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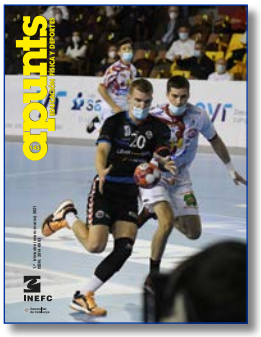

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Situational and Game Conditioning Factors in Goals Scored with a Fly Goalkeeper in Futsal

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Handball Spain: Ademar León and Liberbank Sinfín play the first match with masks during a Sacyr Asobal league game in October 2020, to comply with the regional regulations of COVID-19. J.Casares/(EPA) EFE/ lafototeca.com

Abstract

The purpose of this study was to analyse goals scored with a fly goalkeeper and to establish an efficacy profile depending on situational and game variables. Astrofutsal® software was used to analyse a sample of 582 goals from 11,446 fly goalkeeper situations in 1,200 matches from the National Professional Futsal League between the 2010 and 2015 seasons. The impact of the situational (opponent quality, match status and match location) and game (goal area, shot type, number of passes and number of players) variables as predictors of goals was analysed by means of two-step cluster analysis. The results demonstrated, in situational terms, the greater importance of having at least the same level as the opponent and playing either at home or away when it comes to scoring goals and getting back into the game with a fly goalkeeper and, in game terms, the importance of executing short attacks (1-10 passes) that end in the area (precision goal) or with an outside shot (surprise goal) as characteristic goal patterns with a fly goalkeeper. The trends identified may help coaches to design a more suitable and productive numerical superiority scenario.

Keywords: team sports, offensive tactics, contextual variables, performance analysis, two-step cluster analysis.

Introduction

5v4+G is a futsal tactical procedure that uses the goalkeeper acting as an outfield player, modifying their regular strategic motor role so that coaches can use players who are not usually goalkeepers to take on functions or engage in specific actions of the game that distinguish them from other players (Hernández, 2001). This enables them to defend their goal but also to leave the goal and participate in offensive actions in order to achieve numerical superiority over defending opponents, in other words 5v4, and seek to obtain performance-related advantages(Vicente-Vila & Lago-Peñas, 2016).

This tactic has been extensively used in the sport since FIFA introduced it into the laws in 2006 and is one of the used training contents most used by coaches in the course of the season (Alvarez et al., 2004). Nevertheless, its theoretical advantage has been little studied, meaning that most of the studies suggest a lower-than-expected effectiveness in ball possession with 5v4+G (Barbosa, 2011; Ganef et al., 2009). This could be related to the decisive role played by certain context-specific variables in the absolute effectiveness of 5v4+G (Méndez, 2017) which, if they were known by coaches, might result in better use of the procedure and ultimately make it more effective (Méndez, 2018; Méndez et al., 2017).

In most of the studies pertaining to performance analysis in futsal, 5v4+G is usually compared to other offensive tactical systems in order to emphasise the importance of goals and shots as the main indicators of team effectiveness in attack. 5v4+G attack and defence against the 5v4+G attack emerge as the least successful forms of offensive organisation in terms of number of goals scored compared to the counter-attack, positional attack and set pieces, in this order (Fukuda & Santana, 2012; Marchi et al., 2010; Poffo & Lima, 2012).

Recent research focusing on comparing 5v4+G and 4v4+G has shown that the numerical and positional advantage that can be obtained with 5v4+G is related to more finishing chances (Ferreira-da-Silva, 2011) and performance in the form of shots (Corrêa et al., 2014; Vicente-Vila, 2012, 2014) or goals (Vicente-Vila, 2014; Vicente-Vila & Lago-Peñas, 2016) in the attack phase, compared to the symmetrical competitive scenario of 4v4+G. Nevertheless, it is still regarded as a risky procedure because the rival team (in the defensive phase) can take possession of the ball and generate a rapid shot on goal when there is no specific goalkeeper defending it, giving rise to changes on the scoreboard that can ultimately tip the scales one way or the other (Ganef et al., 2009; Newton-Ribeiro, 2011).

Some authors have described the effectiveness of ball possession in futsal with regard to the game's structural characteristics, focusing on the importance of the finishing space, the number of passes and the number of players. With regard to 5v4+G, Vicente-Vila (2014) found that the central areas and areas close to goal yield a better rate of offensive effectiveness.

However, the procedure's greater or lesser degree of success might be conditioned by the context in which the actual attack takes place, which may limit players' behaviour due to the possible presence of a hostile environment and/or if the team is losing against a specific opponent (Méndez, 2017). In fact, 5v4+G is usually deployed in practice as a regular strategic tactic (between 90% and 100% of cases of ball possession in attack) when the team is losing by one or more goals (Barbosa, 2011; Vicente-Vila, 2014) and in the closing minutes of the match (Ganef et al., 2009; Newton-Ribeiro, 2011). These two factors present characteristics common to what is normally known as the critical moment which expert futsal coaches recognise as triggering a response that coincides with the appearance of 5v4+G (Méndez et al., 2017) and as a key point that strongly conditions the opportunities of a getting a shot in with 5v4+G and may decide the final outcome of futsal matches (Méndez et al., 2019). The presence of variables such as match location and the rival's skill has also been investigated with a view to predicting performance success (Sampedro & Prieto, 2012) and may boost or minimise the effects of a "critical" scenario.

However, although it can be used as an advantage that is allowed by the laws and is a tactic to which coaches resort increasingly more regularly in the course of the match, the available literature related to 5v4+G in futsal is meagre, probably due to the fact that performance analysis in futsal through the compilation of these variables is somewhat complex (Vicente-Vila & Lago-Peñas, 2016).

It is necessary to identify the situation and game variables that may condition the outcome of elite futsal matches, seeking through this approach to improve the understanding of the dynamics of play and the strategies of the different possible superiority scenarios (Gómez et al., 2018). In this way, some authors have used cluster techniques as a suitable statistical model when attempting to explore and model such data in team sports (Gómez et al., 2018).

The objective of this study was to analyse the impact of clustering certain situational and game variables to determine their degree of importance as predictors of goals scored, not conceded, when the 5v4+G attack procedure is used, and whether this relationship may define a characteristic performance profile structure of this type of attack in conditions of superiority implemented by elite futsal teams.

Material and method

Participants

This study analysed a total of 582 goals scored in the 11,446 5v4+G situations used by coaches in the course of 1,325 matches in the regular and play-off phase of the 2010-2011, 2011-2012, 2012-2013, 2013-2014 and 2014-2015 seasons of the futsal First Division (LNFS). Astrofutsal® (Méndez & Méndez, 2005), which has been the statistics supplier of the National Futsal League (LNFS) since the 2004/05 season, stipulated the condition of obtaining informed consent. Access to its datasets requires a fee-bearing licence and applications must be submitted through registration at www.astro-sport.com. This platform granted the authorisations needed to use the data contained in its statistical reports for research purposes in order to avoid conflicts of interest. The local Institutional Review Board (INEFC) approved the study.

Observational design

An observational methodology with an ideographic, specific and multidimensional design was used (Anguera & Hernández, 2013). For data collection, an ad hoc observation instrument was designed, comprised of a system of variables and categories designed specifically for this research.

Observation instrument

The observation system, specific for recording goals scored with a fly keeper, was configured and designed in the game variables section (Table 1) and in the field diagram (Figure 1) by a panel of eight experts who are high-performance specialists in futsal and practising first-division coaches with the highest qualifications in the sport. The categorical variables model used by other authors in relation to similar studies (Méndez-Domínguez et al., 2019) was used in the situational variables section. The system is comprised of 23 categories distributed in seven variables (Table 1 and Figure 1) which fulfil mutually exclusive and collectively exhaustive (MECE) conditions.

Recording instrument

Astrofutsal ® software was used to facilitate the recording of goals scored with 5v4+G and their subsequent coding (Méndez & Méndez, 2005). The software's construct validity was performed by a panel of experts who had to fulfil the requirement of having been European and/or world futsal champions with their national teams. Four experts were finally chosen.

Two expert observers with 12 years of experience in futsal event notational analysis using this tool were involved in the data quality process. For inter-observer

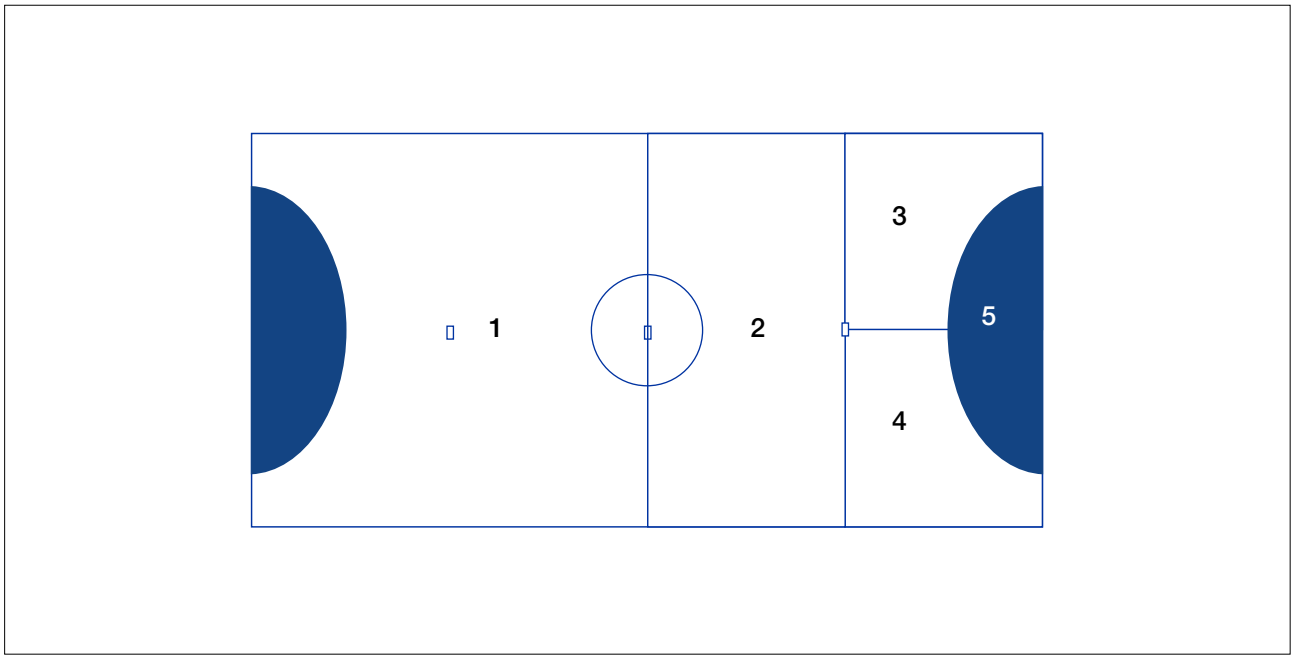

Figure 1
Information from the final goal areas in attack with 5v4+G.

Table 1
Definition of the observation instrument's category system.

Dimensions	Criteria	Code	Categories	Code	Description
situational					
	Match Status	MS	Losing	LOS	Goal by losing team
			Drawing	DRA	Goal by team while match is drawn
			Winning	WIN	Goal by winning team
	Opponent quality	QO	Better uses 5v4+G against worst	BEST	Goal by best team using 5v4+G
			5v4+G between same-level teams	EQU	Goal by one of the teams of the same level and one of them with 5v4+P
			Worst uses 5v4+G against best	WORST	Goal by worst team using the tactic
	Goal location	GLV	Goal 5v4+G home	HG	Goal by home team with 5v4+G
			Goal 5v4+G away	AG	Goal by away team using 5v4+G
game					
	Area	FA	1 1/2 pitch	A1	Goal scored in 1/2 pitch
			2 10-20 m	A2	Goal scored between 10-20 m
			3 Left attack	A3	Goal scored in left area attack
			4 Right attack	A4	Goal scored in right area attack
			5 Goal area	A5	Goal scored in goal area
	Shot type	ST	Outside shot	OS	Goal outside a heavily defended area
			Inside pass (pass, 1-2, 1x1)	IP	Goal inside a heavily defended area
			Far post:	FP	Goal with an attacking player reaching the far post
	No. players	NP	1	1P	Goal involving 1 player
			2	2P	Goal involving 2 players
			3	3P	Goal involving 3 players
			4	4P	Goal involving 4 players
			5	5P	Goal involving 5 players
	Pass sequence	PS	1-10 passes	PS<10	Goal with a sequence of less than 10 passes
			11 forward passes	PS>10	Goal with a sequence of more than 10 passes

reliability, the match between Pozo de Murcia and Inter Movistar in the 2014-2015 Play-off final series was analysed first, followed by 58 (10%) of the 582 goals scored with the 5v4+G procedure chosen at random in order to be labelled with regard to the study variables. The two observers recorded the main futsal events during the match and subsequently characterised the 5v4+G goals. The records were compared using Cohen's Kappa coefficient (k) (Robinson & O'Donoghue, 2007), obtaining Kappa values for the events of both teams of 0.91 and 0.92, respectively, with the Kappa value of the 5v4+G goal actions being 0.89 and 0.88, respectively.

Statistical procedure and analysis

All the variables studied and their corresponding frequencies and percentages are shown in Table 2. Each one of the goals scored with 5v4+G was characterised around nominal or categorical variables pertaining to two dimensions. The situational variables included (i) Match Status (MS), according to which it was established that a team could be winning, drawing or losing; (ii) Match location (HAG= home/away goal), to distinguish between the team scoring a goal with 5v4+G playing at home (HG= home goal) or away from home (AG= away goal); (iii) Opponent quality (OQ), based on the classification of the 16 teams at the end of the normal season, was measured by the difference in classification at the end of the season between both teams (Classification A - Classification B), and three groups were established according to the k-means clustering (best-classified does

Table 2
Distribution of frequencies and % of goals scored with 5v4+G.

Criterion	Categories	Code	*n* of each criterion= 582	%
Match Status	Losing	LOS	508	87.3
	Drawing	DRA	61	10.5
	Winning	WIN	13	2.2
Opponent quality	Best uses 5v4+G against worst	BEST	71	12.2
	5v4+G between same-level teams	EQU	368	63.2
	Worst uses 5v4+G against best	WORST	143	24.6
Goal location	5v4+G home goal	HG	267	45.9
	5v4+G away goal	AG	315	54.1
Area	1 1/2 pitch	A1	1	.2
	2 10-20 m	A2	66	11.3
	3 Left attack	A3	71	12.2
	4 Right attack	A4	85	14.6
	5 Goal area	A5	359	61.7
Shot type	Outside shot	OS	114	19.6
	Inside pass (pass, 1-2, 1x1)	IP	328	56.4
	Far post:	FP	140	24.1
No. of players	1	1P	5	.8
	2	2P	42	7.2
	3	3P	89	15.2
	4	4P	204	35
	5	5P	242	41.5
Pass sequence	1-10 passes	PS<10	111	19.1
	11 forward passes	PS>10	471	80.9

5v4+G against worst; teams with a similar classification and one of them acts with 5v4+G; worst-classified does 5v4+G against best).

The game variables included in the final model were (iv): Finishing area (FA), distributed into sectors according to Lapresa et al. (2013), but with a different sectorial organisation, where five different areas with their own significance were established (Fig. 1); (v) The pass sequence (PC= pass cluster) carried out between the attacking players before the final shot that ends in a goal was established by means of k-means clustering, establishing short sequences (1 and up to 10 passes) and long sequences (11-36 passes); (vi) The shot type (ST) taken ending in a goal with 5v4+G was categorised into three types with the help of experts: a) Outside shot, taken without entering the opponent's defensive system or with 4 opposing players and the goalkeeper ahead of the ball; b) Inside shot after a pass, penetration, running with the ball, 1-2, 1x1 or block, and c) shot after a pass to the far post after ball movement; and (vii) Number of players (NP) who played the ball with 5v4+G to break through the defence, including a range comprising the participation of one player alone and up to the 5 players.

The statistical analysis consisted of two-step cluster analysis: first of all, the variables were selected to verify the relationships of dependence and to check that the variables included in the cluster model were not statistically significant versus each other using the contingency tables procedure. Secondly, a two-step cluster analysis was performed, selecting the log-likelihood distance measure for the calculation of similarity between two clusters and using a Schwarz information criterion (SIC) algorithm to detect all the homogeneous clusters according to the values observed in this apparently heterogeneous set (Vila-Baños et al., 2014). In it, an attempt was made to explore and discover the natural clusters of the overall set of goals scored with 5v4+G with regard to a dimensional model related to the game variables and another one related to the situational variables.

When determining the validity of the models, the aim was to characterise the clusters according to the variables included in them, yielding standardised weightings to support the cluster distribution and to afford them significance with regard to the goals scored with 5v4+G. The statistical analyses were performed using IBM SPSS for Windows, version 22.0 (Armonk, NY: IBM Corp.) software.

Results

The preliminary tests by means of crosstabs and chi-square tests verified the conditions of independence between the situational variables and also between the game variables. The two-step cluster analysis technique reported that both models considered all the variables entered and was sufficient in the case of the game variables and good in the case of the situational variables and they were therefore accepted. This made it possible to identify different types of attack when the teams were playing in conditions of numerical superiority with 5v4+G. Tables 3 and 4 display the information for each group and the importance of each variable in the model and for each cluster. Figures 2 and 3 show the size of each cluster, with each of the variables considered in both models, sorted from most to least important and with the predominant category and weighting inside them.

In the case of the situational model (Fig. 2), six clusters were obtained including the three variables sorted from most to least important, the most important being OQ and the least important being HAG. The characteristics of the two most important groups of this model indicated that 31.4% of the

Table 3
Information from the situational variables according to the cluster.

Cluster	6	5	4	2	1	3
Total frequencies and between category	31.4%; *n* = 183	23.9%; *n*= 139	12%; *n*= 70	11.9%; *n* = 69	11.7%; *n* = 68	9.1%; *n* = 53
OQ (I= 1)	100% 5v4 between equals	100% 5v4 between equals	100% Worst does 5v4	66.7% 5v4 between equals	100% Worst does 5v4	100% Best does 5v4
MS (I= 0.54)	100% Losing	100% losing	98.6% losing	88.4% drawing	100% losing	92.5% losing
HAG (I= 0.46	100% Away goal	100% Home goal	100% Away goal	56.5% Home goal	100% Home goal	60.4% Away goal

Note. I: importance of the variable in the model: OQ: Opponent quality; MS: Match Status; HAG: Home or away goal.

Table 4
Information from each game-related variable according to the cluster.

Cluster	1	2	3
total frequencies and between category	48.8%; *n* = 280	32.1%; *n* = 184	19.2%; *n* = 110
PC (I= 1)	100% between 1-10 passes	100% between 1-10 passes	100% between 11-36 passes
EA (I= 0.74)	100% goal area	35.3% right side	66.4 % goal area
ST (I= 0.38)	61.1% 1x1, pass, 1-2	55.1% outside shot	58.2% 1x1, pass, 1-2
NP (I= 0.22)	41.4% 5 players	44% 4 players	85.5% 5 players

Note. I: importance of the variable in the model: PC: Pass cluster; EA: end area; ST: Shot type; NP: Number of players involved.

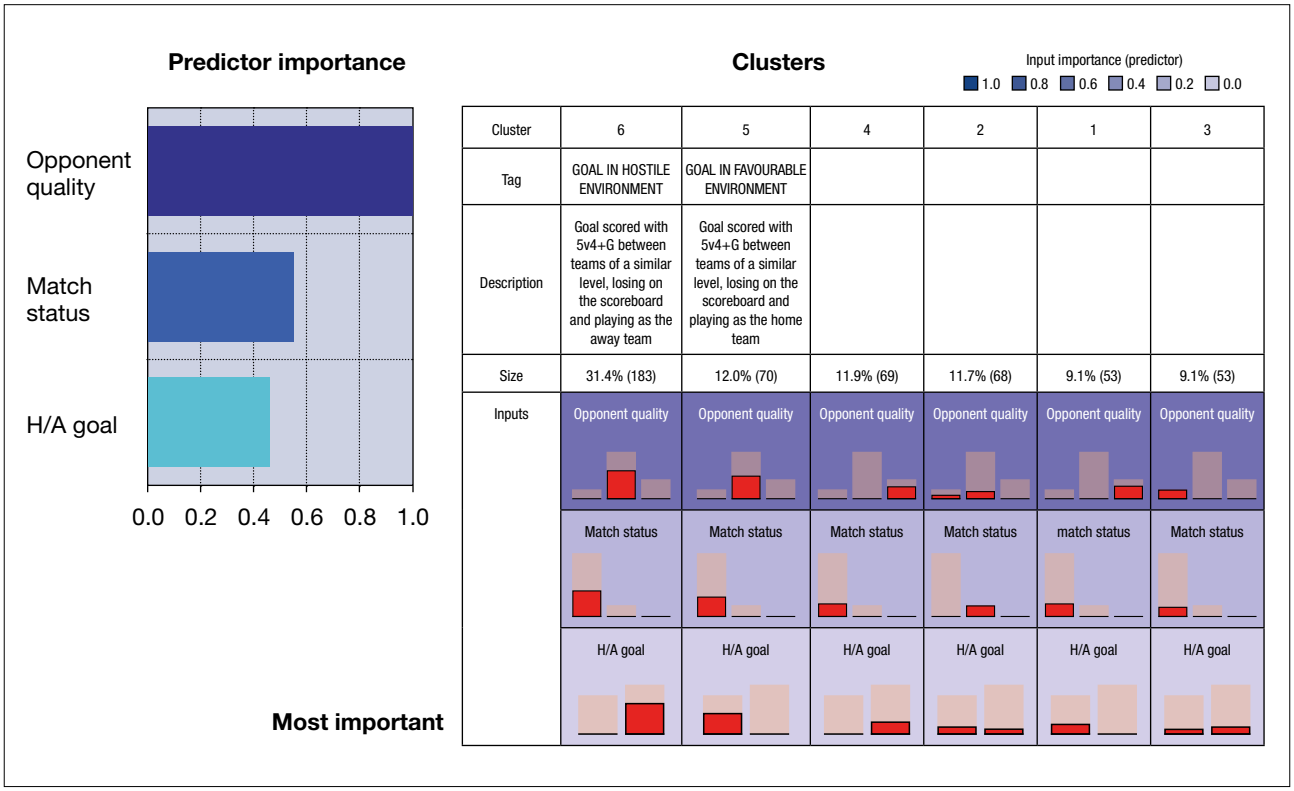

Figure 2
Information from the clusters related to the situational variables and their importance.

sample of goals scored with 5v4+G were characterised by being scored with 5v4+G between teams of a similar level (100%), the team with 5v4+G was at a disadvantage (losing) on the scoreboard (100%) and was the away team (100%). On account of its characteristics, this goal has been called 5v4+G goal in a hostile environment. The second most important group characterised 23.9% of the sample of goals scored with 5v4+G when it was between teams of a similar level (100%), with the team using 5v4+G at a disadvantage (losing) on the scoreboard (100%) but playing as the home team (100%). On account of its characteristics, this goal has been called 5v4+G goal in a favourable environment.

With regard to the game model (Fig. 3), three clusters were obtained with the most important variables being passes (PC) and EA, while the least important one was NP. The characteristics of the two most important groups

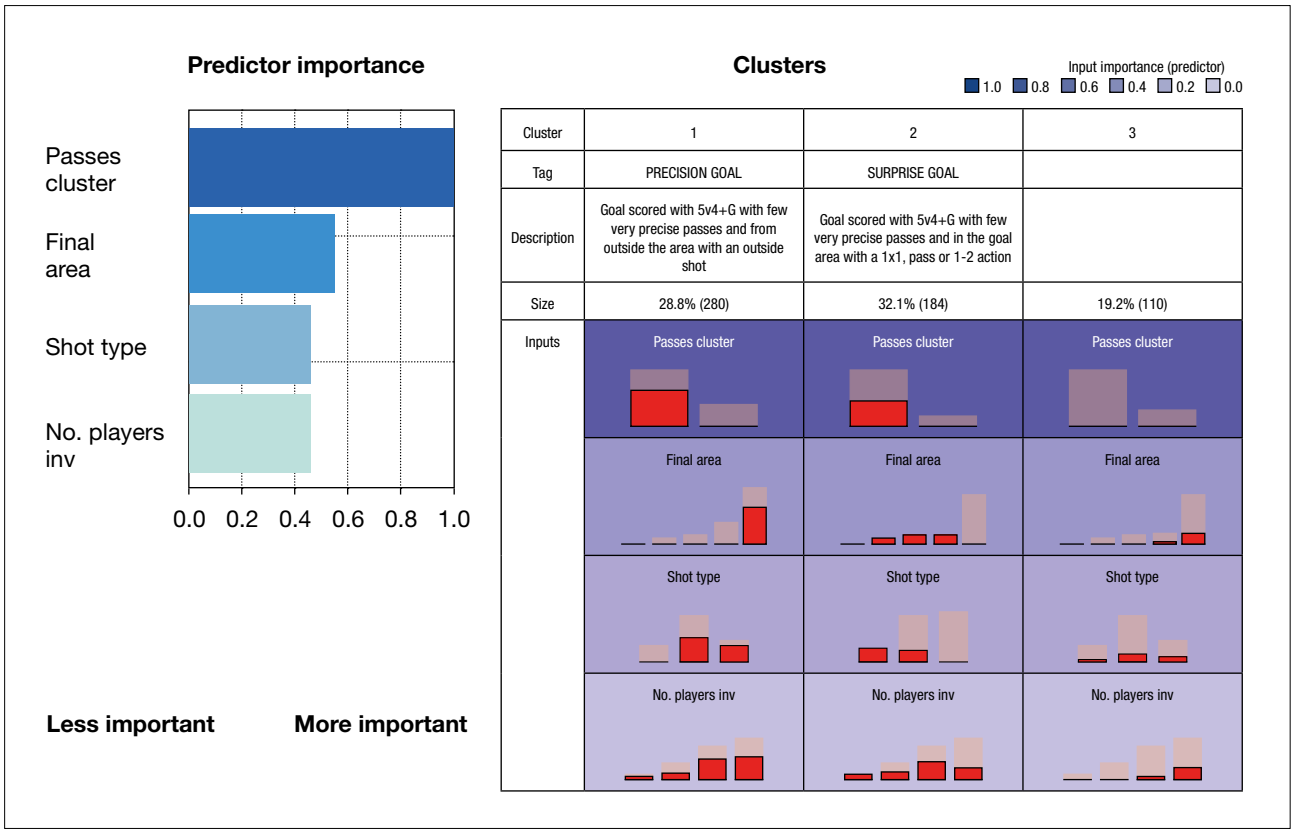

Figure 3
Information about the clusters related to the game variables and their importance.

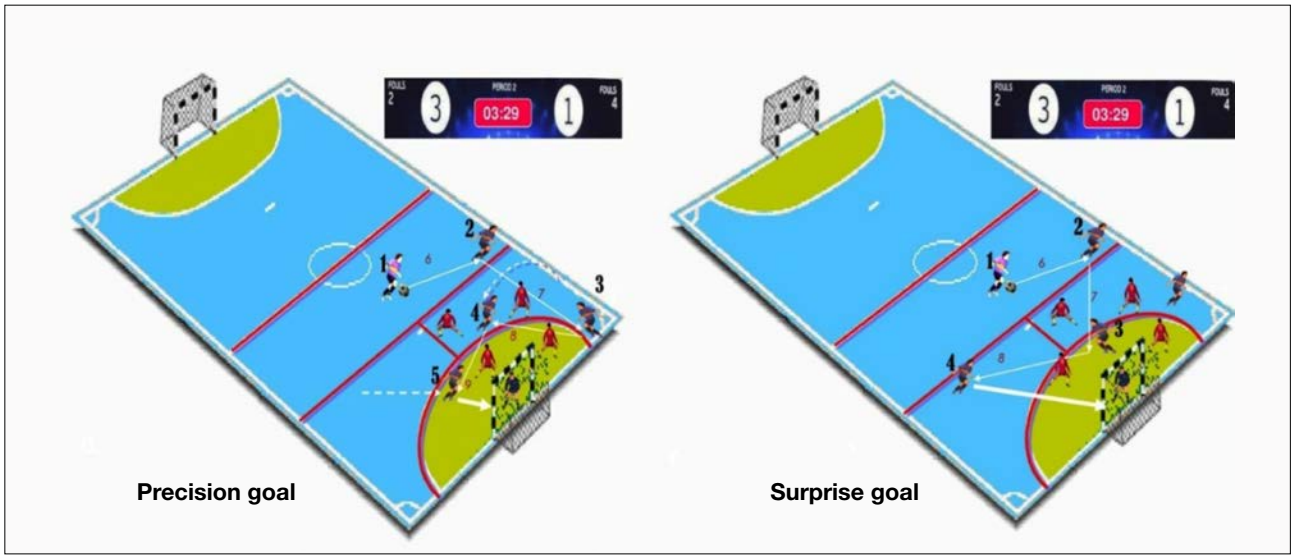

Figure 4
Characteristic pattern of goals scored with 5v4+G in relation to the information provided by the clusters.

established a first group with 48.8% of the sample of goals scored with 5v4+G obtained by means of a sequence of between 1 and 10 passes (100%), shooting in the area (100%), with a 1x1 action, pass, 1-2 (61.1%), and involving the 5 players (41.4%). This goal has been called the precision goal. The second group included 32.1% of the sample and was characterised as being a 5v4+G goal obtained with a sequence of between 1 and 10 passes (100%), which ended

on the right side of the attack (35.3%), with an outside shot (51.1%), and with the participation of 4 players (44%). The goal has been called the surprise goal.

A possible characterisation of the goal scored with 5v4+G in relation to the evolution of the game and the context is displayed in Figure 4.

Discussion

The objective of this study was to identify the situational variables (HAG, MS and OQ) and game variables (NP, PC, ST and EA) with the greatest affinity to the goal scored, not conceded, with 5v4+G, and to be able to establish a characteristic profile of this type of attack involving numerical superiority in professional futsal. In line with the posits of previous studies, coaches seek to identify their opponents' strong and weak points as a team as a way of controlling and administering their strategies and tactics in the course of the match (Sarmento et al., 2015).

The results showed that the total number of goals scored with 5v4+G (582) in relation to the total number of actions with this procedure (11,446) came to a somewhat low proportion (5.1%). In accordance with the rationale of the study, this finding tallies with the low effectiveness of ball possession with 5v4+G (Barbosa, 2011; Ganef et al., 2009) and with the tag of worst type of attack compared to the other forms of offensive organisation (Fukuda & Santana, 2012; Marchi et al., 2010; Poffo & Lima, 2012). These results could be consistent with the need to perform a suitable diagnosis of the use of 5v4+G that might optimise the key moments when it is used. This may happen by coaches anticipating the moment 5v4+G is used in an attempt to prevent it from taking place at the same time as a critical moment (Méndez et al., 2017), but also through a change in their mindset to no longer regard it as a last resort and instead make it an alternative to symmetrical play (Ganef et al., 2009; Newton-Ribeiro, 2011), thus leveraging the laws (Méndez, 2018).

With regard to the situational variables, the two-step cluster analysis demonstrated the much greater importance of OQ compared to MS and HAG. To a certain extent this situation is only to be expected because the rationale behind attack actions with 5v4+G is that the teams are losing and are trying to get back into the match (Newton-Ribeiro, 2011), and so the temporary MS may not be as relevant as expected in scoring the goal and HAG is equally less important. This result tallies with the study by Vicente-Vila and Lago-Peñas (2016) who ascertained an unexpected non-significant influence of game location (HAG) and match status on the likelihood of success in ball possession.

The HAG variable is even less important. Vicente-Vila and Lago (2016) also found that match location had no impact on ball possession effectiveness. Moreover, Vicente-Vila (2014) found a greater number of away than home goals in 5v4+G situations, concluding that playing at home or away was not related to the successful offensive outcome of possession units in futsal. In fact, according to Oliveira et al. (2012) this variable depends more on the opponent's level (OQ) and on certain intervals during the game, which could explain why the away team scored 100% of the goals with 5v4+G in the most important cluster at the situational level (31.4% of the goal sample).

Secondly, the cluster analysis showed that the two most important factors associated with goals were PC and EA. The most important cluster characterised the precision goal (48.8% of the sample), with a low pass sequence (1-10 passes) and shot in the goal area, which tallies with other futsal studies in which the greatest success of ball possession in 5v4+G was related to the low number of passes made and shots taken in the goal area (Lapresa et al., 2013; Vicente-Vila & Lago-Peñas, 2016).

In general terms, the distribution of the goals scored with 5v4+G is characterised by a more elaborate build-up of possession, seeking through a higher number of passes (11-36 = 80.9%) and with the involvement of the 5 available players (41.5%) to achieve effective finishing situations, although in the two most important clusters greater importance is attached to the lower pass sequence (1-10). This situation does not appear to contradict the results found in other studies where finishes ending in a goal with 5v4+G were associated with possession units with a number of passes equal to or greater than 4-5 (Vicente-Vila, 2012, 2014). However, the use of positional attacks that maintain ball possession appears to increase density of passes between players and also improves their effectiveness due to greater flexibility in the way they play (Sarmento et al., 2016). Consequently, in the event of a substantial effect using a lower pass sequence (cluster 1 and 2 = 1-10 passes) this could be related to an increase in ball movement speed and greater passing precision.

Most of the 5v4+G attacks that end in a goal do so in the goal area (61.7%; n = 359), which is seen in the most important cluster which characterises 48.8% of the sample and where this category reaches 100% of cases. These results concur with the important effect related to goalscoring that researchers have attributed to the goal area zone. Vicente Vila (2014) and Vicente-Vila and Lago-Peñas (2016) found that greater effectiveness in ball possession was accomplished when the team's possession ended in the goal area zone, concluding that the central and close-to-goal areas present

a higher rate of offensive effectiveness. Moreover, more than 70% of shots that end in a goal in futsal were taken from the central areas and inside the goal area, with this zone presenting statistical significance related to successful possession units in attack (Lapresa et al., 2013), meaning that there is therefore a significant association between the EA of the goal zone and the increased offensive effectiveness of possession units (Lima-Pessoa et al., 2009).

This study has certain limitations that should be addressed in the future. First of all, it describes 5v4+G attacks, meaning that the analysis of this superiority procedure should be studied and compared to the most common superiority contexts in futsal (4v3+G and 5v3+G). Secondly, the research should be extended with new situational and game-related variables that would make it possible to further our understanding of their relationship with effectiveness.

Conclusions

The analysis of the goals scored with 5v4+G showed the importance of situational and game variables which may yield established regular patterns related to team behaviour and performance during this strategic procedure. The importance of implementing a 5v4+G attack with at least the same level of skill as the opponent and with a low-pass sequence (1-10 passes) ending in the goal area was demonstrated. Furthermore, the two-step clustering technique made it possible to reflect the basis of the predictive models with the identification of 5v4+G attack patterns according to the importance of the situational variables (goal in favourable environment and goal in hostile environment) and game variables (precision goal and surprise goal). Further research in other leagues should be conducted in order to compare findings, although the information is extremely relevant to the action of the coach and for the definition of strategy during the game to be reproduced in specific scenarios in an attempt to anticipate the types of behaviour that may occur during the match (Sarmento et al., 2016).

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