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Published online: 13 Jul 2019.

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Goals scored and received in 5vs4 GK game strategy are constrained by critical moment and situational variables in elite futsal

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ABSTRACT

The aim of this study was to identify the importance and meaning of goals using the goalkeeper as an outfield player in elite futsal according to critical and situational variables. The sample consisted of 11,446 actions corresponding to 1,325 matches from the 1ˢᵗ division Spanish Futsal League during the seasons from 2010 to 2015. Multinomial logistic regression and classification tree multivariate models were used to identify the best predictor variables related to the likelihood of scoring goals, receiving goals, or no goals. Results from Multinomial logistic regression emphasised goals scored in balanced matches and playing with the goalkeeper as an outfield player before the last eight minutes. When the teams were drawing or losing, finished with goals received or without goals. The classification tree results identified a greater likelihood of scoring goals when the teams were winning, in balanced matches, and within the last eight minutes. Conversely, a greater likelihood of suffering goals was observed using the goalkeeper as an outfield player when the teams were losing, in unbalanced matches and in the last eight minutes. The identified trends will allow futsal coaches to recognise the most suitable situations for achieving efficacy when using the goalkeeper as an outfield player strategy.

Introduction

Futsal is usually compared to football and associated with a small-sided version of this game. However, Futsal has its own specific dynamics due to the different rules, number of players, field dimensions and balls used. For instance, the FIFA futsal regulations allow the use of the goalkeeper as an outfield player (5vs4+ GK) during the game. It means that any player may change places with the specific goalkeeper (FIFA futsal law 3- the number of players -changing the goalkeeper). Usually, futsal coaches use the risky 5vs4+ GK strategy (the team plays without a goalkeeper in the goal and leaving out free space in the defensive midfield) to unbalance the numerical relations between outfield players and increase the likelihood of generating goal scoring opportunities (Corrêa, Davids, Silva, Denardi, & Tani, 2014; Vicente-Vila & Lago-Peñas, 2016). This game strategy is almost always used in the final moments of the match when the team is losing, as a strategic option to recover the balance on the scoreboard (Barbosa, 2011; Ganef, Pereira, De Almeida, & Coppi, 2009; Newton-Ribeiro, 2011; Vicente-Vila, 2012; Vicente-Vila & Lago-Peñas, 2016).

The observed changes on the numerical relations between outfield players promote adaptations especially in the interpersonal relations between defending players. Due to the numerical inferiority on the field, defensive players tend to be more coordinated to maintain the compactness between the ball and the goal (Travassos, Araújo, Vilar, & McGarry, 2011). Such a strategy allows the defensive team to intercep passing actions or block shots to goal and quickly progress on

the field with the attacking team unbalanced or shooting at the goal without the goalkeeper. The capacity of the defensive team to manage the numerical unbalance or the attacking team to play without a goalkeeper in the goal can be a decisive factor for defining the final outcome of futsal matches, which seems to be related to the tactical effectiveness of the defensive system to perform disarmament of the ball, and to the offensive system that ends the attack situations and then does not generate turnovers (Miloski, Pinho, Gobo, Rebouças, & Schultz, 2014).

According to previous research, the 5vs4 + GK game strategy may cause changes on the scoreboard that can establish a final balance of goals in favor (goals scored) or against (goals received). For instance, in Brasil it was reported a similar number of goals in favor (17%) and against (17%) (Barbosa, 2011). However, some studies indicated a better final balance (*saldo pro goleiro*) of goals in favor (*goal pro goleiro*) than of goals against (*goal contra goleiro*) during international matches (Ganef et al., 2009). These findings were confirmed in later studies, where it has been revealed the highest number of goals scored (21%) in relation to the goals received (5%) in the men's national league (Fukuda & Santana, 2012), as well as in the U20 women's championship (Bezerra & Coppi, 2012) when teams are using this game strategy. Conversely, a recent study revealed that the use of the 5vs4+ GK game strategy did not cause changes in match status, and the teams that were losing and used the 5vs4+ GK game strategy lost the

game in 93% of the cases and received more goals compared to those scored (Méndez, 2018). Despite such results, and due to the importance of this game strategy for coaches, further studies are needed to understand the really impact of this option on the efficacy and consequently on the final outcome of the match (Vicente-Vila & Lago-Peñas, 2016).

Previous research on team sports has also analysed the effect of some Critical Moment Variables (CMV) such as match status, play time and game criticality on variations of game dynamics (Navarro, Lorenzo, Gómez, & Sampaio, 2009; Sampaio, Lorenzo, & Ribeiro, 2006). In Futsal, the analysis of Critical Moments (CM) revealed how match status, play time and fouls committed constrained shooting chances (Méndez, Gómez, Rúiz, & Travassos, 2019), but also constrained coaches to adopt the 5vs4+ GK game strategy (Méndez, Gómez-Ruano, Ruiz, & Cui, 2017). Particularly, it was observed that when a disadvantaged match status of one goal or more occurs, this game strategy was preferentially adopted (Barbosa, 2011). In addition, the 5vs4+ GK game strategy occurs almost always in the last minutes of the match as a final strategy to reduce the goal disadvantage in a short time (Ganef et al., 2009; Newton-Ribeiro, 2011). Also, the effect of some Situational Variables (SV) has been highly investigated (Gómez, Lago-Peñas, & Pollard, 2013; Lago-Ballesteros, Lago-Peñas, Rey, Martínez, & Domínguez, 2012). For instance, in futsal the match location revealed an effect on teams' success, with a greater likelihood for home teams (Sampedro & Prieto, 2011, 2012). Recently, a study on attacking game situations in numerical superiority with the 4vs3+ GK and 5vs3 + GK game strategies also revealed a higher attack effectiveness for home teams and the great importance of the match type (Gómez, Méndez, Indaburu, & Travassos, 2018).

However, the available literature exploring the relationship between Situational Variables (SV) and the impact generated by the CM on ball possession efficacy in teams using the 5vs4+ GK game strategy is limited (Moore, Bullough, Goldsmith, & Edmondson, 2014). Due to the main goal of the 5vs4+ GK game strategy, that is generating goal scoring opportunities without exposing the team to shots from the opposing team, such information is paramount to help coaches to improve the use of such a risky strategy, so it would be interesting that they will not think of using it as a last resource or emergency solution, rather turning it into an alternative to the symmetry game through of an adequate training from the youth categories (Ganef et al., 2009; Newton-Ribeiro, 2011). Thus, multivariate statistical models, such as multinomial logistic regression or classification tree analysis, have been suggested to be suitable for exploring and modeling data related to the control of team performance indicators (Gómez, Lorenzo, Ibañez, & Sampaio, 2013; Gómez, Moral, & Lago-Peñas, 2015; Maneiro, Casal, Ardá, & Losada, 2019). Therefore, the aim of the present study was to understand how SV and CMV in futsal constrain ball possession efficacy in the 5vs4+ GK game strategy using multivariate analysis. It was hypothesised that ball possession efficacy with the 5vs4+ GK game strategy is constrained by SV and CMV.

Method

Data sampling and ethical approval

A total of 1,325 matches from the regular phase and playoffs of the 2010–2011 to the 2014–2015 Spanish men's professional futsal league matches (LNFS 1st division) were analyzed. A sample of 11,446 5vs4+ GK game pieces were considered for the analysis. Each game piece was coded according to ball possession efficacy as: a) goal scored, b) goal received and c) no goal.

The Spanish Professional Futsal League (LNFS) granted the necessary permits to provide the images and use them for research purposes. The Ethics Committee of Research and Development activities of UPM (Technical University of Madrid) was responsible for the evaluation of ethical aspects in order that data collection and processing used in this study will not affect fundamental rights. The ethics committee confirmed that the study respects the European data protection law (General Data Protection Regulation) regarding the public data processing of team sports. Once informed of the activity described in this manuscript, it was reviewed and approved by the Ethics Committee of Research and Development activities of UPM in order to be published.

Data processing

The matches were analysed through systematic observation using the video analysis software Astrofutsal® (Méndez & Méndez, 2005), which is being employed for notational analysis in sports research and is currently a common tool for analysing international futsal competitions (Paz-Franco, Bores-Cerezal, Barcala-Furelos, & Mecias-Calvo, 2014). Payment licence are necessary to access their datasets, and requests should be addressed through registration at http://www.astro-sport.com. The informed consent of the company was obtained in order that this study could use their statistical reports data in research, as well as in subsequent publications, in exchange for the source of the data repository being named.

Two experienced observers (12 years of experience in the notational analysis of futsal events with the use of this tool), participated in the process of data reliability. The match between Pozo de Murcia vs Inter Movistar (Playoff final series 2014–2015) was re-analysed to check inter-observer reliability. The two observers recorded the futsal match events and then the 5vs4+ GK actions of both teams, and their records were compared using Cohen's *Kappa* index (k) (Robinson & O'Donoghue, 2007), obtaining a very good agreement between both independent observers (values greater than .89) (Viera & Garrett, 2005).

Data notation

All the variables studied are defined in the Table 1. The efficacy of each 5vs4+ GK ball possession: goal scored (attacking team scoring a goal) goal received (defending team scoring a goal) and no goal (ball possession did not cause changes on the scoreboard) was considered as the dependent variable.

The independent variables were related to CMV and SV. The SV included: (i) match location (playing at home or away); (ii) opponent's strength, considering the 16-team ranking at the end

Table 1. Distribution of frequencies (%) for ball posession efficacy (no goal, goal scored, goal received) in attack with goalkeeper as an outfield player according to critical and situational variables (Contingency table: Chi-square, degrees of freedom, significance, minimum expected frequency and effect size).

Variables	No Goal $n = 10218$		Goal scored $n = 582$		Gol Received $n = 646$		χ^2	df	P	MEF	ES
	%	n	%	n	%	n					
Competition											
Regular phase	90.6	9259	92.4	538	91.5	591	2.621	2	.270	53.80	0.01
Play off	9.4	959	7.6	44	8.5	55	-	-	-	-	-
Match Location											
Home	40.4	4124	45.9	267	40.1	259	7.027	2	.030*	236.4	0.02
Away	59.6	6094	54.1	315	59.9	387	-	-	-	-	-
Opponent's strength											
Best (5v4) vs. worst	7.8	795	12.2	71	4.6	30	45.482	4	.001**	45.56	0.04
5v4 between balanced	61.0	6238	63.2	368	56.5	365	-	-	-	-	-
Worst (5v4) vs. best	31.2	3185	24.6	143	38.9	251	-	-	-	-	-
Match type											
Balanced	55.4	5656	72.5	422	30.3	196	230.988	2	.001**	262.9	0.14
Unbalanced	44.6	4562	27.5	160	69.7	450	-	-	-	-	-
Play time											
1st half	-	348	-	11	-	16	-	-	-	-	-
0–8	2.3	8	0.0	0	0.0	0	6.709	8	.446	0.23†	0.10
9–16	5.5	19	0.0	0	0.0	0	-	-	-	-	-
17–24	10.3	36	18.2	2	12.5	2	-	-	-	-	-
25–32	24.4	85	45.5	5	43.8	7	-	-	-	-	-
33–40	57.5	200	36.4	4	43.8	7	-	-	-	-	-
2nd half	-	9772	-	567	-	626	-	-	-	-	-
0–8	1.9	189	1.4	8	1.6	10	7.822	8	.451	10.70	0.01
9–16	3.1	306	2.3	13	2.9	18	-	-	-	-	-
17–24	8.6	838	9.5	54	7.2	45	-	-	-	-	-
25–32	28.2	2753	29.5	167	25.9	162	-	-	-	-	-
33–40	58.2	5686	57.3	325	62.5	391	-	-	-	-	-
Extra time	-	98	-	4	-	4	-	-	-	-	-
Match status											
Losing	91.1	9311	63.6	370	97.7	631	641.250	4	.001**	10.12	0.16
Drawing	7.6	781	24.6	143	1.7	11	-	-	-	-	-
Winning	1.2	126	11.9	69	0.6	4	-	-	-	-	-
Fouls committed											
0	3.7	375	3.4	20	3.6	23	15.588	10	.112	21.25	0.02
1st	11.4	1164	10.8	63	12.4	80	-	-	-	-	-
2nd	25.2	2572	29.6	172	24.3	157	-	-	-	-	-
3rd	25.9	2648	23.7	138	27.1	175	-	-	-	-	-
4th	16.0	1635	18.9	110	15.3	99	-	-	-	-	-
5th	17.9	1824	13.6	79	17.3	112	-	-	-	-	-
Criticality											
High (12–15)	73.0	7460	54.6	318	73.8	477	98.599	4	.001**	19.63	0.06
Medium (9–11)	23.6	2412	41.2	240	23.7	153	-	-	-	-	-
Low (4–8)	3.4	346	4.1	24	2.5	16	-	-	-	-	-

of the regular season, measured as the end-of-season ranking differences between the two teams (Rank team A – Rank team B). The *k*-means cluster analysis established three different groups (1: best ranked teams vs. worst ranked teams; 2: balanced level of opposition: best teams vs. best teams and worst teams vs. worst teams; 3: worst ranked teams vs. best ranked teams); (iii) the competition phase: regular phase or playoff (where only the first eight ranked teams participate); and (iv) match type: balanced (with a difference of up to two goals) or unbalanced (with a more than two goal difference).

The CMV included: (v) play time, which was defined in five sub-periods of eight minutes in each half time. The *k*-means cluster analysis was established with 5 levels, so that it could correspond with the likert scale of 5 degrees that measures the criticality of the play time, finally establishing groupings with average values of 8-minute for each level (0–8, 9–16, 17–24, 25–32, 33–40, and extra time in case needed in play-offs); (vi) the match status (winning, drawing or losing); (vii) fouls committed, the number of the team's accumulated fouls (0, 1st, 2nd, 3rd, 4th or 5th); and (viii) the critical level of the

match, considering the three previous variables, where the highest values represent the appearance of unfavourable CM (Ferreira & Volossovitch, 2013; Ferreira, Volossovitch, & Sampaio, 2014) for one of the teams. The *k*-means cluster analysis established three different critical levels (low: cumulative values between 4 and 8; medium: values between 9 and 11, and high: values between 12 and 15).

Statistical analysis

Firstly, a descriptive and inferential analysis was performed using Crosstab Commands. Pearson's Chi-square test was used to analyse the relationships between ball possession efficacy with SV and CMV. The effect sizes (ES) were calculated using Cramer's *V* test and their interpretation were based on the following criteria: 0.10 = small effect, 0.30 = medium effect and 0.50 = large effect (Volker, 2006).

Secondly, a multinomial logistic regression model was used to assess the influence exerted by the interaction of the independent variables (SV and CMV) on ball possession

efficacy with 5vs4+ GK (Gómez et al., 2015; Vicente-Vila & Lago-Peñas, 2016). In the logistic regression model, ball possession efficacy was included as a polytomous dependent variable, depending on whether the 5vs4+ GK ended in a goal scored, goal received, or no goal. In addition, the reference category of the dependent variable was established, so that all the categories were compared to each other (1: attacks without goals compared to attacks with goals received; 2: attacks with goals scored compared to attacks with goals received, and 3: attacks with goals scored compared to attacks without goals) and always in relation to the independent variables included in the study. For each variable the odds ratios (OR) and their 95% confidence intervals (CI) were determined. The significance level was established at $P < 0.05$.

Thirdly, the exhaustive chi-squared automatic interaction detection (CHAID) classification tree analysis was used to split the sample into nodes (subgroups) in order to identify the best predictors (independent variables) of ball possession efficacy with 5vs4+ GK (Gómez et al., 2015).The statistical model specifications were: (i) the significance level was set at $P < 0.05$; (ii) Pearson's Chi-square was used; (iii) the maximum number of iterations were 100–50; (iv) the minimum change in expected cell frequencies was 0.001; (v) the Bonferroni method was used to obtain the significance values of adjustment; (vi) cross-validation was carried out and, for each subsample, one tree was built with the remaining cases (90%); (vii) the tree had a three level maximum, and (viii) the misclassification risk was calculated as a measure of the model reliability (Schnell, Mayer, Diehl, Zipfel, & Thiel, 2014). Statistical analyses were performed using IBM SPSS for Windows statistics, version 22.0 (Armonk, NY: IBM. Corp.).

Results

The distribution of frequencies for ball posession efficacy (goal scored, goal received, no goal) from the studied variables is shown in Table 1 (percentage and case numbers). A significant relationship was found between the greater likelihood of scoring goals and the 5vs4+ GK game strategy by local teams, in best ranked teams vs. worst ranked teams, and balanced matches. Conversely, but as expected, a significant relationship was found between the greater likelihood of receiving goals and the 5vs4+ GK game strategy when the team was losing, and at a high criticality level.

Results from the multinomial logistic regression analysis (Table 2, III and IV) identify ball possession efficacy with the 5vs4+ GK game strategy concerning the independent variables. The results showed that the model was statistically significant ($\chi^2 = 669,232$; $P = .001$), correctly classifying 89.3% of the cases. Table 2 compares the attacks without goals against attacks with goals received and concerning the independent variables. The model showed a greater likelihood of there being no changes on the scoreboard when the 5vs4+ GK game strategy was used during the first half (OR = 3.847), and during the first four play time intervals, namely between 0–8 min (OR = 2.211), 9–16 min (OR = 2.016), 17–24 min (OR = 1.829), and

Table 2. Effects of the independent variables on ball possession efficacy in attack with goalkeeper as an outfield player, comparing attacks without goals with the ones with goals received.

Ball possession performance[a]	Variables	B	S.E.	Wald	df	P	OR	OR (95% C.I.) Lower	Upper
Attack without a goal	Constant	1760	.792	4.938	1	.026	-	-	-
	Regular Phase	−.162	.154	1.116	1	.291	.850	.629	1.149
	Play Off	0	-	-	0	-	-	-	-
	Home	−.089	.085	1.112	1	.292	.915	.785	1.080
	Away	0	-	-	0	-	-	-	-
	Best (5v4) vs. worst	.194	.205	.895	1	.344	1.214	.812	1.813
	5v4 between balanced	.126	.088	2.048	1	.152	1.135	.954	1.349
	Worst (5v4) vs. best	0	-	-	0	-	-	-	-
	Balanced match	1.045	.092	128.009	1	.001**	2.844	2.373	3.409
	Unbalanced match	0	-	-	0	-	-	-	-
	1st half	1.347	.649	4.305	1	.038*	3.847	1.078	13.738
	2nd half	.853	.595	2.056	1	.152	2.347	.731	7.530
	Extra time	0	-	-	0	-	-	-	-
	0–8 min	.794	.358	4.902	1	.027*	2.211	1.095	4.465
	9–16 min	.701	.268	6.842	1	.009**	2.016	1.192	3.409
	17–24 min	.604	.168	12.866	1	.001**	1.829	1.315	2.544
	25–32 min	.367	.100	13.490	1	.001**	1.444	1.187	1.757
	33–40 min	0	-	-	0	-	-	-	-
	Losing	−.541	.517	1.095	1	.295	.582	.211	1.604
	Drawing	.609	.596	1.045	1	.307	1.839	.572	5.916
	Winning	0	-	-	0	-	-	-	-
	0	−.309	.282	1.194	1	.275	.734	.422	1.278
	1st foul	−.175	.164	1.128	1	.288	.840	.608	1.159
	2nd foul	−.036	.133	.073	1	.788	.965	.744	1.251
	3rd foul	−.076	.127	.356	1	.551	.927	.722	1.189
	4th foul	.013	.144	.009	1	.925	1.014	.764	1.345
	5th foul	0	-	-	0	-	-	-	-

Note: S.E: = Standard error; CI = Confidence intervals; a) the reference category of the dependent variable that is compared: **Goal received**; b) the redundant category of the independent variable that is compared when OR = 1.
* $P < .05$.; **$P < .01$.

Table 3. Effects of the independent variables on ball possession efficacy in attack with goalkeeper as an outfield player, comparing attacks with goals scored with the ones with goals received.

Ball possession performance[a]	Variables	B	S.E.	Wald	df	P	OR	OR (95% C.I.) Lower	OR (95% C.I.) Upper
Attack with Goal Scored	Constant	.121	1.022	.014	1	.906	-	-	-
	Regular Phase	−.201	.227	.785	1	.376	.818	.524	1.227
	Play Off	0	-	-	0	-	-	-	-
	Home	−.049	.121	.165	1	.685	.952	.751	1.207
	Away	0	-	-	0	-	-	-	-
	Best (5v4) vs. worst	.033	.259	.016	1	.898	1.034	.622	1.717
	5v4 betw balanced	.159	.136	1.374	1	.241	1.172	.899	1.529
	Worst (5v4) vs. best	0	-	-	0	-	-	-	-
	Balanced match	1.565	.137	130.944	1	.001**	4.782	3.658	6.251
	Unbalanced match	0	-	-	0	-	-	-	-
	1st half	1.311	.958	1.871	1	.171	3.709	.567	24.257
	2nd half	1.650	.872	3.581	1	.058	5.206	.943	28.743
	Extra time	0	-	-	0	-	-	-	-
	0–8 min	.809	.536	2.272	1	.132	2.245	.784	6.424
	9–16 min	.413	.405	1.045	1	.307	1.512	.684	3.341
	17–24 min	.940	.232	16.456	1	.001**	2.560	1.626	4.033
	25–32 min	.589	.142	17.159	1	.001**	1.803	1.364	2.382
	33–40 min	0	-	-	0	-	-	-	-
	Losing	−3.161	.530	35.565	1	.001**	.042	.015	.120
	Drawing	−.564	.609	.857	1	.354	.569	.173	1.877
	Winning	0	-	-	0	-	-	-	-
	0	−.031	.409	.006	1	.940	.970	.435	2.161
	1st foul	.314	.247	1.620	1	.203	1.369	.844	2.220
	2nd foul	.472	.196	5.783	1	.016*	1.602	1.091	2.353
	3rd foul	.207	.194	1.139	1	.286	1.230	.841	1.799
	4th foul	.553	.210	6.943	1	.008**	1.739	1.152	2.624
	5th foul	0	-	-	0	-	-	-	-

Note: S.E: = Standard error; CI = Confidence intervals; a) the reference category of the dependent variable that is compared: **Goal received**; b) the redundant category of the independent variable that is compared when OR = 1.
* $P < .05$.; **$P < .01$.

25–32 min (OR = 1.444), in the case of balanced matches (OR = 2.844).

Table 3 compares the attacks with goals scored against attacks with goals received and concerning the independent variables. The model showed a greater likelihood of scoring goals with the 5vs4+ GK game strategy in balanced matches (OR = 4.782), in play time intervals furthest from the end of the match, particularly between 17 to 24 min (OR = 2.560) and 25 to 32 min (OR = 1.803), and before the arrival of the 5th foul, particularly with the 2nd accumulated foul (OR = 1.602) as well as the 4th one (OR = 1.739). Conversely to what would happen with a favorable scoreboard, when the 5vs4+ GK game strategy was used by a losing team there was a lower likelihood of scoring goals (OR = .042), increasing the probability of receiving goals.

Table 4 compares the attacks with goals scored against attack without goals and concerning the independent variables. The model showed a greater likelihood of scoring goals with the 5vs4+ GK game strategy in balanced matches (OR = 1.681), in play time intervals furthest from the end of the match, specifically between the 17 to 24 min (OR = 1.400) and 25 to 32 min (OR = 1.248), and before the arrival of the 5th foul, particularly with the 1st foul (OR = 1.630), 2nd foul (OR = 1.661) as well as the 4th one (OR = 1.715). Conversely to what would happen with a favorable scoreboard, when the 5vs4+ GK game strategy was used in a drawn match there was a lower likelihood of scoring goals (OR = . 309), which became

a greater disadvantage if the 5vs4+ GK game strategy was used by the losing team (OR = . 073), increasing the probability of attacks without goals.

Thirdly, the exhaustive CHAID classification tree shows three significantly influenced factors on ball possession efficacy of the 5vs4+ GK game strategy (tree-stage three). Those factors led to 16 nodes (10 final nodes) of contrasting groups of ball possession efficacy; mainly established by match status (level 1), match type (level 2), and play time interval (level 3). Figure 1 shows the categories for the dependent variable (goal scored, goal received, no goal) and also the 16 nodes defined by the classification tree. The predictive power of the classification tree model explained 89.4% of total variance after cross-validation analysis, reaching a precision of 99.7% in cases of no goal, of 7.9% in cases of goals scored and of 1% in cases of goals received. The unbalanced precision value of the dependent variables was due to the large number of cases without a goal over the total.

At level 1 the root node is split by the match status at the moment the 5vs4+ GK is used, achieving greater efficacy with a favorable scoreboard (winning) (node 3: 34.7% of attacks with goals scored; 63.3% of attacks without goals; 2% of attacks with goals received), and less efficacy with an unfavorable scoreboard (losing) (node 1: 3.6% of attacks with goals scored; 90.3% of attacks without goals; 6.1% of attacks with goals received). At level 2 it showed the importance of match type. Ball possession efficacy of the 5vs4+ GK game strategy was higher in those balanced matches when winning (node 9:

Table 4. Effects of the independent variables on ball possession efficacy in attack with goalkeeper as an outfield player, comparing the attacks with goals scored with the ones without goals.

Ball possession performance[a]	Variables	B	S.E.	Wald	df	P	OR	OR (95% C.I.) Lower	Upper
Attack with Goal Scored	Constant	−1.639	.676	5.877	1	.015	-	-	-
	Regular Phase	−.039	.174	.051	1	.822	.962	.684	1.352
	Play Off	0	-	-	0	-	-	-	-
	Home	.040	.091	.194	1	.659	1.041	.871	1.243
	Away	0	-	-	0	-	-	-	-
	Best (5v4) vs. worst	−.161	.166	.934	1	.334	.852	.615	1.180
	5v4 betw balanced	.033	.107	.093	1	.761	1.033	.838	1.274
	Worst (5v4) vs. best	0	-	-	0	-	-	-	-
	Balanced match	.519	.105	24.558	1	.001**	1.681	1.369	2.065
	Unbalanced match	0	-	-	0	-	-	-	-
	1st half	−.037	.722	.003	1	.959	.964	.234	3.968
	2nd half	.797	654	1.486	1	.223	2.218	.616	7.988
	Extra time	0	-	-	0	-	-	-	-
	0–8 min	.015	.413	.001	1	.971	1.015	.452	2.280
	9–16 min	−.288	.312	.848	1	.357	.750	.407	1.384
	17–24 min	.336	.167	4.068	1	.044*	1.400	1.010	1.941
	25–32 min	.222	.105	4.429	1	.035*	1.248	1.015	1.535
	33–40 min	0	-	-	0	-	-	-	-
	Losing	−2.620	.170	237.280	1	.001**	.073	.052	.102
	Drawing	−1.173	.182	41.464	1	.001**	.309	.216	.442
	Winning	0	-	-	0	-	-	-	-
	0	.278	.307	.818	1	.366	1.320	.723	2.411
	1st foul	.489	.191	6.564	1	.010**	1.630	1.122	2.369
	2nd foul	.507	.149	11.524	1	.001**	1.661	1.239	2.226
	3rd foul	.283	.151	3.510	1	.061	1.327	.987	1.784
	4th foul	.540	.158	11.660	1	.001**	1.715	1.258	2.338
	5th foul	0	-	-	0	-	-	-	-

Note: S.E: = Standard error; CI = Confidence intervals; a) the reference category of the dependent variable that is compared: **No goal**; b) the redundant category of the independent variable that is compared when OR = 1.

* $P < .05$.; **$P < .01$.

42.7% of attacks with goals scored; 54.5% of attacks without goals; and 2.8% of attacks with goals received); but it conversely decreased when the strategy was used in unbalanced matches when losing (node 4: 2.9% of attacks with goals scored; 88.2% of attacks without goals; 8.9% of attacks with goals received). At level 3, the tree identified significant differences with the predictor variables when the play time interval was included. Thus, when winning matches that were already balanced (node 9), the likelihood of scoring goals with the 5vs4+ GK game strategy increased in the final eight minutes of the match (node 16: 57.5% of goals scored) compared to the others (node 15: 23.8% of goals scored). Similarly, the likelihood of receiving goals was greater in the final eight minutes of the match (node 11: 10.7%) compared to the others (node 10: 7.2% of goals received), particularly when losing matches that were already unbalanced (node 4).

Discussion and conclusion

The aim of this study was to explore how CMV and SV constrain ball possession efficacy (goal scored, goal received and no goal) of the 5vs4+ GK game strategy for future predictions about its use. Results from research in futsal should lead coaches to greater knowledge of variables that constrain the use of the 5vs4+ GK strategy and its risk in different matches and at different moments of the game. In general, the results revealed an equal proportion between the goals scored (n = 582, 5.1%) and the goals received (n = 646, 5.6%) using the 5vs4+ GK game strategy. However, there was a strong constraint of the SV match type and a general constraint of

CMV on ball possession efficacy. Overall, the greater likelihood of scoring goals was achieved in the regular phase, playing at home, in balanced games, by the best ranked teams, before the last eigth minutes of the match, with a favorable match status (winning), and a variable number of accumulated fouls. Conversely, the likelihood of receiving goals corresponded to the regular phase, playing away, in unbalanced games, by the worst ranked teams, in the last eight minutes of the match, when losing, with a variable number of accumulated fouls, but always at a high criticality level.

The analysis of SV revealed the strongly constraint of match type on the ball possession efficacy. The logistic regression results showed that balanced matches had advantages regarding ball possession efficacy. Particularly a 4.78 times greater likelihood of scoring goals than receiving goals, a 2.84 times greater likelihood of not scoring than receiving goals, and a 1.68 times greater likelihood of scoring goals than not scoring, compared to unbalanced matches. Likewise, the classification tree found the significant effect of the match type starting from match status, and showed the greater efficacy in balanced compared with unbalanced matches. As match status worsened there was a progressive decrease in efficacy, which can be interpreted as a greater difficulty in scoring goals, but also a greater ease in receiving goals. For instance, in balanced games it went from 42.7% of attacks with goals scored when winning to 4.2% when losing; while in unbalanced games it went from 14.3% of attacks with goals scored when winning to 2.9% when losing, which also had a negative impact on an increase in the goals received (8.9%). Match type is recognised as a discriminator

of the main performance indicators, and its influence has been investigated to contextualize the factors linked with victory or defeat (Csataljay, O'Donoghue, Hughes, & Dancs, 2009). Besides, the analysis showed an unexpected non-influence of match location and opponent's strength, which can be explained by the fact that it is usual that the teams' strategy and their success level are affected by environmental conditions and by the opponent's assertive behaviors (Gómez, DelaSerna, Lupo, & Sampaio, 2014), which can lead to the positive effect of the playing at home advantage being nullified by playing against balanced or stronger teams (Sampedro & Prieto, 2011).

The multivariate analysis established the strongly constraint of CMV on the 5vs4+ GK game strategy, particularly revealing that match status strongly influences ball possession efficacy when using 5vs4+ GK. The findings from the logistic regression model revealed that when the teams were losing the likelihood of scoring goals was lower. Also, as match status worsened there was less likelihood of the attacking team scoring goals. Consistently with the previous results, the classification tree revealed that the greatest efficacy of the 5vs4+ GK game strategy was achieved when the attacking team was winning (34.7% of attacks with goals scored, 63.3% of attacks without goals, 2% of attacks with goals received), while the least efficacy was revealed when the attacking team was losing (3.6% of attacks with goals scored, 90.3% of attacks without goals, and 6.1% of attacks with goals received). Similarly, in a recent study from the UEFA futsal Euro 2016, it was found that the national teams that were losing and at the end were defeated scored more goals with the 5vs4 + GK strategy, but they also received more goals compared to the teams that were winning and at the end won (Göral, 2018). And another recently published study revealed that the 5vs4+ GK strategy was the most powerful match variable for discriminating losing teams, and confirmed again that the losing teams used the 5vs4+ GK strategy much more than the winning teams (Mendez, Gonçalves, Santos, Ribeiro, & Travassos, 2019). This fact could be explained by the need to achieve a balanced scoreboard in the teams that were losing and used this strategy, and by the lower frequency of use in the teams that were winning. However, the unexpected non-significant influence of match status on the ball possession efficacy (Gómez et al., 2015; Vicente-Vila & Lago-Peñas, 2016) could be justified by the fact that futsal teams losing by a recoverable difference (up to 2 goals) do not take risks playing with the 5vs4+ GK strategy, mortgaging a possible increase in offensive efficacy, or also as Lago-Peñas (2009) pointed out that critical variables would have unique effects on individual players, teams and playing styles.

Furthermore, multinomial logistic regression found a strong constraint between play time intervals and ball possession efficacy. As the end of match time approached there was a negative trend in 5vs4+ GK efficacy. Thus, the play time intervals between the 17–24 min and 25–32 min, had the advantage of a 2.56 and 1.80 times greater likelihood of scoring goals than receiving goals, and the advantage of a 1.40 and 1.25 times greater likelihood of scoring goals than there being no goals in attack with 5vs4+ GK, compared to the final play time interval (33–40 min). All of which seems to point to the fact that ball possession efficacy faded near the final minutes, which would be consistent with the greatest difficulty in achieving efficacy when a CM occurs, and agrees with the criticality attributed to these final minutes by the scientific community (Ferreira, 2013; Ferreira & Volossovitch, 2013; Ferreira et al., 2014; Navarro, Gómez, Lorenzo, & Jiménez, 2013; Sampaio et al., 2006). Also, the results of the classification tree coincide in pointing out the final minutes of the match as those with the worst efficacy with 5vs4+ GK (92.8% of attacks without goals), but also aggravating the likelihood that it would end in goals received (n = 256, 10.7%), which can be explained by having been used in games that were unbalanced when losing. However, the tree also showed a greater likelihood of scoring goals within the final play time interval (33-40min) (n = 46, 57.5%) compared to the others (n = 15, 23.8%). This fact is striking because the approach to the end of a match is a difficult moment, an aspect which should be added the impact generated by the presence of a risk strategy that could decrease the efficacy, finding unexpectedly that was better, which can be explained because the strategy was used in matches that were balanced when winning (see Figure 1). This seems to agree with a previous study that revealed the importance of play time intervals close to the end of the match to establish the occurrence of this strategy with a better balance of goals in favor (*saldo pro goleiro*) (Ganef et al., 2009; Newton-Ribeiro, 2011). All of this is consistent with most of the studies found in the futsal field, where the occurrence of the 5vs4+ GK strategy may lead to the appearance of goals (scored or received) in those final minutes, revealing that the last 10 minute period showed a higher frequency of goals and higher averages compared to the three initial play time intervals (Abdel-Hakim, 2014; Fukuda & Santana, 2012; Poffo & Lima, 2012; Siqueira, Da-Silva, Aragonez, Damico, & Crescente, 2016).

Finally, fouls committed also constrain ball possession efficacy. Results from the logistic regression model showed that the arrival of the 2nd and 4th foul were linked with the probability that an attack with 5vs4+ GK ended in a goal scored and not in a goal received or no goal, compared to the 5th foul. The trend suggests that it is better attacking with 5vs4+ GK before the 5th cumulative foul, where the likelihood of suffering goals increased. The 5th accumulated foul or its proximity, and its possible consequences of a penalty free kick from the second penalty mark at 10 m (FIFA futsal law 13- Free Kicks), usually appears in the final moments of the match and the scoreboard at a disadvantage for the team that attacks with 5vs4+ GK, hence the presented findings may suggest that the lower efficacy coincides with the occurrence of a CM, and this could hinder the goal scoring chances, an aspect which has been argued in other sports (Sampaio et al., 2006). However, although the allowed limit constrains the game and team efficacy, the number of fouls committed was not significant to decide the winner and did not interfere in the futsal match outcome (Pereira-Guimarães, Neves, Rodrigues, & Coppi, 2010).

In conclusion, the 5vs4+ GK game strategy is gaining increasing importance due to the fact that both the attacking and defending teams, have a high likelihood of achieveing advantages on the scoreboard. Further research should take into

BALL POSSESSION EFFICACY

Legend:
◇ No Goal
○ Goal Scored
⬡ Goal Received

Node 0

Category	%	n
◇ No Goal	89,3	10218
○ Goal Scored	5,1	582
⬡ Goal Received	5,6	646
Total	100,0	11446

Match Status
Adj. P-value=0.001, Chi-Square=641.250, df=4

Losing — Node 1

Category	%	n
◇ No Goal	90,3	9311
○ Goal Scored	3,6	370
⬡ Goal Received	6,1	631
Total	90,1	10312

Drawing — Node 2

Category	%	n
◇ No Goal	83,5	781
○ Goal Scored	15,3	143
⬡ Goal Received	1,2	11
Total	8,2	935

Winning — Node 3

Category	%	n
◇ No Goal	63,3	126
○ Goal Scored	34,7	69
⬡ Goal Received	2,0	4
Total	1,7	199

Match type (Node 1)
Adj. P-value=0.001, Chi-Square=138.736, df=2

Match type (Node 2)
Adj. P-value=0.001, Chi-Square=15.814, df=2

Match type (Node 3)
Adj. P-value=0.001, Chi-Square=17.083, df=2

Unbalanced — Node 4

Category	%	n
◇ No Goal	88,2	4429
○ Goal Scored	2,9	147
⬡ Goal Received	8,9	446
Total	43,9	5022

Balanced — Node 5

Category	%	n
◇ No Goal	92,3	4882
○ Goal Scored	4,2	223
⬡ Goal Received	3,5	185
Total	46,2	5290

Unbalanced — Node 6

Category	%	n
◇ No Goal	90,4	85
○ Goal Scored	5,3	5
⬡ Goal Received	4,3	4
Total	0,8	94

Balanced — Node 7

Category	%	n
◇ No Goal	82,8	696
○ Goal Scored	16,4	138
⬡ Goal Received	0,8	7
Total	7,3	841

Unbalanced — Node 8

Category	%	n
◇ No Goal	85,7	48
○ Goal Scored	14,3	8
⬡ Goal Received	0,0	0
Total	0,5	56

Balanced — Node 9

Category	%	n
◇ No Goal	54,5	78
○ Goal Scored	42,7	61
⬡ Goal Received	2,8	4
Total	1,2	143

Play time (Node 4)
Adj. P-value=0.001, Chi-Square=24.270, df=2

Play time (Node 5)
Adj. P-value=0.001, Chi-Square=24.910, df=4

Play time (Node 9)
Adj. P-value=0.001, Chi-Square=18.273, df=2

0-8/9-16/17-24/25-32 min — Node 10

Category	%	n
◇ No Goal	89,3	2354
○ Goal Scored	3,5	92
⬡ Goal Received	7,2	190
Total	23,0	2636

33-40 min — Node 11

Category	%	n
◇ No Goal	87,0	2075
○ Goal Scored	2,3	55
⬡ Goal Received	10,7	256
Total	20,8	2386

17-24 min — Node 12

Category	%	n
◇ No Goal	89,3	285
○ Goal Scored	8,2	26
⬡ Goal Received	2,5	8
Total	2,8	319

0-8/9-16/25-32 min — Node 13

Category	%	n
◇ No Goal	91,7	1307
○ Goal Scored	5,3	76
⬡ Goal Received	2,9	42
Total	12,4	1425

33-40 min — Node 14

Category	%	n
◇ No Goal	92,8	3290
○ Goal Scored	3,4	121
⬡ Goal Received	3,8	135
Total	31,0	3546

0-8/9-16/17-24/25-32min — Node 15

Category	%	n
◇ No Goal	74,6	47
○ Goal Scored	23,8	15
⬡ Goal Received	1,6	1
Total	0,6	63

33-40 min — Node 16

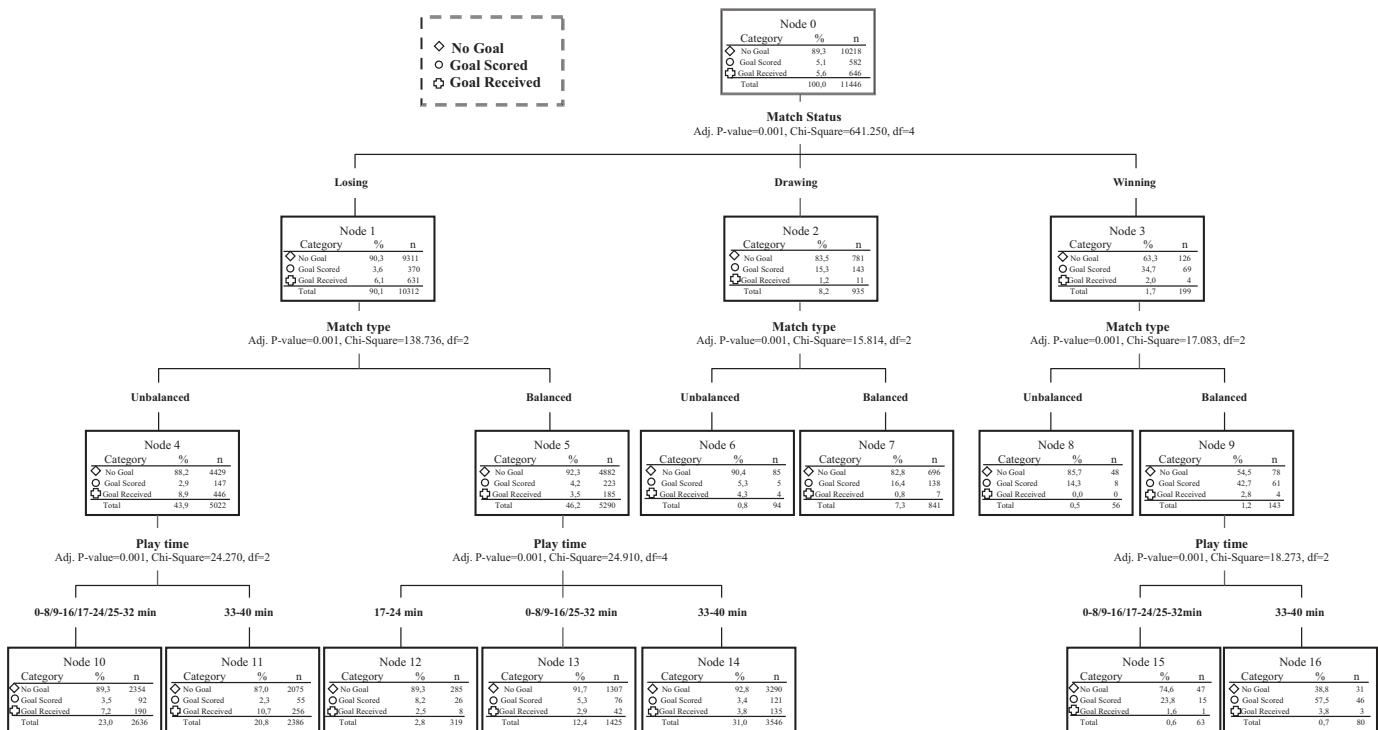| Category	%	n
◇ No Goal	38,8	31
○ Goal Scored	57,5	46
⬡ Goal Received	3,8	3
Total	0,7	80

Figure 1. Classification tree analysis of ball possession efficacy.

account the different match status of each team before using this strategy, to measure its profitability, because it is not the same to use it when a team goes from winning to losing, than when it goes from drawing to losing, or when it goes from losing to winning, which could bring unknown data about the players' behavior. Also, a more appropriate diagnosis is lacking for coaches using this strategy to minimize the risks of receiving goals and to optimize the key moments of its use, which can be with CM anticipation, but also using the 5vs4+ GK as a possible advantage granted by the game rules. It is currently being used by the best teams in a numerical inferiority situation by dismissal, and also by the weakest teams, not so much to create goal scoring opportunities as to speculate with ball possession, which can give new data on efficacy.

Practical implications and limitations

The identified trends are of great relevance from the coach's point of view where the numerical superiority/inferiority game context directly impacts the team's performance. Accordingly, from a practical application point of view, the information obtained may change the coach's game strategy so as not to use this strategical option as a last resort tactic. For that, there is a need for coaches to change their perspective about 5vs4+ GK and incorporate it in the design of practice tasks as a usual game scenario, that can be used at any moment of the game as a dynamic game situation (3vs2., 4vs3 ... up to 5vs4) (Ganef et al., 2009; Newton-

Ribeiro, 2011). Also such results can help them identify the most appropriate moments for its application. Although it is not usual, the team that is not losing may use the risk strategy before having to overcome an adverse scoreboard, when the players are still not exposed to a CM, which would facilitate the aim of breaking a negative inertia of ball possession and goal chances by the opposing team, in order to reach the desired advantage.

The present study has some limitations that need to be addressed in future studies, one of them may be related to how to make the data analysis even more robust. It could be interesting the possibility of using survival models or statistical analyses that consider the data time dimension (random forest or T-patterns), which are particularly relevant for the analysis of the goals' achievement patterns, and the factors that can influence the probability of scoring a goal with this strategy.

Disclosure statement

No potential conflict of interest was reported by the authors.

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