applied sciences

MDPI

Article

The Effect of Situational Variables on Women's Rink Hockey Match Outcomes

Jordi Arboix-Alió [1,2,3,*], Guillem Trabal [4,5], Dani Moreno-Galcerán [4,5], Bernat Buscà [1], Adrià Arboix [6], Vasco Vaz [7], Hugo Sarmento [7] and Raúl Hileno [8]

1 Department of Sports Science, Ramon Llull University, FPCEE Blanquerna, 08022 Barcelona, Spain; bernatbs@blanquerna.url.edu
2 School of Health Sciences, Ramon Llull University, FCS Blanquerna, 08025 Barcelona, Spain
3 FC Barcelona, Sport Performance Area, 08970 Barcelona, Spain
4 Department of Physical Activity Sciences, University of Vic—Central University of Catalonia, 08500 Vic, Spain; guillem_tt@hotmail.com (G.T.); daniel.moreno@uvic.cat (D.M.-G.)
5 Sport, Exercise, and Human Movement (SEaHM) Research Group, University of Vic—Central University of Catalonia, 08500 Vic, Spain
6 Cerebrovascular Division, Department of Neurology, Hospital Universitari del Sagrat Cor, Universitat de Barcelona, 08029 Barcelona, Spain; aarboix@hscor.com
7 Research Unit for Sport and Physical Activity (CIDAF), Faculty of Sport Sciences and Physical Education, University of Coimbra, 3004-504 Coimbra, Portugal; vascovaz@fcdef.uc.pt (V.V.); hugo.sarmento@uc.pt (H.S.)
8 National Institute of Physical Education of Catalonia (Inefc), University of Lleida, 25006 Lleida, Spain; rhileno@gencat.cat
* Correspondence: jordiaa1@blanquerna.url.edu

Abstract: The main objective of the present study was to develop a concise predictive model to determine the likelihood of winning in female rink hockey based on various situational variables. Additionally, the study aimed to assess the individual impact of each predictor on match outcomes. The analysis encompassed a dataset of 840 matches during five consecutive seasons (from 2018–2019 to 2022–2023) in the Spanish first division (*OkLiga*). Employing the comprehensive method of all possible regressions, the most effective predictive logistic model for match outcomes was identified. This entire model featured five categorical predictor variables (*match location*, *team level*, *opponent level*, *scoring first*, and *match status at halftime*) and one binary outcome variable (*match outcome*). Subsequently, the final model, which exhibited a sensitivity and specificity surpassing 80% for a cut-off point of 0.439, emerged. This model was applied to predict winning a match in 18 frequent situations determined from a two-step cluster analysis. Within this predictive framework, *match status at halftime* emerged as the most influential predictor impacting the match outcome, followed by *opponent level*, *team level*, and *match location*. The implications of our findings extend to rink hockey coaches and practitioners. Recognizing the significant impact of situational variables on match outcomes empowers them to customize game plans and design more specific strategies, thereby enhancing game understanding and elevating the overall performance.

Keywords: match analysis; roller hockey; female sports; binary logistic regression; predictive model

Citation: Arboix-Alió, J.; Trabal, G.; Moreno-Galcerán, D.; Buscà, B.; Arboix, A.; Vaz, V.; Sarmento, H.; Hileno, R. The Effect of Situational Variables on Women's Rink Hockey Match Outcomes. *Appl. Sci.* **2024**, *14*, 3627. https://doi.org/10.3390/app14093627

Academic Editor: Anthony William Coleman

Received: 25 February 2024
Revised: 18 April 2024
Accepted: 23 April 2024
Published: 25 April 2024

1. Introduction

In recent times, there has been a rising interest in the analysis of sports performance, leading to an increase in studies examining various match variables across different sports. Rink hockey, a team sport featuring two teams of five players competing on a rectangular court measuring 40 × 20 m and surrounded by a one-meter-high barrier, is no exception, and the number of studies about this topic has grown considerably [1]. However, it is worth noting that only a limited number of these studies have specifically addressed female teams.

Similar to many other team sports, match analysis has gained significant acceptance among players, coaches, and sports scientists due to the growing professionalization of sports [2,3]. This practice is considered essential for evaluating and enhancing sports performance. Match analysis serves as a valuable tool for providing an objective assessment of the opponents' strengths and weaknesses [4]. Additionally, it plays a crucial role in developing players' technical and tactical knowledge, fostering critical thinking, improving decision-making skills, and boosting overall confidence [5].

Situational variables are one of these indicators of performance. This term encompasses various match and situational conditions capable of exerting a substantial influence on performance at a behavioral level [6]. Situational variables, such as match location, match status, or match time, have been established as pivotal determinants of performance, particularly in the analysis of game-related statistics, significantly impacting both team and player performance [7,8]. Since rink hockey, much like other team sports, is impacted by strategic elements, it is logical to suggest that situational variables play a role in shaping the performance of both teams and players [6]. Furthermore, the particular regulations of rink hockey, divided into two halves of 25 min each, with the option of two timeouts per team, allow for the adaptation of tactics and strategies based on game constraints and situational variables.

Probably the most analyzed topic in male rink hockey teams has been game location [1]. This phenomenon, termed Home Advantage (HA), represents the perceived edge that teams have when playing on their home turf compared to away matches, typically estimated at around 60%, aligning with trends observed in other team sports [9]. In rink hockey, previous investigations have proved the existence of HA, determining its effect to be around 60%. To illustrate this, Gómez et al. [10] and subsequently Arboix-Alió and Aguilera-Castells [11] documented HA rates of 58.32% and 59.80%, respectively, in the Spanish League (*OkLiga*). Likewise, in the Portuguese League, Arboix-Alió et al. [12] identified a HA value of 60.88%.

Other variables that have been examined include "scoring the first goal" [13], the crown effect [14], the impact of goalkeeper performance [15–17], and the influence of set-pieces [18]. Furthermore, as it happens with other team sports [8,19], it appears that the cumulative effect of various situational variables (e.g., playing at home, scoring first, and winning at halftime) tends to amplify their impact on the final outcomes of rink hockey matches [20].

However, there is currently no knowledge of such studies involving female rink hockey players. To address these gaps and acknowledge the lack of studies on women's rink hockey, a further investigation is needed to determine whether situational variables similarly affect the performance of female teams as they do in the case of their male counterparts. As a result, this study aimed to build a parsimonious model to predict the likelihood of winning a match, utilizing various situational variables. The secondary objective was to assess the significance of each predictor in determining match outcomes and to identify how these factors might influence match results in professional female rink hockey.

2. Materials and Methods

2.1. Sample

The sample comprised 840 matches spanning five consecutive seasons, from 2018–2019 to 2022–2023, within the Spanish first division (*OkLiga*). The *OkLiga* follows a balanced schedule, with each team participating in one home game and one away game. Data collection procedures involved sourcing match information from the official website of the Spanish Rink Hockey Federation, accessible at www.fep.es (accessed on 4 July 2023).

2.2. Design and Procedures

Table 1 shows the recording of a total of five categorical predictor variables and one binary outcome variable.

Table 1. Properties of the analyzed variables.

Role	Variable (Abbreviation)	Category (Code)	Description
Outcome	Match outcome (MatOut)	Not won (0) Won (1)	The analyzed team lost or tied the match The analyzed team won the match
Predictor	Match location (MatLoc)	Away (0) Home (1)	The analyzed team played away The analyzed team competed on their field
	Team level (TeaLev)	Relegation (1) Remained (2) Champions (3)	The analyzed team finished between 12th and 14th position The analyzed team finished between 5th and 11th position The analyzed team finished between 1st and 4th position
	Opponent's level (OppLev)	Champions (1) Remained (2) Relegation (3)	The opponent's team finished between 1st and 4th position The opponent's team between 5th and 11th position The opponent's team between 12th and 14th position
	Scoring first (ScoFir)	No (0) Yes (1)	The analyzed team was not the first to score in the match The analyzed team was the first to score in the match
	Match status at halftime (MatStaHal)	Loses (1) Draws (2) Wins (3)	The analyzed team was losing at halftime The analyzed team was drawing at halftime The analyzed team was winning at halftime

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

2.3. Statistical Analysis

A descriptive analysis (involving absolute and relative frequencies) and an inferential analysis (in which confidence intervals for proportions were calculated using the Wilson method) were carried out on the categorical variables.

The method of all possible regressions was employed to determine the optimal predictive logistic model for the match outcome [21,22]. In the original full model, there were five situational predictors (MatLoc, TeaLev, OppLev, ScoFir, and MatStaHal), alongside one binary outcome (MatOut). However, the multiplicative term TeaLev × OppLev was omitted due to the emergence of collinearity issues, which resulted in a substantial rise in the mean-variance inflation factor (mean VIF) from 1.79 to 4.04 when this term was included. The criteria employed for selecting the best predictive logistic model included the following aspects: (a) the parsimony principle [23]; (b) a large value of the area under the receiver operating characteristic (ROC) curve (AUC); (c) a small value of Akaike information criterion (AIC) [24]; (d) a good fit in the Hosmer–Lemeshow test ($p > 0.10$) [25]; (e) balanced sensitivity (Se) and specificity (Sp) for a cut-off point of 0.5; and (f) a non-significant difference between the ROC curve of the full model and the candidate sub-model ($p > 0.05$).

After selecting the best predictive model, its reliability was assessed through cross-validation. Subsequently, an examination was conducted to ensure that this model met several key assumptions, with the respective statistical criteria indicated in parentheses: (a) absence of influential observations (2.0 Delta chi-squared influence statistic, $\Delta\chi^2 > 3.84$; and Delta-D influence statistic, $\Delta Dev > 3.84$) [26]; (b) absence of collinearity (variance inflation factor, VIF < 5); and (c) presence of equi-dispersion (residual mean deviance, RMD ≈ 1). It is worth noting that the assumption of linearity between the predictors and the logit was not assessed since all the predictors in this study were categorical in nature.

Following the verification of the selected model's diagnostics, its parameters were estimated, and an evaluation of its overall goodness-of-fit was conducted. This assessment included a likelihood ratio test and the calculation of several pseudo-R^2 indices, including Cox–Snell, Nagelkerke, and adjusted McFadden. Subsequently, the model equation was employed to predict the probability of winning a match under 18 common scenarios, which were determined through a two-step cluster analysis. In this clustering analysis, two fixed clusters were defined, employing a log-likelihood distance measure and Schwarz's Bayesian criterion as the clustering criterion. Finally, the optimal cut-off point, based on the ROC curve, was determined to achieve a balance between sensitivity and specificity, maximizing the selected model's performance.

The two-step cluster analysis was conducted using IBM SPSS Statistics v. 20.0 software (SPSS Inc., Chicago, IL, USA). All other statistical analyses were carried out using Stata/IC v. 17.0 software (StataCorp, College Station, TX, USA), employing the following commands: `proportions` (for estimating proportions and calculating Wilson confidence intervals), `allsets` (for identifying the best subset for logistic regression and computing AIC, AUC, Se, Sp, and Hosmer–Lemeshow goodness-of-fit for each subset), `roccomp` (for assessing the equality of ROC curves), `crossfold` (for performing cross-validation), `predict` (for computing influence statistics), `estat vif` (for calculating VIF), `logit` (for reporting coefficients of the logistic model), `lrtest` (for conducting the likelihood ratio test), `fitstat` (for reporting pseudo-R^2 indices), `contract` (for determining the frequency of each combination of predictor values), `lincom` (for making predictions and calculating confidence intervals for each prediction), and `dtroc` (for computing the optimal cut-off point based on the ROC curve).

3. Results

Table 2 displays both the absolute and relative frequencies of the six categorical variables incorporated into the full model. The Wilson method was used to compute the 95% confidence interval for a proportion (95% CI for π).

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

				95% CI for π	
Variable	**Category**	***n***	**%**	***LL***	***UL***
Match outcome	Not won	923	54.9	52.6	57.3
	Won	757	45.1	42.7	47.4
Match location	Away	839	49.9	47.6	52.3
	Home	841	50.1	47.7	52.4
Team level	Relegation	379	22.6	20.6	24.6
	Remained	775	46.1	43.8	48.5
	Champions	526	31.3	29.1	33.6
Opponent's level	Champions	528	31.4	29.3	33.7
	Remained	774	46.1	43.7	48.5
	Relegation	378	22.5	20.6	24.6
Scoring first	No	842	50.1	47.7	52.5
	Yes	838	49.9	47.5	52.3
Match status at halftime	Loses	667	39.7	37.4	42.1
	Draws	347	20.7	18.8	22.7
	Wins	666	39.6	37.3	42.0

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

A total of 31 models were estimated using the method of all possible regressions. Table 3 presents the top five models based on the AIC criteria. The full model, which comprised five situational predictors (MatLoc, TeaLev, OppLev, ScoFir, and MatStaHal), had the lowest AIC (1238.7) and the highest AUC (0.9163). However, the third model in Table 3 was chosen as the best predictive model for several reasons. It was a more parsimonious model than the first model because it excluded the ScoFir predictor and had a lower AIC (1245.7) and a higher AUC (0.9143). Additionally, it exhibited a balanced Se (78.9%) and Sp (88.1%) for the cut-off point π = 0.5, demonstrated a good fit in the Hosmer–Lemeshow test (p = 0.145), and only had a non-significant 0.20% decrease in the AUC compared to the full model (p = 0.116). In contrast, the remaining models in Table 3 were not selected as the best predictive model because they did not meet certain selection criteria. For instance, the second model had a significant p-value in the Hosmer–Lemeshow test, while the fourth and fifth models experienced a significant decrease in the AUC compared to the full model.

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

Model	Predictors	AIC	AUC	Se	Sp	p_{HL}	ROC
1	MatLoc, TeaLev, OppLev, ScoFir, MatStaHal	1238.7	0.9163	82.3%	86.0%	0.436	base
2	TeaLev, OppLev, ScoFir, MatStaHal	1245.5	0.9151	79.0%	88.0%	0.009	−0.12% (p = 0.337)
3	MatLoc, TeaLev, OppLev, MatStaHal	1245.7	0.9143	78.9%	88.1%	0.145	−0.20% (p = 0.116)
4	TeaLev, OppLev, MatStaHal	1253.2	0.9105	78.9%	88.1%	0.247	−0.58% (p = 0.004)
5	MatLoc, TeaLev, OppLev, ScoFir	1371.1	0.8933	83.1%	80.2%	0.849	−2.30% (p < 0.001)

Note. AUC = area under the ROC curve; AIC = Akaike's information criterion; ROC = comparison of models with ROC curves (chi-squared test); Se = sensitivity for cut-off point 0.5; Sp = specificity for cut-off point 0.5; p_{HL} = significance of the Hosmer–Lemeshow test.

Regarding the reliability of the chosen model, cross-validation yielded a pseudo-R^2_{Mean} = 0.528, while bootstrap resampling resulted in an AUC of 0.908. Both of these values affirm the model's true predictive capability when applied to external samples. Concerning the diagnostic assessment of the selected model, 205 observations were identified, which accounted for 12.2% of the total, with notable influence statistics. However, it was opted not to exclude them from the model because they had been accurately recorded. Furthermore, no evidence of collinearity was found among the predictors, with the mean VIF standing at 1.51. It was also observed a slight infra-dispersion between the observed and expected variance (RMD = 0.73). Consequently, the standard errors of the model coefficients were marginally overestimated, leading to a slight increase in the type II error (β).

Table 4 displays the parameters of the chosen model, including their b coefficients, odds ratios (exponentials of the b coefficients), confidence intervals, and p-values. The global likelihood ratio test demonstrated that the set of parameters within the estimated model significantly predicted the match outcome (χ^2_{LR} = 1082.9, df = 7, p < 0.001). The pseudo-R^2 measures revealed that the estimated model accounted for between 46.1% and 63.6% of the variability in the data ($R^2_{Cox-Snell}$ = 0.475, $R^2_{Nagelkerke}$ = 0.636, $R^2_{adjMcFadden}$ = 0.461). The odds ratios (ORs) indicated that several factors increased the chances of winning the match: playing at home (in comparison to playing away), having a high-level team (in contrast to a low-level team), facing a low-level opposing team (versus a high-level opponent), and either drawing or winning at halftime (compared to losing). Among these factors, match status at halftime had the most substantial impact on the match outcome (χ^2_{LR} = 342.3, df = 2, p < 0.001), followed by the opponent's level (χ^2_{LR} = 176.0, df = 2, p < 0.001), team level (χ^2_{LR} = 175.0, df = 2, p < 0.001), and match location (χ^2_{LR} = 9.5, df = 1, p = 0.002).

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

		95% CI for β			95% CI for OR			
Predictors	***b***	***LL***	***UL***	***OR***	***LI***	***LS***	p_{Wald}	p_{LR}
Match location								0.002
Away (base)								
Home	0.445	0.161	0.729	1.560	1.174	2.072	0.002	
Team level								<0.001
Relegation (base)								
Remained	1.374	0.956	1.793	3.952	2.601	6.006	<0.001	
Champions	2.808	2.341	3.275	16.572	10.388	26.437	<0.001	
Opponent's level								<0.001
Champions (base)								
Remained	1.473	1.112	1.834	4.364	3.042	6.260	<0.001	
Relegation	2.836	2.376	3.297	17.053	10.761	27.022	<0.001	

Table 4. *Cont.*

Predictors	*b*	95% CI for β		*OR*	95% CI for OR		p_{Wald}	p_{LR}
		LL	*UL*		*LI*	*LS*		
Match status at halftime								<0.001
Loses (base)								
Draws	1.496	1.124	1.868	4.462	3.076	6.473	<0.001	
Wins	3.023	2.665	3.381	20.556	14.370	29.406	<0.001	
Constant	−4.991	−5.560	−4.422	0.009	0.004	0.012	<0.001	<0.001

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

The logistic regression equation below was constructed based on the *b* coefficients listed in Table 4:

$$\text{logit (MatOut = Won} \mid \text{MatLoc TeaLev OppLev MatStaHal)} = -4.991 + 0.445 \times \text{MatLoc} + 1.374 \times \text{TeaLea2} + 2.808 \times \text{TeaLev3} + 1.473 \times \text{OppLev2} + 2.836 \times \text{OppLev3} + 1.496 \times \text{MatStaHal2} + 3.023 \times \text{MatStaHal3}$$

Subsequently, the logistic function presented below was employed to predict the likelihood of winning the match in 18 common scenarios of the analyzed competition:

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

Table 5 displays the 18 predictions. As an example, the first prediction can be interpreted as follows: When a team of the same level plays an away game against an opponent of the same level and loses at halftime, the probability of winning the match is estimated to be 0.105 (95% CI: 0.075 to 0.145). This specific scenario was the most frequently observed in the analyzed competition, occurring 91 times, which accounts for 5.42% of the total occurrences.

Table 5. Predictions of the probability of winning a match in 18 frequent situations.

Situation	MatLoc	TeaLev	OppLev	MatStaHal	Pr(MatOut = Won)	95% CI for Pr		*n*	%
						LL	*UL*		
1	Away	Remained	Remained	Loses	0.105	0.075	0.145	91	5.42
2	Home	Remained	Remained	Wins	0.790	0.733	0.838	90	5.36
3	Away	Champions	Remained	Wins	0.910	0.875	0.936	85	5.06
4	Home	Remained	Champions	Loses	0.040	0.026	0.061	85	5.06
5	Home	Champions	Remained	Wins	0.940	0.915	0.959	85	5.06
6	Away	Remained	Champions	Loses	0.026	0.017	0.041	84	5.00
7	Away	Remained	Remained	Wins	0.707	0.638	0.767	55	3.27
8	Away	Champions	Relegation	Wins	0.975	0.961	0.985	55	3.27
9	Home	Relegation	Champions	Loses	0.010	0.006	0.018	55	3.27
10	Home	Remained	Remained	Loses	0.155	0.114	0.207	55	3.27
11	Away	Relegation	Champions	Loses	0.007	0.004	0.012	54	3.21
12	Home	Champions	Relegation	Wins	0.984	0.974	0.990	53	3.15
13	Home	Remained	Remained	Draws	0.450	0.372	0.530	51	3.04
14	Away	Remained	Remained	Draws	0.344	0.274	0.421	50	2.98
15	Away	Remained	Relegation	Wins	0.904	0.860	0.935	45	2.68
16	Home	Relegation	Remained	Loses	0.044	0.027	0.071	45	2.68
17	Away	Relegation	Remained	Loses	0.028	0.018	0.047	42	2.50
18	Home	Remained	Relegation	Wins	0.936	0.905	0.958	42	2.50

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

The optimal cut-off point, determined by the ROC curve, was found to be π = 0.4396. At this cut-off point, a high ability to detect both match victories (Sensitivity, Se = 85.6%) and non-victories (Specificity, Sp = 82.6%) was achieved, resulting in an overall correct classification rate of 83.9%. Therefore, the sensitivity and specificity values were more balanced for the π = 0.4396 cut-off point (Se = 85.6, Sp = 82.6%) compared to the π = 0.5 cut-off point (Se = 78.9%, Sp = 88.1%).

4. Discussion

The main aim of this study was to create a parsimonious model to predict the winning probability in female rink hockey according to different situational variables and evaluate the contribution of each predictor to the match outcome. As far as we know, this study is the first to examine the interactive effects of situational variables in female rink hockey. Our key findings indicate that match status at halftime had the most significant impact on match outcomes, followed by the opponent's level, team level, and match location. While there are no comparable studies available for direct comparison, our findings align with those of Arboix-Alió et al. [20] for a sample of male rink hockey. Moreover, these findings follow the trend of other team sports [27,28], confirming that situational variables play a crucial role in team performance, supporting the idea that match analysis is essential in enhancing sports performance in team sports.

4.1. Match Status at Halftime

Match status at halftime emerged as a powerful predictor of match outcomes in female rink hockey. Teams that were drawing or winning at halftime had a significantly higher likelihood of winning the match compared to teams that were losing (OR = 20.56). This result aligns with previous rink hockey research in male competitions [20] and with studies in other team sports, demonstrating the significance of a positive halftime performance in determining the final match result [8]. Halftime provides an opportunity for coaches to evaluate their team's performance, make necessary adjustments, and motivate players for the second half. Maintaining a strong defensive position during halftime may also reduce the likelihood of conceding goals and increase the chance of securing a positive outcome.

In addition to the straightforward goal differences reflected in the final match outcome, the advantage of winning at halftime can be attributed to tactical and psychological factors. Similar to other team sports, when a team secures a substantial lead, they may adopt playing tactics that aim to control the game pace and maintain their advantage. Similar to what has been reported in football [29], rink hockey teams might choose to employ a ball retention tactic. This involves deliberately slowing down the tempo of the game and adopting a more controlled approach to play. By doing so, teams aim to maintain their lead and effectively manage any goal differences that may arise during the match. This strategic decision allows teams to exert a greater control over the flow of the game and minimize the risk of conceding goals to the opposition.

Moreover, the psychological aspect plays a significant role in the performance of teams playing the second half with a lead of one or more goals. According to the cognitive activation theory of stress, competition-induced changes in androgens levels can influence athletes' behavior in subsequent interactions, depending on the current outcome [30]. This hormonal response difference between winners and losers has been documented in various physically competitive situations [31] and may also explain the performance disparity between winning and losing teams observed in this study. In the context of rink hockey, previous research by Arboix-Alió et al. [18] found that players demonstrated a significantly better success in free direct hits when leading 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). This indicates that a lead provides players with enhanced confidence and focus, leading to an improved performance in critical situations. Similarly, Sousa et al. [15] reported that, when a team had a lead of two or more goals over the opponent, the effectiveness of the opponent goalkeepers decreased by 45% compared to matches with a tied status in the Portuguese male rink hockey first division. This suggests that being in a winning position positively impacts the attacking team's effectiveness, as they are better able to capitalize on scoring opportunities.

4.2. Team Level and Opponent's Level

The second most influential predictor was the level of teams and opponents. Matches involving teams with a high level had a significantly higher probability of winning compared to matches featuring teams with a low level. This finding underscores the importance of team strength and competitive balance in female rink hockey. In closely contested matches between two high-level teams, the outcome may be more unpredictable, whereas matches between unevenly matched teams may result in more one-sided outcomes.

Based on the present results, it can be observed that this influence of teams' level on match outcomes has a higher effect on female than in male rink hockey [20]. The reason can be attributed to the presence of a higher level of bias in female competitions in comparison to male competitions, likely stemming from the higher varying budgets of female teams competing in the same division [32]. This budget disparity leads to higher-level heterogeneity compared to rink hockey male leagues, where both professional and amateur athletes participate in the same competitions. This advantageous situation, referred to as the "drag effect" [33], provides certain rink hockey teams with a significant edge, while others do not benefit from prominent professional structures, further increasing the difference in level between clubs.

4.3. Match Location

The probability of winning the match when playing at home was higher than when playing away (OR = 1.56). This finding corroborates the presence of HA in women's rink hockey, an effect that was reported to be 54.33% by Arboix-Alió et al. [12] in the female Portuguese rink hockey league.

Comparing the present results with their male counterparts, the match location in rink hockey has a lesser influence on females than on males (OR = 2.311) [20]. Moreover, these outcomes are in line with expectations, as the existing literature from various sports also presents indications of higher HA values in men's teams. For instance, in football, Pollard and Gómez [34] assessed the HA effect across 26 European countries and discovered elevated HA values across all leagues for male teams. Similar patterns were observed in sports such as water polo [35], softball, and field hockey [36].

Numerous potential explanations can account for the disparities observed between sexes in relation to factors associated with HA effect, such as crowd influence, referee bias, territorial protection, and psychological aspects [35]. Although there may not be overt reasons for some of these factors to diverge between male and female players, the higher attendance at men's competitions could play a role in amplifying the HA effect in male sports [34].

Another angle to consider for the lower levels of HA observed in women's sports could be the fluctuations in testosterone levels among males before matches, with a more pronounced increase when playing at home [37]. According to Wolfson et al. [38], females experience a lesser rise in testosterone levels that remains consistent regardless of the playing location, since the feeling of territorial protection associated with the "home" environment is more potent in males than in females, leading to elevated testosterone levels and a heightened disposition for aggressive and dominant performance [37].

4.4. Scoring First

Finally, scoring the first goal of the match was not a significant predictor. As in men's hockey, although the likelihood of winning a match increased when teams secured the first goal, its impact did not emerge as a decisive situational variable influencing the match outcome [20].

In contrast, studies on other team sports, such as football, have demonstrated the significance of scoring the first goal. García-Rubio et al. [39] uncovered a noteworthy 3.36-fold increase in the odds ratio of winning for teams that achieved the initial goal. The absence of statistical significance in the current study may be attributed to the distinctive nature of rink hockey as a higher-scoring sport compared to football [40].

The distinctive attributes of rink hockey may elucidate the observed disparities among the various predictors. For instance, in rink hockey, the impact of scoring the first goal does not hold the same decisive weight as in other team sports characterized by a lower frequency of goals. Nevertheless, emerging as the most influential factors for victory are leading at halftime and the team's overall performance level. Notwithstanding these findings, it becomes evident that the cumulative effect of these variables significantly bolsters the likelihood of winning a match. For instance, the combined scenario of being a top team playing at home, along with securing a lead at halftime and facing a Relegation team, confers a remarkable probability of clinching victory in the match.

It is essential to acknowledge the limitations of this study to provide a comprehensive interpretation of the findings. Firstly, the sample was limited to matches from the Spanish first division (*OkLiga*). Consequently, future investigations should aim to validate our findings within diverse rink hockey competitive environments, including other national championships (such as the Italian and Portuguese leagues) or lower tiers of competition (grassroots sports or minor leagues). Additionally, exploring potential variations in these game variables based on the significance of the match (European or World Championships, or Euroleague) could provide intriguing insights. Additionally, while the study focused on situational variables, other factors, such as individual player performance, team formations, and tactical decisions, may also influence match outcomes. Future research could incorporate these additional variables to develop more comprehensive predictive models.

5. Conclusions

The present study underscores the notable influence of situational variables on the outcomes of female rink hockey matches. The results demonstrate the significance of match location, team level, opposing team level, and match status at halftime as predictors of match results. While these findings provide insights into specific aspects of performance scenarios, coaches and practitioners can leverage this information to shape more coherent training plans aligned with the dynamics of the game. The exploration of situational variables offers a wealth of information to bolster decision-making processes surrounding game strategies, player lineups, offensive tactics, team behavior, and set-pieces, contingent on factors like time remaining, team requirements, opponent characteristics, game momentum, and venue conditions.

Furthermore, this study holds the potential to assist staff members in crafting tailored practices that align with specific competition stages or simulate varying scenarios encompassing score advantages or deficits. These hypothetical scenarios could aid coaches in evaluating players' reactions under pressure, ultimately elevating performance in high-stakes situations. Hence, enhancing psychological preparedness could prove instrumental in optimizing sports performance, particularly when grappling with the inherent pressures of competitive team sports.

Author Contributions: Conceptualization, J.A.-A., G.T. and D.M.-G.; methodology, J.A.-A., G.T. and R.H.; formal analysis, J.A.-A., B.B. and R.H.; data curation, J.A.-A., G.T. and D.M.-G.; funding acquisition, J.A.-A.; investigation, J.A.-A., G.T. and B.B; writing—original draft preparation, J.A.-A. and G.T.; writing—review and editing, J.A.-A., G.T., B.B., D.M.-G., A.A., H.S. and V.V.; project administration, J.A.-A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available upon reasonable request from the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Arboix-Alió, J.; Buscà, B.; Peña, J.; Aguilera-Castells, J.; Miró, A.; Fort-Vanmeerhaeghe, A.; Trabal, G. Situational and Game Variables in Rink Hockey: A Systematic Review. *Apunt. Educ. Fís. Deport.* **2023**, *2*, 22–35. [CrossRef]
2. Drust, B. Performance analysis research: Meeting the challenge. *J. Sports Sci.* **2010**, *28*, 921–922. [CrossRef] [PubMed]
3. Liu, H.; Hopkins, W.G.; Gómez, M.A. Modelling relationships between match events and match outcome in elite football. *Eur. J. Sport Sci.* **2016**, *16*, 516–525. [CrossRef] [PubMed]
4. Sousa, T.; Sarmento, H.; Field, A.; Vaz, V. The perceptions of elite rink hockey head coaches: Preparation/observation and intervention. *Int. J. Perform. Anal. Sport* **2021**, *21*, 277–294. [CrossRef]
5. Almeida, J.; Sarmento, H.; Kelly, S.; Travassos, B. Coach decision-making in Futsal: From preparation to competition. *Int. J. Perform. Anal. Sport* **2019**, *19*, 711–723. [CrossRef]
6. Lago-Peñas, C. The Role of Situational Variables in Analysing Physical Performance in Soccer. *J. Hum. Kinet.* **2012**, *35*, 89–95. [CrossRef] [PubMed]
7. Lago-Peñas, C.; Gómez-Ruano, M.; Megías-Navarro, D.; Pollard, R. Home advantage in football: Examining the effect of scoring first on match outcome in the five major European leagues. *Int. J. Perform. Anal. Sport* **2016**, *16*, 411–421. [CrossRef]
8. Lago-Peñas, C.; Dellal, A. Ball possession strategies in elite soccer according to the evolution of the match-score: The influence of situational variables. *J. Hum. Kinet.* **2010**, *25*, 93–100. [CrossRef]
9. Pollard, R. Home advantage in soccer: A retrospective analysis. *J. Sports Sci.* **1986**, *4*, 237–248. [CrossRef] [PubMed]
10. Gómez, M.; Pollard, R.; Luis-Pascual, J.-C. Comparison of the Home Advantage in Nine Different Professional Team Sports in Spain. *Percept. Mot. Skills* **2011**, *113*, 150–156. [CrossRef] [PubMed]
11. Arboix-Alió, J.; Aguilera-Castells, J. Analysis of the home advantage in roller hockey. *J. Sport Health Res.* **2019**, *3*, 263–272.
12. Arboix-Alió, J.; Buscà, B.; Aguilera-Castells, J.; Trabal Taña, G.; Sánchez-Lopez, M.-J. Comparison of home advantage in men's and women's Portuguese roller hockey league. *Cuad. Psicol. Deport.* **2020**, *20*, 181–189. [CrossRef]
13. Arboix-Alió, J.; Aguilera-Castells, J. Influencia de marcar primero en hockey sobre patines. *Cuad. Psicol. Deport.* **2018**, *3*, 220–231.
14. Arboix-Alió, J.; Trabal, G.; Buscà, B.; Peña, J.; Arboix, A.; Hileno, R. The Behaviour of Home Advantage during the COVID-19 Pandemic in European Rink Hockey Leagues. *Int. J. Environ. Res. Public Health* **2021**, *19*, 228. [CrossRef] [PubMed]
15. Sousa, T.; Sarmento, H.; Marques, A.; Field, A.; Vaz, V. The influence of opponents' offensive play on the performance of professional rink hockey goalkeepers. *Int. J. Perform. Anal. Sport* **2020**, *20*, 53–63. [CrossRef]
16. Trabal, G.; Daza, G.; Riera, J. La eficacia del portero en la falta directa del hockey patines. *Apunt. Educ. Fís. Deport.* **2020**, *139*, 56–64. [CrossRef]
17. Trabal, G.; Daza, G.; Riera, J. Habilidades técnicas del portero de hockey patines en la falta directa. *Retos* **2019**, *36*, 69–73. [CrossRef]
18. Arboix-Alió, J.; Trabal, G.; Valente-Dos-Santos, J.; Aguilera-Castells, J.; Fort-Vanmeerhaeghe, A.; Buscà, B. The influence of contextual variables on individual set-pieces in elite rink hockey. *Int. J. Perform. Anal. Sport* **2021**, *21*, 336–347. [CrossRef]
19. Lago, C.; Casais, L.; Dominguez, E.; Sampaio, J. The effects of situational variables on distance covered at various speeds in elite soccer. *Eur. J. Sport Sci.* **2010**, *10*, 103–109. [CrossRef]
20. Arboix-Alió, J.; Aguilera-Castells, J.; Buscà, B.; Miró, A.; Hileno, R.; Trabal, G.; Peña, J. Situational variables in elite rink hockey: Effect of match location, team level, scoring first and match status at halftime on the competitive outcome. *Int. J. Perform. Anal. Sport* **2021**, *21*, 1101–1116. [CrossRef]
21. Hosmer, D.W.; Jovanovic, B.; Lemeshow, S. Best Subsets Logistic Regression. *Biometrics* **1989**, *45*, 1265. [CrossRef]
22. Lawless, J.F.; Singhal, K. Efficient Screening of Nonnormal Regression Models. *Biometrics* **1978**, *34*, 318. [CrossRef]
23. Ratkowsky, D.A. Principles of nonlinear regression modeling. *J. Ind. Microbiol.* **1993**, *12*, 195–199. [CrossRef]
24. Akaike, H. Information Theory and an Extension of the Maximum Likelihood Principle. In *Selected Papers of Hirotugu Akaike*; Springer: New York, NY, USA, 1998; pp. 199–213.
25. Hosmer, D.W.; Lemesbow, S. Goodness of fit tests for the multiple logistic regression model. *Commun. Stat.—Theory Methods* **1980**, *9*, 1043–1069. [CrossRef]
26. Hosmer, D.W.; Taber, S.; Lemeshow, S. The importance of assessing the fit of logistic regression models: A case study. *Am. J. Public Health* **1991**, *81*, 1630–1635. [CrossRef] [PubMed]
27. Lago-Peñas, C.; Gómez-López, M. How Important is it to Score a Goal? The Influence of the Scoreline on Match Performance in Elite Soccer. *Percept. Mot. Skills* **2014**, *119*, 774–784. [CrossRef] [PubMed]
28. Gómez, M.; Lago-Peñas, C.; Viaño, J.; González-Garcia, I. Effects of game location, team quality and final outcome on game-related statistics in professional handball close games. *Kinesiology* **2014**, *46*, 249–257.
29. O'donoghue, P.; Robinson, G. Score-line effect on work-rate in English FA Premier League soccer. *Int. J. Perform. Anal. Sport* **2016**, *16*, 910–923. [CrossRef]
30. Oliveira, T.; Gouveia, M.J.; Oliveira, R.F. Testosterone responsiveness to winning and losing experiences in female soccer players. *Psychoneuroendocrinology* **2009**, *34*, 1056–1064. [CrossRef] [PubMed]

31. Fry, A.C.; Schilling, B.K.; Fleck, S.J.; Kraemer, W.J. Relationships Between Competitive Wrestling Success and Neuroendocrine Responses. *J. Strength Cond. Res.* **2011**, *25*, 40–45. [CrossRef] [PubMed]
32. Arboix-Alió, J.; Buscà, B.; Aguilera-Castells, J. Competitive balance using Accumulated Points Difference method in male and female roller hockey leagues. *J. Phys. Educ. Sport* **2019**, *19*, 1200–1204. [CrossRef]
33. Zambom-Ferraresi, F.; García-Cebrián, L.I.; Lera-López, F. Competitive balance in male and female leagues: Approximation to the Spanish case. *J. Phys. Educ. Sport* **2018**, *18*, 1323–1329. [CrossRef]
34. Pollard, R.; Gómez, M.A. Comparison of home advantage in men's and women's football leagues in Europe. *Eur. J. Sport Sci.* **2012**, *14*, S77–S83. [CrossRef] [PubMed]
35. Prieto, J.; Gómez, M.-Á.; Pollard, R. Home Advantage in Men's and Women's Spanish First and Second Division Water Polo Leagues. *J. Hum. Kinet.* **2013**, *37*, 137–143. [CrossRef] [PubMed]
36. Gayton, W.F.; Mutrie, S.A.; Hearns, J.F. Home Advantage: Does it Exist in Women's Sports. *Percept. Mot. Skills* **1987**, *65*, 653–654. [CrossRef]
37. Pollard, R.; Prieto, J.; Gómez, M.Á. Global differences in home advantage by country, sport and sex. *Int. J. Perform. Anal. Sport* **2017**, *17*, 586–599. [CrossRef]
38. Wolfson, S.; Neave, N.; Anderson, M. Hormones and the home advantage in English football. In *12th European Congress of Sport Psychology*; FEPSAC: Halkidiki, Greece, 2007; pp. 57–60.
39. Garcia-Rubio, J.; Gomez, M.A.; Lago-Peñas, C.; Ibañez, S.J. Effect of match venue, scoring first and quality of opposition on match outcome in the UEFA Champions League. *Int. J. Perform. Anal. Sport* **2015**, *15*, 527–539. [CrossRef]
40. Sampedro, J.; Prieto, J. El efecto de marcar primero y la ventaja de jugar en casa. *Rev. Psicol. Deport.* **2012**, *21*, 301–308.