ORIGINAL

INDIRECT FREE KICKS IN PROFESSIONAL FOOTBALL. IDENTIFICATION OF EXPLANATORY VARIABLES

TIROS LIBRES INDIRECTOS EN FÚTBOL DE ALTO NIVEL. IDENTIFICACIÓN DE VARIABLES EXPLICATIVAS

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

ABSTRACT

Indirect free kicks are situations that occur during football matches, with potentially transcendental actions in the final result. The objectives were to determine the effectiveness of these actions, identify variables associated with success, and propose a successful indirect free kick model.

After registering 447 indirect free kicks during the 64 games of the World Cup in South Africa 2010, and performing statistical analysis, results indicate a low efficiency in the shot, shot between the three posts and goal. 64.3 % of goals that came from indirect free kick contributed to score points in the final result. The mode of sending, number of attackers involved and the offensive organization are variables that have been revealed as modulators of effectiveness. These statements could be a starting point to equip coaches with new tactical tools.

KEY WORDS: Logistic Regression, observational methodology, football

RESUMEN

Los tiros libres indirectos son situaciones que se producen durante los partidos de fútbol, siendo acciones potencialmente trascendentales en el resultado final. Los objetivos fueron determinar la efectividad de estas acciones, identificar las variables asociadas con el éxito, y proponer un modelo de tiro libre indirecto exitoso.

Tras registrar 447 tiros libres indirectos durante los 64 partidos del Mundial de Sudáfrica 2010, y de realizar análisis estadístico, los resultados indican una baja eficacia en el remate, remate entre los tres palos y el gol. El 64,3% de los goles con procedencia en un tiro libre indirectos han contribuido a sumar puntos en el resultado final. El modo de envío, número de atacantes que intervienen y la organización ofensiva son variables que se han revelado como moduladoras de la eficacia. Estos enunciados podrían suponer un punto de partida para dotar a entrenadores de nuevas herramientas tácticas.

PALABRAS CLAVE: Metodología observacional, tiros libres indirectos, fútbol.

1. INTRODUCTION

One of the main characteristic and distinguishing features between football and other sports stems from the last-minute goals. According to Abt, Dickson and Mummery (2002), one of the reasons why football is dominant in contemporary world sport is the scarce frequency of goals in contrast with other sports. Lago (2008), Tenga, Ronglan and Bahr (2010) share the view that a mere shot on target irrespective of its result is per se an indicator of success within the game in such sports with few or no goals.

The difference in performance between teams has decreased over the years as a result of, among other aspects, the continuous professionalization of football (Frydenberg, 2011; Perea, 2008). In this respect, Castellano (2009) comes to the conclusion that football is changing and fewer goals are scored in every match (Figure 1). Castelo (1994) also holds that perception as he believes that one of the main problems with football is the difficulty in generating scoring opportunities because of its low effectiveness compared to other sports considering the number offensive actions and scored goals.

In search of a possible explanation, authors such as Wallace and Norton (2013) point out the increased intensity of play together with the high concentration of players in areas near the ball as the main variables which prevent many goals being scored. Likewise, Marques (1995) mentions that the decisive moment in football, as opposed to other sports like basketball or handball with high scores, is really unpredictable since a victory can be achieved with one single shot on target at any time during a game. In the same line of argument, Dufour (1993) realizes that for every 100 attacking attempts, hardly 10 result in shots on target and only 1 in goal. According to Garganta and Pinto (1995), just one of every 50 offensive actions ends in goa, which shows how difficult it is to achieve a goal in a football match.

Average number of goals scored per game
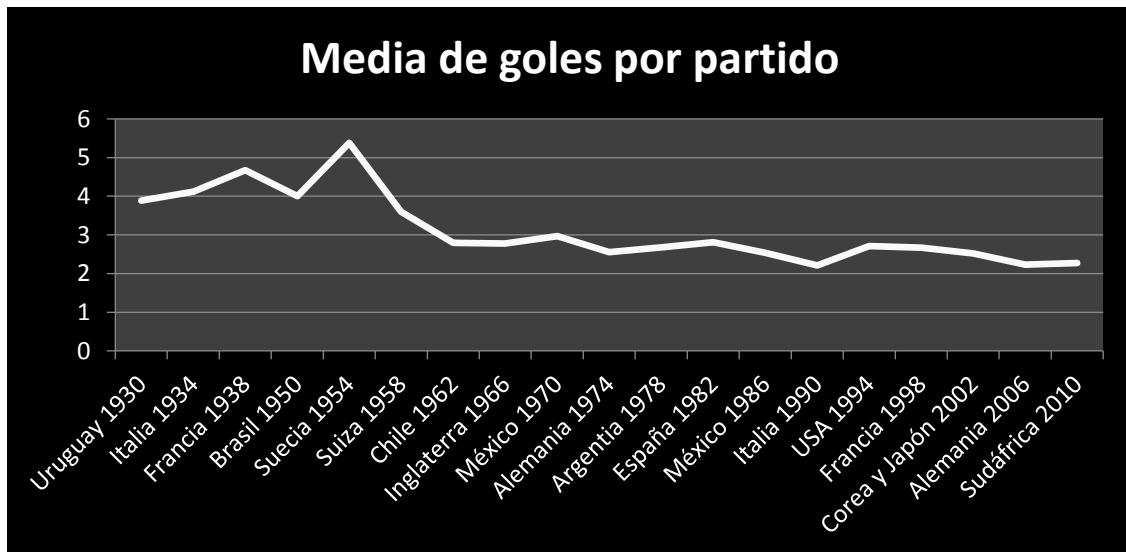
Figure 1. Changing trend of the average number of goals scored per game in the history of football world cup championships since Uruguay in 1930 until South Africa in 2010. Source: Maneiro (2014, based on Castellano 2009).

Therefore, it is legitimate to claim that goals are rather unlikely events in elite football. This idea has been put forward by some authors (Acar et al., 2009; Ardá, Maneiro, Rial, Losada & Casal, 2014; Griffiths, 1999; Stanhope, 2001; Lago Peñas, Lago Ballesteros, Dellal, & Gómez, 2010; Ensun, Williams & Grant, 2000; Hill & Hughes, 2001; Pulling, Robins & Rixon, 2013; Sainz de Baranda & López Riquelme, 2012; Taylor, James & Mellalieu, 2005 and Yamanaka et al., 2002) who tried to determine the variables associated with goals, analyzing how these were achieved and searching for strategies to

increase their number. Most of them reached the same conclusion that dead-ball actions (DBA) are a potentially effective way of generating more scoring opportunities.

Dead-ball actions are situations where the game is resumed following an interruption. This can be done by throwing in the ball from the sidelines or kicking it back into play through corner kicks, kick-offs, penalties or direct and indirect free kicks. The latter DBAs, i.e. indirect free kicks have also been studied, but to a lesser extent than corner kicks. As a matter of fact, De Paz & Yagüe (1995) looked into 100 goals from the 1993-1994 Spanish La Liga first division football championship and found that 29% of them originated from DBAs, 31.03% of which actually came from indirect free kicks. Roxburgh & Turner (2008, 2009, 2010, 2011) analyzed various goals scored in four different editions of the UEFA Champions League between the years 2007 and 2011 and showed that nearly 6% of goals were scored from indirect free kicks. Njororai (2013) analyzed the goals scored during the 2010 FIFA World Cup in South Africa and his results indicate that 28.57% of the goals originated from indirect free kicks. According to Maneiro (2014), 5 indirect free kicks are needed in order to achieve a shot on target, 11 for a shot between the two posts and the crossbar and 36 for a goal.

Authors like Armatas, Yiannakos & Sileloglou (2007); Bar-Eli & Azar (2009); Carling et al. (2005) and Sainz de Baranda & López Riquelme (2012) state that this type of actions may contribute to increasing the number of goals and, especially, Casal, Maneiro, Ardá, Rial & Losada (2014) and Maneiro (2014) confirm that they had a major impact on the final results of matches.

It is therefore important to analize indirect free kicks within the context of football. This study attempts to shed some light on how professional teams approach and carry out these actions through the specification of their level of effectiveness and the identification of the factors affecting performance in this type of situations. Elite footballers and other related professionals will find this information highly valuable and very useful.

2. MATERIAL AND METHODS

2.1. Sample

447 indirect free kicks from the total of 2011 direct and indirect free kicks carried out throughout the 64 matches played during the 2010 FIFA World Cup in South Africa. Different aspects such as the venues (all the games were played on neutral fields), the teams' level (only the world's best national squads took part in the tournament) and the partial result were taken into account for the selection of the sample.

Only indirect free kicks performed in four or fewer passes (Bate, 1988) where the ball is moved to the final scoring area are encoded.

2.2. Instruments

An ad hoc instrument was created, which consists of a field-shape design based on the 12 category systems presented in Table 1.

Table 1. Variables recorded in the ad hoc instrument.

VARIABLES	
Time	until 30' 31'- 60' 61'-90'
Position of free kick	Far right Far left Near right Near left Area in front of penalty box
Laterality of kick	Natural Switched
No. of attackers	2-3 4-5 6 or more
No. of defenders	4-5 6 or more
Interaction context	Inferiority Equality
Delivery of ball	Direct Indirect
Path of ball	Ground Aérea
Type of marking	Man-to-man Zone Combined
No. of involved attackers	1-2 3-4
Zona where the pass is made	Near post Far post
Shooting area	Near post Far post
Offensive organization	Static Dynamic
Result	Winning Drawing Losing

The IBM SPSS Statistics 20 was used as analytical instrument and the method adopted was the binary logistic regression.

2.1. Procedure

This study, among the different designs of the observational methodology, corresponds to quadrant IV, which is a nomothetic, follow-up and multidimensional design (Anguera, Blanco & Losada, 2001).

The observational instrument, which resulted from the combination of the field-shape design with the category systems as described by Anguera, Blanco and Losada (2001), was used as the basic observational methodology instrument.

The eight observation sessions dedicated to training the observers were carried out applying the interobserver agreement criterion, which was only recorded when there was agreement. The authors of this paper are all research experts using this methodology apart from being professors of Sport Sciences and national football coaches.

In order to design this *ad hoc* observational instrument, this study is based on the different criteria and categories described in previous studies (Table 2).

Table 2. Variables empirically collated in other studies.

VARIABLES	SOURCE

Time	- Armatas, Yiannakos & Sileloglou (2007). - Jinshan et al. (1993). - Abt, Dickson & Mummery (2002). - Acar *et al.* (2009).
Laterality of kick	- Saraiva (2007). - Carling *et al.* (2005). - Perea (2008).
Laterality of shot	- Carling *et al.* (2005). - Silva (2011). - Sainz de Baranda & López-Riquelme (2012). - Olsen y Larsen (1997). - Taylor, James & Mellalieu (2005).
Delivery of ball	- Saraiva (2007). - Carling *et al.* (2005).
Type of marking	- Sainz de Baranda & López-Riquelme (2012). - Castelo (1999).
No. of involved attackers	- Casal, Maneiro, Ardá, Rial, & Losada (2014) - Maneiro (2014)
Zone to which pass is made	- Silva (2011)
Shooting area	- Saraiva (2007). - Carling *et al.* (2005). - Silva (2011). - Taylor *et al.* (2005).
Path of ball	- Casal, Maneiro, Ardá, Rial, & Losada (2014) - Maneiro (2014)
Offensive organization	- Ardá, Maneiro, Rial, Losada, & Casal (2014) - Maneiro (2014)
Final result of game	- Casal (2009).

The data quality control was performed through the analysis of Cohen's Kappa coefficient for interobserver agreement. The medianvalue of Kappa, $\bar{k} = \frac{\sum k_i}{n}$, where *k* is Kappa's value for each interobserver and *n* the number of the calculated Kappa's values. Kappa's median or global value is very good (0.882), (Fleiss, Levin & Paik, 2003).

With regard to the data analysis and according to the initial objectives, three types of analysis or complementary approaches are adopted: descriptive or univariate, comparative or bivariate and predictive or multivariate analysis. The

univariate analysis aims to describe the real impact of this type of DBAs in professional football (how many indirect free kicks are carried out per game, their delivery method and the level of effectiveness). The bivariate analysis aims to identify variables which may be associated with the achieved effectiveness through the creation of different contingency tables (including the chi-square contrast and association measures). The multivariate analysis will allow the statistical examination of different factors witch predict success via the Binary Logistic Regression. The integration of the three types of analysis should lead to practical recommendations which will help both experts and professionals perform better in their teams.

3. RESULTS

Regarding the impact of this type of actions during the games, it should be noted that a total of 2011 free kicks were performed during the 64 matches of the 2010 FIFA World Cup , which represents an average of 31.42 per game. A total of 447 actions were selected from thoses 2011 free kicks, which complies with the selections rules. It was therefore also noted that 77.7% of the awarded free kicks correspond to direct free kicks whereas 22.3% were indirect or direct free kicks performed as indirect ones in a rapid attempt to score a goal and where an average of 6.9 actions per game was recorded. Although these figures appear small in elite football (over three indirect free kicks as rapid attempts to score goals per team and game) and potentially relevant in terms of results (there 7 real actions which may result in goals), its effectiveness is actually very low (Figure 2). In fact, only 3.1% of these actions result in a goal, only 8.1% of them result in a shot on target and finally only 23% result in a shot.

Figure 2. Effectiveness of indirect free kicks according to the criteria used.

Shot (23), Shot on target (8.1) and Goal (3.1)
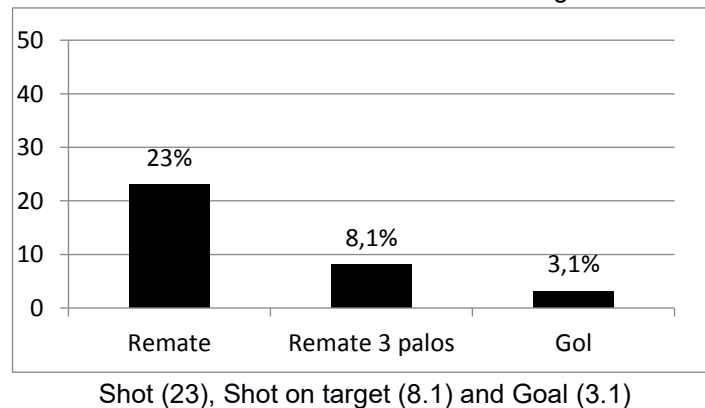
An initial interpretation of these results leads to the empirical observation of the low effectiveness of this type of actions since more than 4 indirect free kicks as rapid attempts to score are required for 1 shot to be performed, 12 are needed to produce 1 shot on target and more than 31 must take place for 1 goal to be scored.

However, goals scored from indirect free kicks have a rather major impact on the final results of games since 64.3% of these goals added points to the final result of games.

BIVARIATE ANALYSIS

Figure 3. Importance of indirect free kicks in the final result.

Victory 0%, Draw 28%, Open result 14%, Confirm result 21%, Contribute to victory 0%, Inconsequential 36%
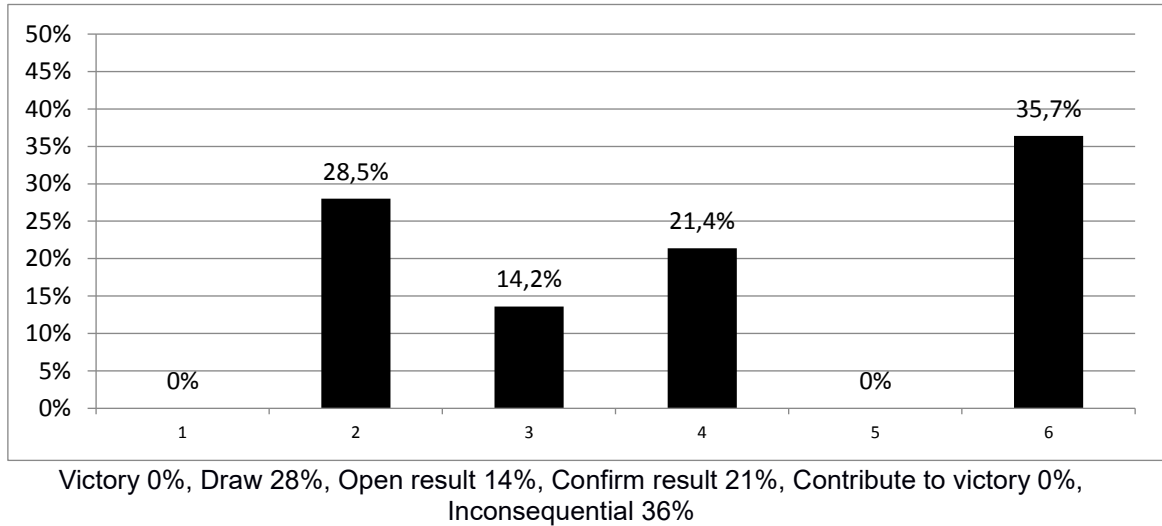
Different contingency tables were designed in order to identify some of the variables which may determine the efectiveness of these DBAs comparing the level of effectiveness in different situations or according to different but interesting variables. The use of chi-square and the corresponding calculation of the contingency coefficient show that effectiveness is statistically linked to specific variables as described in table 2 about shots.

In this case, table 3 shows the results for the first criterion where only the SHOT is performed. There are 6 variables which present a statistically significant relation: the interaction context ($\chi2=10.01$, $p=0.007$), delivery of the ball ($\chi2=20.47$, $p<0.001$), path of the ball ($\chi2=27.03$, $p<0.001$), the number of involved attackers ($\chi2=52.50$, $p<0001$), the offensive organization ($\chi2=59.01$, $p<0.001$) and the result of the game ($\chi2=7.25$, $p=0.02$).

The data show a greater level of effectiveness when the context of interaction is in equality, the ball is delivered indirectly, the ball is not passed through the air, 3 or 4 attackers are involved , the offensive organization is dynamic and the performing team is winning.

TABLE 3. Effectiveness of indirect free kicks according to different variables. Sample: 2010 FIFIA World Cup (Criterion 1 'Shot': YES/NO).

CRITERION 1: SHOT

	VARIABLES	% YES	% NO	χ²	Sig.	Contingency Coefficient
Time	0' - 30'	18.2	81.8			
	31'- 60'	26.8	73.2	2.84	0.24	---
	61'-90'	24	76			
Position	Far right	10.5	89.5			
	Far left	26.1	73.9			
	Near right	23.4	76.6	3.92	0.41	---
	Near left	19.1	80.9			
	Area facing penalty box	26.5	73.5			
Laterality of kick	Natural	23.8	76.2	0.92	0.76	---
	Switched	22.2	77.8			
No. of attackers	1-3	291	70.9			
	4-5	21.7	78.3	1.99	0.36	---
	6 or more	21.8	78.2			
No. of defenders	1-4	27.5	72.5			
	5-6	27.6	72.4	4.74	0.09	---
	7 or more	18.9	81.1			
Interaction context	Inferiority	21.7	78.3			
	Equality	50	50	10.01	0.007	0.14
	Superiority	0	100			
Delivery of ball	Direct	19.2	80.8	20.47	<0.001	0.21
	Indirect	45.5	54.5			
Path of ball	Ground	60	40	27.03	<0.001	0.24
	Air	19.9	80.1			
Type of marking	Man-to-man	35	65			
	Zone	25.7	74.3	2.20	0.33	---
	Combined	21.8	78.2			
No. of involved attackers	1-2	18.3	81.7	52.50	<0.001	0.33
	3-4	69	31			
Zone where pass is made	Near post	22.7	77.3	0.009	0.92	---
	Far post	23.5	76.5			
Shooting area	Near post	22.6	77.4	0.01	0.89	---
	Far post	235	76.5			
Offensive organization	Static	7.3	92.7	59.01	<0.001	0.34
	Dynamic	38.3	61.7			
Result	Winning	33.7	66.3			
	Drawing	21.5	78.5	7.25	0.02	0.12
	Losing	18.5	81.5			

Finally, table 4 shows the results obtained for the second criterion ('Shot on target': YES/NO). According to this second more restrictive criterion, there 4 variables or situations implying significantly different levels of effectiveness: the delivery of the ball ($\chi2=12.39$, $p<0.001$), the path of the ball ($\chi2=13.51$, $p<0.001$), the number of attackers ($\chi2=43.86$, $p<0.001$) and the offensive organization ($\chi2=24.43$, $p<0.001$).

TABLE 4. Effectiveness of indirect free kicks according to different variables. Sample: 2010 FIFIA World Cup (Criterion 2 'Shot on target': YES/NO).

	CRITERION 3: SHOT ON TARGET

VARIABLES		% YES	% NO	χ²	Sig.	Contingency Coefficient
Time	0' - 30'	6.8	93.2			
	31'- 60'	8.1	91.9	0.43	0.80	---
	61'-90'	8.9	91.1			
Position	Far right	5.3	94.7			
	Far left	13	87			
	Near right	8.6	91.4	1.70	0.79	---
	Near left	61	93.9			
	Area facing penalty box	8.6	91.4			
Laterality of kick	Natural	7.2	92.8	0.24	0.62	---
	Switched	9	91			
No. of attackers	1-3	6.3	93.7			
	4-5	7.2	92.8	2.96	0.22	---
	6 or more	1.8	87.2			
No. of defenders	1-4	10	90			
	5-6	6.3	93.7	1.19	0.54	---
	7 or more	9	91			
Interaction context	Inferiority	7.8	92.2			
	Equality	13.6	86.4	1.13	0.56	---
	Superiority	0	100			
Delivery of ball	Direct	6	94	12.39	<0.001	0.17
	Indirect	19.7	80.3			
Path of ball	Ground	25.7	74.3	13.51	<0.001	0.18
	Air	6.6	93.4			
Type of marking	Man-to-man	5	95			
	Zone	9.5	90.5	0.45	0.79	---
	Combined	7.9	92.1			
No. of involved attackers	1-2	5.2	94.8	43.86	<0.001	0.31
	3-4	35.7	64.3			
Zone where pass is made	Near post	7.7	92.3	0.01	0.89	---
	Far post	8.5	91.5			
Shooting area	Near post	8.4	91.6	0.01	0.91	---
	Far post	7.7	92.3			
Offensive organization	Static	1.4	98.6	24.43	<0.001	0.23
	Dynamic	14.5	85.5			
Type of shot	Header	33.9	66.1	0.003	0.96	---
	Kick	36.4	63.6			
Result	Winning	12.8	87.2			
	Drawing	5.4	94.6	5.61	0.06	---
	Losing	10.1	89.9			

In fact, it is noted that the number of shots on target is bigger when the ball is delivered indirectly, the ball is not passed through the air, there are 3 or 4 attackers on the ball and the offensive organization is dynamic. Table 5 shows the results for the third criterion ('Goal': YES/NO). There are 3 variables or situations for the most restrictive criterion with significantly different levels of effectiveness: the delivery of the ball (χ2=6.90; p=<0.009), the number of attackers on the ball (χ2=15.16; p=<0.001) and the offensive organization (χ2=8.57; p=0.003). It was noted that the number of goals is bigger when the

ball is delivered indirectly, there are 3 or 4 attackers on the ball and the offensive organization is dynamic.

TABLA 5. Effectiveness of indirect free kicks according to different variables. Sample: 2010 FIFIA World Cup (Criterion 3 'Goal': YES/NO).

VARIABLES		CRITERION 3: GOAL				
		% YES	% NO	χ^2	Sig.	Contingency Coefficient
Time	0' - 30'	3	97			
	31'- 60'	2,4	97.6	0.36	0.83	---
	61'-90'	3,6	96.4			
Position	Far right	0	100			
	Far left	13	87			
	Near right	1,6	98.4	9.14	0.05	---
	Near left	3,5	96.5			
	Area facing penalty box	3,1	96.9			
Laterality of kick	Natural	2,1	97.9	1.02	0.31	---
	Switched	4,2	95.8			
No. of attackers	1-3	2,5	97.5			
	4-5	3,4	96.6	0.27	0.87	---
	6 or more	2,6	97.4			
No. of defenders	1-4	5	95			
	5-6	1,7	98.3	2.00	0.36	---
	7 or more	3,9	96.1			
Interaction context	Inferiority	3,3	96.7			
	Equality	0	100	0.82	0.66	---
	Superiority	0	100			
Delivery of ball	Direct	2,1	97.9	6,90	0.009	0.14
	Indirect	9,1	90.9			
Path of ball	Ground	5,7	94.3	0.16	0.68	---
	Air	2,9	97.1			
Type of marking	Man-to-man	0	1.0			
	Zone	4,1	95.9	0.85	0.65	---
	Combined	3,1	96.9			
No. of involved attackers	1-2	2	98	15.16	<0.001	0.20
	3-4	14,3	85.7			
Zone where pass is made	Near post	2,4	97.6	0.45	0.50	---
	Far post	4	96			
Shooting area	Near post	3,1	96.9	<0.001	1	---
	Far post	3,2	96.8			
Offensive organization	Static	0,5	99.5	8.57	0.003	0.15
	Dynamic	5,7	94.3			
Type of shot	Header	13,6	86.4	<0.001	1	---
	Kick	13,6	86.4			
Result	Winning	3,5	96.5			
	Drawing	2,1	97.9	2.37	0.30	---
	Losing	5	95			

Finally, a second transverse interpretation considering the criteria, on the one hand and the categories, on the other hand, reveals the 'key' role played by 4

specific variables in the effectiveness of indirect free kicks:

1. The delivery of the ball.
2. The path of the ball.
3. The number of attackers on the ball.
4. The offensive organization.

With regard to the third objective in this study (the design of an explanatory model for indirect free kicks), different Binary Logistic Regression Analyses were performed (Table 5). The 3 criteria mentioned above (all of them in a dichotomy format) were used as Dependent Variables whereas those variables with a statistically significant relation with each of the 3 criteria were used and Independent Variables or Predictors (6 for the first ONE, 4 for the second and 3 for the third criterion). The analysis was performed via the *Stepwise* method using Wald statistic as inclusion criterion.

SHOT $f_{(x)} = \alpha + \beta_1$ (Interaction context) $+ \beta_2$ (Delivery of ball) $+ \beta_3$ (Path of ball) $+ \beta_4$ (No. Of involved attackers) $+ \beta_4$ (Offensive organization) $+ \beta_6$ (Result) $+ \beta_6$

SHOT ON TARGET $f_{(x)} = \alpha + \beta_1$ (Delivery of ball) $+ \beta_2$ (Path of ball) $+ \beta_3$ (No. Of involved attackers) $+ \beta_4$ (Offensive organization) $+ \varepsilon$

GOAL $f_{(x)} = \alpha + \beta_1$ (Delivery of ball) $+ \beta_2$ (No. Of attackers) $+ \beta_3$ (Offensive organization) $+ \varepsilon$

As shown in Table 6, the three analyses (one with dependent criterion or variable) resulted in statistically significant models in all three cases and its explanatory power was moderate (R^2=0.36 for the *shot* criterion, R^2=0.26 for the *shot on target* and R^2=0.18 for *goal*). Two specific variables were used in the equation of the three criteria: the offensive organization and the number of attackers on the ball. In relation to the first, the negative signs associated with the logistic coefficients (B) reveal a greater level of effectiveness when the organization is dynamic (reference category), with values OR between 1.10 and 0.12, which shows that the success rate (shot, shot on target or goal) is approximately 10 times higher when the indirect free kick is performed within a dynamic offensive organization than a static organization. The logistic coefficients (B) in connection with the number of attackers on the ball are also negative, which indicates that the probability of success is also higher when 3 or 4 attackers are involved in the action compared to just 1 or 2 with predictions between 5.55 (OR=0.18) and 7.14 (OR=0.14) times better.

TABLE 6. Results of the Binary Logistic Regression Analyses.

CRITERIO 1: REMATE					
VARIABLES	**B**	**E.T.**	**Wald**	**Sig.**	**Exp (B) [IC]**
Organización ofensiva	-2,08	0,32	41,29	<0,001	0,12 [4,24-15,08]
Trayectoria	1,92	0,48	16,01	<0,001	6,84 [0,06-0,37]
Nº atacantes intervienen	-1,87	0,42	20,15	<0,001	0,15 [2,87-14,73]
Contexto de interacción	-1,26	0,51	6,22	<0,05	0,28 [1,31-9,61]
Constante	2,17	0,64	11,67	<0,01	8,79
χ^2 (sig)	**R2 Nagelkerke**		**Hosmer & Lemenshow**		**% jugadas correctamente clasificadas**
120,594 (p<0,001)	0,36		0,32 (p=0,85)		83,40%
CRITERIO 2: REMATE ENRE LOS TRES PALOS					
VARIABLES	**B**	**E.T.**	**Wald**	**Sig.**	**Exp (B) [IC]**
Organización ofensiva	-2,26	0,62	13,24	<0,001	0,10 [2,83-32,13]
Nº atacantes intervienen	-1,97	0,41	23,27	<0,001	0,14 [3,23-16,08]
Constante	-0,26	0,34	0,60	0,44	0,77
χ^2 (sig)	**R2 Nagelkerke**		**Hosmer & Lemenshow**		**% jugadas correctamente clasificadas**
51,92 (p<0,001)	0,26		1,01 (p=0,61)		91,90%
CRITERIO 3: GOL					
VARIABLES	**B**	**E.T.**	**Wald**	**Sig.**	**Exp (B) [IC]**
Organización ofensiva	-2,30	1,05	4,77	<0,05	0,10 [1,27-78,56]
Nº atacantes intervienen	-1,71	0,58	8,76	<0,01	0,18 [1,78-17,28]
Constante	-1,54	0,45	11,75	<0,01	0,21
χ^2 (sig)	**R2 Nagelkerke**		**Hosmer & Lemenshow**		**% jugadas correctamente clasificadas**
19,85 (p<0,001)	0,18		0,25 (p=0,88)		96,90%

(Criterion 1: Shot; Variables: Offensive organization, Path of ball, number attackers on ball, interaction context, Constant; % Correctly classified actions)

The path of the ball and the interaction context are included in the equation for the first criterion (Shot). The first case shows a positive coefficient (B=1.92) and OR= 6.84, which reveals a 7 times higher shot rate when the indirect free kick is performed without the ball being played in the air. The coefficient related to the interaction context is negative (B=-1.26) and its OR=0.28, which indicates a 3.57 times better prediction when the action is performed with both teams in a situation of equality.

 Once the values of the different parameters have been estimated, it is possible to express each of the predictive equations as Logit units and then determine the probability of shot, shot on target or goal when we look at the desired option of each variable, thus maximizing the strategy. Therefore, for the second criterion (shot on target) if the offensive organization is dynamic (1) with 3 or 4 attackers on the ball (1), the equation is as follows:

$$Logit (p) = -0.26 -2.26 (1) - 1.97 (1)$$

In such circumstances the estimated shot probability would be 0.434. Consequently, the fact that a logistic model is available causes the shot on target probability rises from 0.081 (in the complete absence of any model) to 0.434, which is five times higher.

4. DISCUSSION

This study aimed to reach three complementary goals. First of all, it was considered relevant for research in football as it provides empirical data which enable professionals to objectively know the level of effectiveness of indirect free kicks in elite competitions. Secondly, once the performance in this type of actions was verified, it was important to be able to identify those variables or tactical elements which may affect these actions, subsequently resorting to bivariate analysis. Finally, the third objective was to design different integrated models which may explain or predict the effectiveness of this type of actions using a multivariate analysis.

First of all, a total of 2011 three kicks were taken, which corresponds to a mean of 31.42 per game. This figure is in line with many previous studies: Castelo (1986), Ensum et al. (2000), Hernández Moreno et al. (2011), Olsen & Larsen (1997) Aand Siegle & Lames (2012), who reported between 30 and 37 free kicks per match. Only the studies conducted by Arias (1996), Castelo (1999) and Yamanaka et al. (2002), who reported higher figures between 40 and 50 actions per game, were described. Considering only the number of indirect free kicks, it is noted that this number drops to 447 actions, which represents 22.3%, a figure that is in line with the research carried out by Van Meerbeek, Van Gool & Bollens (1998).

With regard to the frequency of indirect free kicks, the study reveals a mean of 6.9 actions per game. This figure is close to the ones described by Casal et al. (2014) y Silva (2011) who report figures of 6.31 and 8.2 respectively. However, Van Meerbeek et al. (1998) and Carling et al. (2005) report a mean of 9.6 and 12 actions per game respectively.

Regarding the effectiveness of this type of actions en terms of shots, the study reveals that only 23% result in a shot, which is in accordance with the figures reported by Casal et al. (2014) who mentions a shot percentage of 27.1%. However, Mara, Weeler & Lyons (2012) report a lower percentage of 14%. But if this criterion is replaced with 'shot on target', the effectiveness shrinks and presents a value of 8.1% as opposed to 17.7%, which was reported by Pérez and Vicente (1996).

Finally, only 3.1% of indirect free kicks result in goals. This figure is in line with the studies conducted by Casal et al. (2014), Castelo (1999) y Silva (2011) who reported percentages of 1 and 3.2 % respectively and are again opposed to the figure of 6.4% described by Pérez and Vicente (1996).
Although their effectiveness is very low, these actions prove to have a major impact on the outcome of the games since 64.1% the goals scored through indirect free kicks helped secure victories for the different teams. Similarly, Maneiro (2014) described a rather close figure and insisted on the necessity to design new strategies to increase the number of the goals. Castelo (1999) and Mombaerts (2000) also support this idea and claim that goals from dead ball actions (DBAs) may decide the result of a game between two similar teams,

These results show a major offensive ineffectiveness as these actions are rather frequent during football games (about 7 actions per game). They are potentially important, but they are mostly ineffective for scoring goals.

This high ineffectiveness may result from the large number of variables required by the team performing the indirect free kick to achieve success in this type of actions: the indirect free kick must be taken with the right power and ball path, perfectly synchronized movements from the players in the shooting area; correct timing between the performer and the player receiving the ball for shooting at goal; control of the time and space context surrounding the shooter in order to avoid the anticipation of the defender; accurate ball path and finally a precise delivery of the ball to areas where the opponents (goalkeeper and defenders) cannot prevent the goal (2014). Saraiva (2007) points out the importance of surprising the opponent in order to achieve a shot on target, whereas Pérez and Vicente (1996) highlight 'the effectiveness in terms of goals of this type of actions when they are carried rapidly because they are 4 times more successful than the slowly performed ones' (p. 53).

When the attacking team takes an indirect free kick, the only advantages they have regard the high contextual certainty about the actions happening shortly before the free kick is initiated, which allow the attacking players to carry out movements planned beforehand in order to destabilize defensive maneuvers and achieve a better shooting position. Another possible advantage of the attacking team is the fact that they control the time when the game is kicked off again, which gives them a stable and static advantage as the opponents must remain at a certain range. This gives the attacking team a time advantage they do not have in the dynamic play (Castelo, 1999; Faria & Tavares, 1996; Maneiro, 2014).

Regarding the second objective of this study and thanks to the design of different contingency tables (featuring a Ji-square contrast), bivariate analyses were performed in an attempt to contrast the possible relation of variables associated with the achieved effectiveness.

Concerning the interaction context in the shooting area, it was seen that free kicks taken in a situation of equality have higher chances of ending in shots than in contexts of numerical inferiority. In reality, this finding may be related to the same number of attackers than defenders in the shooting area, which creates more opportunities for shots than with the attacking team in inferiority.

In respect of the delivery of the ball into the shooting area, it was noted that the indirect free kicks where the ball is delivered indirectly (more than one player touching the ball) to the shooting area present higher chances of ending in shots on target, shots in general and goals than those performed directly. This result is similar to those produced by Casal, et al. (2014), Maneiro (2014) and Silva (2011). According to Maneiro (2014), one possible explanation is the uncertainty generated in the defending team, which increases the range of possible maneuvers as different small step or passes are performed causing confusion and disorganization in the previously established defensive positions.

Castelo (1999) refers to it as 'the ball progression in the direction of the opposite goal building up the shooting opportunity' (p. 121).

With regard to the path of the ball towards the shooting area and despite the fact that the vast majority of indirect free kicks are performed through air balls, it is noted that ground-based ball deliveries present higher chances of ending in shots on target and shots in general. This finding is in line with the results obtained by Casal et al. (2014) who also mentions the surprise factor of these actions as 9 out of 10 are played through the air or pass-shot actions thus ruling out the predictability of a ball delivered straight to the shooting area. According to Ali (1998), it is an effective way to over the advantage of the defenders and goalkeeper in terms of height since they usually feel more comfortable dealing with air balls.

The results also show that the chances of a shot on target, a shot in general or a goal as regards the number of players on the ball is greater when 3 or 4 attackers are involved.

This result is in line with Silva (2011) who reports that 63.63% of the goals from indirect free kicks involve 3 or 4 players. Ardá et al. (2014), Casal et al. (2014), Grehaigne (2001) and Teodorescu (1984) produced similar results with an emphasis on the contribution of more than 2 attackers in these actions in order to achieve a shot or score a goal. Maneiro (2014) points out the effectiveness of these actions as opposed to air ball deliveries where the ball goes to an area instead of a teammate.

In addition, the chances of a shot on targe, shot in general and goal rises when the offensive organization is dynamic. Cunha (1987) and Bonfanti and Pereni (2002) refer to misleading maneuvers (pp. 25-26) carried out by the attacking players in the shooting area in order to achieve success. Authors like Castelo (1999) refer to the creation of free spaces (p. 176) and false signals (p. 167) so as to hide the real tactical intentions of the attackers. Casal et al. (2014) and Maneiro (2014) report that the use of creation and space occupation maneuvers, dodging, clearing and dragging allow to neutralize the defensive scheme of the other team, creating spaces where shots can be taken.

As regards the time of the game, it was noted that the indirect free kicks taken while winning present greater chances of ending in shots. This may result from the defending team's objective as they are usually more interested in scoring and defending.

Different logistic analyses were performed for the tird objective of this study in order to design a successful strategy for these actions. Although the statistical results are not so convincing due to their limited explanatory power, they are still relevant when applied as they may contribute to increasing the chances of success or effectiveness in these actions.   2 of the variables with statistically relevant relation are found in the 3 logistic regression models, which confirms the idea that the success in these actions depends on whether 3 or 4 players are involved and whether the organizational structure is dynamic based on the

constant creation of free spaces and the clearing of players in the shooting area.

The results suggest that the final desired model of football is that which implies little elaboration based on the tactical control of the shooting context and delivery of play advocating a modern style of football which relies on the association between players with misleading maneuvers and paying more attention to safer ground-based passes and not air balls.

5. CONCLUSIONS

This study could be summarized in 4 main points: 1) Indirect free kicks form a quite frequent type of DABs in elite football (6.9 indirect free kicks per game). 2) The effectiveness of these actions is very limited since 4 indirect free kicks are needed to produce a shot (12 respectively in order to produce a shot on atrget; and 31 indirect free kicks in order to produce a goal). 3) The results obtained in this study approve of the strategic approach adopted by teams which include a minimum of elaboration based on dynamic offensive organizations and the participation of 3 or 4 players as the best way to reach the shooting area or take a shot. 4) When the indirect free kick is performed through a dynamic offensive organization and the participation of between 3 and 4 players, the shot on target rate would increase from 8.1% to 43.4%.

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