses (base)								
Draws	1.073	0.419	1.728	2.925	1.520	5.630	0.001	
Wins 1	2.062	1.390	2.734	7.862	4.016	15.390	<.001	
Wins +1	3.844	2.836	4.852	46.710	17.047	127.988	<.001	
Constant	−4.679	−5.786	−3.573	0.009	0.003	0.028	<.001	<.001

Note. *b* = regression coefficient *b*; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; OR = odds ratio (exponential of coefficient *b*); p_{Wald} = significance of parameter β with the Wald test; p_{LR} = significance of parameter β with the partial likelihood ratio test.

Then, the probability of winning the match in 32 frequent situations of the analysed competition was predicted from the following logistic function:

Pr(MatOut =Won | MatLoc TeaLev OppLev MatStaHal) = $\frac{1}{1+e^{-\text{logit}}}$

These 32 predictions are presented in Table 5. As an example, the first prediction is interpreted as follows: the probability of winning the game when a permanence-level team plays away against a Euroleague-level team and loses at halftime is .020 (CI 95%: .008 to .050). This situation was the most frequent in the competition analysed (*n* = 14, 2.94%).

The optimal cut-off point based on the ROC curve was π = .413. For this cut-off point, a high capacity to detect matches won (Se = 80.3%) and not won (Sp = 80.2%) was obtained, and a high total percentage of correct classifications was also achieved (80.3%). Consequently, the sensitivity and specificity values were more balanced for the π = .413 cut-off point (Se = 80.3, Sp = 80.2%) than for the π = .5 cut-off point (Se = 71.9%, Sp = 86.1%).

4. Discussion

The primary purpose of the present study was to build a parsimonious model to predict the probability of winning a rink hockey match using different situational variables and evaluating the contribution of each predictor on the match outcome. To our knowledge, this is the first study focused on the interactive effects of situational variables in rink hockey. The main findings were that the predictor with the highest contribution to the match outcome was *match status at halftime*, followed by the *opponent's level, team level*, and *match location*. Despite the lack of studies available to compare the present results, these findings are in line with other team sports (Gómez et al., 2014; Lago-Peñas & Gómez-López, 2014; Taylor et al., 2008), confirming that situational variables influence rink hockey outcomes.

Table 5. Predictions of the probability of winning a match in 32 frequent situations.

Situation	MatLoc	TeaLev	OppLev	MatStaHal	Pr(MatOut = Won)	95% CI for Pr *LL*	95% CI for Pr *UL*	*n*	%
1	Away	Remained	Euroleague	Loses	.020	.008	.050	14	2.94
2	Home	Relegation	Euroleague	Loses	.021	.008	.057	11	2.31
3	Home	Relegation	CERS Cup	Loses	.060	.025	.139	11	2.31
4	Home	CERS Cup	Euroleague	Loses	.095	.045	.190	11	2.31
5	Away	Relegation	Euroleague	Loses	.009	.003	.027	10	2.10
6	Away	CERS Cup	Euroleague	Loses	.044	.019	.097	10	2.10
7	Away	Relegation	CERS Cup	Loses	.027	.010	.069	9	1.89
8	Away	Remained	CERS Cup	Loses	.057	.026	.120	9	1.89
9	Home	Euroleague	Relegation	Wins +1	.995	.981	.998	9	1.89
10	Home	Remained	Euroleague	Loses	.045	.019	.101	8	1.68
11	Away	CERS Cup	Euroleague	Draws	.118	.055	.235	8	1.68
12	Home	Remained	CERS Cup	Loses	.122	.061	.228	8	1.68
13	Home	CERS Cup	CERS Cup	Loses	.238	.134	.388	8	1.68
14	Away	CERS Cup	CERS Cup	Draws	.284	.167	.439	8	1.68
15	Home	Euroleague	Remained	Wins +1	.979	.936	.993	8	1.68
16	Away	Euroleague	Relegation	Wins +1	.987	.960	.996	8	1.68
17	Away	Relegation	Remained	Loses	.034	.013	.085	7	1.47
18	Away	CERS Cup	Remained	Draws	.337	.201	.506	7	1.47
19	Home	Euroleague	CERS Cup	Draws	.691	.510	.828	7	1.47
20	Away	Euroleague	CERS Cup	Wins +1	.939	.843	.978	7	1.47
21	Home	Euroleague	CERS Cup	Wins +1	.973	.922	.991	7	1.47
22	Away	Euroleague	Euroleague	Loses	.101	.045	.210	6	1.26
23	Away	CERS Cup	CERS Cup	Loses	.119	.060	.223	6	1.26
24	Away	Euroleague	CERS Cup	Loses	.249	.133	.416	6	1.26
25	Home	CERS Cup	Remained	Loses	.286	.158	.462	6	1.26
26	Home	Remained	CERS Cup	Draws	.289	.161	.462	6	1.26
27	Home	CERS Cup	CERS Cup	Draws	.478	.318	.642	6	1.26
28	Away	CERS Cup	Remained	Wins 1	.577	.402	.735	6	1.26
29	Home	CERS Cup	CERS Cup	Wins 1	.711	.543	.836	6	1.26
30	Home	Euroleague	Remained	Wins 1	.885	.771	.947	6	1.26
31	Away	CERS Cup	Relegation	Wins +1	.970	.912	.990	6	1.26
32	Home	CERS Cup	Relegation	Wins +1	.987	.958	.996	6	1.26

Note. Pr(MatOut = Won) = probability of winning a match; CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *n* = number of observations.

4.1 Match status at halftime

The result at halftime was the strongest situational variable predictor. Winning at halftime provides teams with a high chance of winning the match (OR = 7.862). Thus, it was especially determinant the status of winning by two or more goals (OR = 46.710). Apart from the mere fact that these goal differences are included in the final match outcome, tactical and psychological factors could also explain the advantage of winning at halftime. As it happens with other team sports, if a team wins by a larger margin of goals, playing tactics might reduce the game pace (Ruano et al., 2016). Indeed, as was previously found in football (O'donoghue & Robinson, 2016), given the partial advantage that represents a comfortable state for players, it is possible that rink hockey teams also assume a ball retention strategy, slowing down the game pace and resulting in more controlled responses in order to maintain the goal differences.

Regarding the psychological responses, playing the second half winning by one or more goals, allows the team to face this challenge confidently. Following the cognitive activation theory of stress, changes in androgens levels driven by competition would modify the behaviour of athletes in subsequent interactions depending on the outcome of the moment (Oliveira et al., 2009). This difference in hormonal response to competition between winners and losers has been documented in different contests that involve physical confrontation (Fry et al., 2011) and could also explain the difference in performance between winners and losers observed in the present study. In the rink hockey scope, Arboix-Alió et al. (2021) reported that players had significantly better success in free direct hits when winning by two goals (OR = 2.4) and in penalties when winning by three or more goals (OR = 3.83). Conversely, players were less effective when losing by two goals (OR = 0.38). In the same vein, Sousa et al. (2020) reported that when a team had at least two or more goals than the opponent, the effectiveness of the opponent goalkeepers was reduced by 45% versus a tied match status in the Portuguese Rink Hockey First Division.

4.2 Team level and opponent's level

The second strongest predictor was the teams' and opponents' level. Specially determinant was belonging to the group of teams ranked from 1 to 4 (*Euroleague group*) since it seemed to be a significant factor in increasing the probability of winning more matches in the *OkLiga* competition.

This fact can be explained because in the *OkLiga* competition exists an evident level of bias, caused probably by the different budgets of teams competing in the same division (Arboix-Alió, Buscà et al., 2021). This issue causes higher-level heterogeneity than in other team sports, with professional and semi-professional athletes in the same competitions. These professional clubs present a clear superiority compared to the other teams attributed to an economic superiority since these teams belong to football clubs. This phenomenon, called the "drag effect" (Zambom-Ferraresi et al., 2018), provides a great advantage to some rink hockey teams, with the others not being part of prominent professional structures. Another aspect that should be considered is the tradition and history of a club, generally related to its foundation with football as the primary sport. Rink hockey clubs with a broad tradition have higher support provided by institutions and sports governing bodies.

4.3 Match location

The probability of winning the match when playing at home was higher than playing away (OR = 2.311). As in many team sports, the HA effect has been proved as a predictor performance variable (Gómez et al., 2011; Pollard & Gómez, 2012; Pollard et al., 2017). However, there is a paucity of studies analysing the match location effect using logistic regressions in the rink hockey context. Only Arboix-Alió et al. (2021) and Trabal et al. (2020) analysed its effect in individual set-pieces performance, reporting that the free direct hits and the penalties were not influenced by match location, probably because are specific and individual actions between one player against the goalkeeper without the intervention of other players.

Despite this lack of studies analysing the match location effect using logistic regressions, these findings are consistent with the positive HA effect. In the specific case of rink hockey, the HA effect has been confirmed in two recent studies, and it has been estimated at around 60% (Arboix-Alió & Aguilera-Castells, 2019; Arboix-Alió et al., 2020).

4.4 Scoring first

Finally, scoring the first goal of the match was not a significant predictor. Despite the probability of winning the match was higher when teams scored the first goal, its effect was not a determinant situational variable to the match outcome.

In other team sports like football, Garcia-Rubio et al. (2015) found an increase of 3.36 in the OR of winning the game for the teams scoring the first goal. The lack of significance in the present study could be explained because rink hockey is a higher-scoring sport than football, scoring an average of 7.13 goals per game in the Spanish League (Arboix-Alió & Aguilera-Castells, 2019) for only 2.65 in football (Sampedro & Prieto, 2012).

The intrinsic characteristics of rink hockey could explain the differences found between the different predictors. For instance, scoring the first goal in rink hockey is not as decisive as in other team sports, where the number of goals is considerably lower. However, winning at the end of the first half or team level seem to be the most determining victory factors. Notwithstanding these results, it seems that the addition of all these variables further increases the chances of winning a game – for example, the fact of being a *Euroleague* team playing at home, together with winning at halftime and playing against a *Relegation* team, gives a 99,5% chance of winning the match.

Despite the usefulness of these findings, the present investigation also has some limitations that should be acknowledged and addressed in future studies. One of the main limitations of the present study is that the controversial *10 events per predictor parameter rule* (10 EPP rule) was applied to calculate the minimum sample size (Ogundimu et al., 2016; Peduzzi et al., 1996; Vittinghoff & McCulloch, 2007). If a regression model starts with 11 candidate parameters or coefficients deduced from the theoretical framework, at least 110 events (110 matches won in our case) are needed to build a new multivariable predictive model for binary responses. The reason for applying this rule is that no previous rink hockey studies have been found to build a predictive model to predict match outcomes. However, based on the results obtained in the present study (proportion of matches won = 0.426 and $R^2_{\text{Cox-Snell}}$ = 0.440) and the novel four-step procedure proposed by Riley et al. (2019), Riley et al. (2020), it will be possible to calculate the sample size more appropriately in future rink hockey studies.

Conversely, the method of *all possible regressions* was used in the present study to build this predictive model. No *stepwise regression* method was used because these automatic predictor selection procedures often present problems (Thompson, 1989). Some of its most important limitations are the following: (a) stepwise regression increases the type I error (α) of significance tests when there are many predictors; (b) the hierarchical principle is not always fulfilled when multiplicative terms are introduced into the initial model (i.e. if this model includes, for example, the term $X_1 \times X_2$, it must also contain the terms X_1 and X_2 separately, and this doesn't always happen with stepwise regression); and (c) the different existing stepwise regression methods do not always lead to the same final regression model, which poses a decision problem for the researcher in choosing the best prediction model (e.g. in the present study, the *backward stepwise selection* method did not exclude the predictor ScoFir from the full model with p_{Wald} = .071, p_{LR} = .072, OR = 1.80, and 95% CI = 0.95 to 3.40, whereas the *forward stepwise selection* method did not include this predictor from starting with an empty model). On the other hand, all possible regressions method overcomes the aforementioned limitations of the stepwise regression method, but has the disadvantage of requiring more computational time (e.g. if the initial full model includes 16 predictors, the Stata allsets command takes about 10 minutes to estimate and compare 65,535 models).

Finally, further research should replicate our findings in other rink hockey competitive contexts like female professional hockey leagues, other national championships (i.e. Italian league, Portuguese league), or lower levels of competition (grassroots sport or minor leagues). Moreover, it could be interesting to analyse whether these game variables change according to the game's relevance (European or World Championships, or Euroleague). The strengths of our study lie in its novelty, being the first study to analyse the situational variables' influence in rink hockey, building a parsimonious model to predict the probability of winning a match.

5. Conclusions and practical applications

In conclusion, the current study indicates that situational variables influence the outcomes in rink hockey matches and, therefore, should be taken into account. Although the present findings can only show a performance scenario about particular game aspects, coaches and practitioners could consider these results to effectively develop training plans that are more coherent to the game dynamics. In this context, the analysis of situational variables can provide valuable information to empower decision-making regarding game plans, line-ups, game offensiveness, team behaviour, and dead-ball play depending on the time left, the team's needs, the opponent's characteristics, the game momentum, or the venue.

Moreover, the present study could help staff members design practices based on the specificity of a particular stage of the competition or simulate different scenarios where score advantage or disadvantage are present. Additionally, these findings can improve the coaches' competencies regarding mental and tactical approaches to the game. For instance, coaches could transfer vital advice to avoid the negative supporters' influence when playing away in terms of psychological behaviour. Focusing on their tactical strategy could lead their players to fix their game task exclusively, avoiding any influence by any bother coming off the court. These hypothetical situations could help coaches assess the players' responses in these situations, improving the game under pressure. Thus, it is interesting to improve the psychological preparation that can optimise sports performance when pressure is inherent to competitive team sports.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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