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ORIGINAL

EMPTY GOAL: IT'S INFLUENCE ON THE 2019 WORLD MEN'S HANDBALL CHAMPIONSHIP

PORTERÍA VACÍA: SU INFLUENCIA EN EL CAMPEONATO MUNDIAL DE BALONMANO MASCULINO 2019

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ABSTRACT

This research aims to determine the influence that the new regulation has on the development of the game. This rule allows the replacement of the goalkeeper by a field player (playing empty goal). Using an ad hoc observation instrument, all the attacks made in the matches corresponding to the final phase of the World Men's Handball Championship held in 2019 were registered. After a descriptive analysis, the polar coordinates technique was applied to specify the behaviour patterns emerging in a situation of 6 vs. 6, depending on whether or not the resource of the empty goal is used. The results indicate that the new regulation is used primarily in numerical inferiority, causing different behaviours in the phases of attack and defensive balance. Finally, it should be noted that knowing the new trends of the game can help optimise learning programmes and sports performance.

KEY WORDS: handball, empty goal, sport performance

RESUMEN

El objetivo de la presente investigación fue conocer el impacto que ejerce en el desarrollo del juego la nueva norma, que permite la sustitución del portero por un jugador de campo (jugando a portería vacía). Empleando un instrumento de observación *ad hoc* se registraron todos los ataques realizados en los partidos correspondientes a la fase final del Campeonato Mundial masculino de Balonmano celebrado en 2019. Tras un análisis descriptivo, se aplicó la técnica de coordenadas polares para conocer los patrones de conducta que emergen en una situación de 6 vs. 6, según se utilice o no el recurso de la portería vacía. Los resultados indican que la nueva norma se utiliza primordialmente en inferioridad numérica, provocando diferentes comportamientos en las fases de ataque y repliegue defensivo. Finalmente, hay que destacar que conocer las nuevas tendencias del juego puede ayudar a optimizar los programas de aprendizaje y rendimiento deportivo.

PALABRAS CLAVE: balonmano, potería vacía, rendimiento deportivo

1 INTRODUCTION

The modification of game rules decisively conditions the behaviour carried out by the teams (Beiztegui-Married, Oliver-Coronado & Sosa-González, 2019; Marczinka & Gál, 2018). Recently, in 2016, the International Handball Federation modified the rules, allowing the goalkeeper to be substituted by an extra field player, without any of the players who act having the obligation to wear the distinctive uniform of goalkeeper and therefore making it possible for any player to leave the playing field to enter the goalkeeper. The substitution of the goalkeeper by a field player is not a novelty, the previous rule allowed this possibility, but presented an important nuance with respect to the current one: there was the obligation, for the field player who entered in substitution of the goalkeeper, to dress with the goalkeeper's uniform, acting as "goalkeeper-false" or "goalkeeper-player" and being the only one that could be changed by the "authentic" goalkeeper.

In the last World Men's Championship, held in the countries of Denmark and Germany in 2019, coaches have used different offensive and defensive strategies, aimed at making the most of the possibilities offered by this new rule. Throughout the tournament, the selections have replaced the goalkeeper by a field player in three specific contexts: in offensive situations with numerical equality, assuming the risk of leaving his goal empty to obtain an offensive numerical superiority with respect to the defence; in offensive situations with numerical inferiority, to compensate the absence of the excluded player or players and even some selections have used this resource in situations of numerical superiority (to play the attack with a numerical superiority of more than one player).

There are not many investigations that have studied the substitution of the goalkeeper by a field player. Before the entry into force of the new rule, Antón (2010) made a review on different strategies used throughout the history, exposing and arguing the advantages and disadvantages of its use. Recently, Beiztegui-Casado et al. (2019) analysed the use of the goalkeeper-player in the World Women's Championship held in Denmark in 2015, finding that its use favours the obtaining of goal in situations of offensive numerical inferiority, at the same time that it does not penalise the team that uses it, as there is no significant difference in the probability of receiving a goal in a counterattack. Already with the new rule implemented, Marczinka & Gál (2018) studied its influence during the World Men's Championship held in France in 2017. In their study they explored the frequency and effectiveness with which the teams used this rule change, stating that they primarily used the possibilities of this new rule in situations of numerical inferiority, thus compensating the loss of the excluded player and assuming the risk of playing in attack with an empty goal.

Due to the novelty of the rule and the lack of studies that address its tremendous influence on the dynamics of the game (Marczinka & Gál, 2018), this paper aims to obtain scientific knowledge on the impact of playing with an empty goal on the development of the game. To do this, the matches corresponding to the final phase (the two semi-final matches, the final and the match for third place) of the World Men's Championship held in 2019 were studied. After a descriptive study on its incidence, the patterns of behaviour that emerge in one of the situations where the new rule is most used were analysed through the application of the technique of polar coordinates: 6 vs. 6 (six attackers against six defenders) when the team that attacks is in numerical inferiority (Marczinka & Gál, 2018) comparing them with the patterns of behaviour that emerge, in the same situation of 6 vs. 6, when both teams are in numerical equality and do not use the resource of playing with the empty goal.

2 MATERIAL AND METHODS

2.1 OBSERVATIONAL METHODOLOGY

An observational design Follow-up/Idiographic/Multidimensional (F/I/M) has been proposed (Anguera, Blanco-Villaseñor, Hernández-Mendo & Losada, 2011). Its justification is the following: follow-up, since several matches were analysed; idiographic due to the fact that although there are several players studied, as they are part of the same team (each of the national selections) they work as a unit; and finally, multidimensional because different levels of response are studied.

2.1 PARTICIPANTS

The matches corresponding to the final phase of the World Men's Championship held in 2019 were analysed: Denmark-France (semi-final), Norway-Germany (semi-final), France-Germany (bronze medal match) and Denmark-Norway (final). This study was developed following the ethical

principles set out in the Declaration of Helsinki and, in accordance with the Belmont Report (1978), no informed consent or examination by the relevant ethics committee was required because: (a) the study involved observation of people in a public setting (sports arena); (b) the individuals and groups observed did not have a reasonable expectation of privacy (matches were broadcast worldwide); and (c) the study did not involve intervention by researchers or direct interaction with the individuals studied.

2.2 INSTRUMENTS

In order to record the behaviours most relevant to the achievement of the proposed research objectives, an *ad hoc* observation instrument was created (table 1). The observation instrument combined the field format with a system of exhaustive and mutually exclusive categories. This combination allows taking advantage of the strong points of both instruments, on the one hand, the categories system offers theoretical consistency, while the field format provides flexibility when it comes to collecting the diversity of behaviours performed by the players (Anguera & Hernández-Mendo, 2013). The observation units began with the start of all positional attacks and concluded once the defensive withdrawal phase was over.

The matches analysed were obtained directly from the Internet, the Dartfish 5.5 software allowed the application of the observation instrument in the recording and coding of the matches. In order to evaluate the goodness of the categories, determine the reliability of the observers and establish the minimum number of matches necessary to generalise with precision, the generalizability analysis was carried out with the EduG software version 6.1. Subsequently, the software SDIS-GSEQ 4.0 (Bakeman & Quera, 1995) was used to analyse data quality and perform the sequential analysis, a prerequisite for the calculation of polar coordinates, which was carried out by the programme Hoisan 1.2 (Hernández-Mendo, López, Castellano, Morales & Pastrana, 2012). Finally, the graphical representation of the different polar coordinate maps was carried out with Snowflake 0.2.

Table 1. Observation instrument

Criterion	Categories
Team (TM)	Team to which the analysed observation unit belongs: Denmark (DEN)/ Norway (NOR)/ France (FRA)/ Germany (GER)
Empty goal (EG)	Substitution of the goalkeeper by an extra player: Played with empty goal (YES)/ Not played with empty goal (NO)
Number (REL)	Numerical relationship between both teams: Equality (EQU)/ Inferiority (INF)/ Superiority (SUP)
Number of players each team plays with (NUM)	Empty goal 7 vs.6 (G7x6)/ Empty goal 7 vs.5 (G7x5)/ Empty goal (G6x5)/ Empty goal 6 vs.6 (G6x6)/ Empty goal (G5x6)/ Empty goal 5 vs.5 (G5x5)/ Empty goal (G5x4)/ No empty goal 6 vs.6 (NG6x6)/ No empty goal 6 vs.5 (NG6x5)/ No empty goal 5 vs.6 (NG5x6)/ No empty goal 5 vs.5 (NG5x5)/ No empty goal 6 vs.4 (NG6x4).
Scoring (SCO)	The team we're analysing is: Winning by a difference not greater than 3 goals (WD3)/ Winning by a difference greater than 3 goals (WM3)/ Winning by a difference greater than 6 goals (WM6)/ Losing by a difference not greater than 3 goals (LD3)/ Losing by a difference greater

	than 3 goals (LM3)/ Losing by a difference greater than 3 goals (LM6)/ Tie (TIE)
Match time (TIM)	Moment of the match in which the analysed attack begins: First 20 minutes of the first half (FIR20)/ Last 10 minutes of the first half (FIR30)/ First 20 minutes of the second half (SEC20)/ Last 10 minutes of the second half until the end of the match (SEC30).
Attack result (RES)	Outcome of attack: Attack ends with a goal, 7 metres or 2-minute exclusion of a defender (G72)/ Attack ends with a free kick, side line throw-in, corner or referee stoppage when the team loses possession (FKC)/ Throw that does not end in goal (T6N)/ Attack ends with a loss of the ball (LOS)
Mobility (MOB)	Number of players exchanging positions during the attack: None (PL0)/ two (PL2)/ three (PL3)/ four or more players (PL4)
Attack sequence (SQN)	Number of attempts, in the same possession carried out by the same team. It is considered that a new attempt begins after a throw is made or the game is interrupted: One attempt (SQ1)/ two attempts (SQ2)/ three attempts (SQ3)/ four attempts (SQ4).
Ending action of the positional attack (ACT)	The action with which the attack ends: Game with pivot (PVT)/ Game towards one of the wingers (WIN)/ Penetration or feint of one of the players of the first line (G6M)/ Game from the proximities of the line of 9 meters (G9M).
Attack system (SYS)	Attack system used in the attack: One of the wingers abandons its position to occupy the pivot position (DWI)/ One of the players of the first line abandons its position to occupy the pivot position (D1L)/ None of the players abandons its position to occupy the pivot position (NOD)/ The attack is initiated with two specific pivots (2PV).
Completion zone (ZON)	By dividing the field into three zones across, the place where the attack ends: Left (LFT)/ Central Zone (CEN)/ Right (RGT)
Defensive system (DEF)	Defensive system used by the defensive team: 6:0 (SIX)/ Defensive system with advanced defender (AVN)/ 5:0 (FIV)/ Defensive system 4:2, 3:3 or individual (ABI)/ Mixed defensive system (MIX)
Crosses/Swaps (C/S)	Number of crosses and/or swaps made in the attack: Zero (CS0)/ One (CS1)/ Two (CS2)/ Three (CS3)/ Four (CS4)/ Five (CS5)
Counterattack (CTK)	Performance of counterattack by team that was in a defensive phase: There is counterattack (YES)/ There is no counterattack (NO)
Beginning of the counterattack (BEG)	The situation from which the counterattack begins: After a throw-in that does not end in goal (SAV)/ After getting the ball back (BACK)/ After scoring goal (GOAL)
Type (TYP)	Type of counterattack performed: First surge (1SU)/ Second surge (2SU)/ Kick-off (KOFF)/ Empty Goal Shot (EGS)
Counterattack result (CAR)	Outcome of counterattack: Goal, 7-metre mark or 2-minute exclusion of a player in withdrawal phase (CEX)/ Kick that does not end in goal (MIS)/ Loss of ball (CLO)/ The counterattack stops and the positional attack phase begins (STP).
Withdrawal team changes (CHA)	Number of changes the team makes in the defensive withdrawal phase: One change (ONE)/ Two changes (TWO)/ Three changes (TER)/ No change (ZERO)
Team (TM)	Counter-attacking team: Norway (NOR)/ France (FRA)/ Denmark (DEN)/ Germany (GER)

2.3 PROCEDURE

2.3.1 DATA QUALITY

A principal observer (national handball coach, with experience in observational methodology and author of the observation instrument designed for this study) carried out the records of each of the matches. In order to analyse the quality of the data, another observer, a national handball coach and with mastery in the use of the recording instrument, carried out a training process that consisted of two phases: explanation of the criteria and categories of the observation instrument and recording of handball matches that were not included in the sample. The training process was concluded when an intra-observer (same match recorded by the same observer at two different times) and inter-observers (same match recorded by the principal observer and by the trained observer) level higher than 0.80 was obtained in Cohen's Kappa statistic, for all the criteria of the observation instrument. For the intra-observer concordance calculation, as well as for the inter-observer concordance calculation, one of the matches corresponding to the second phase of the championship was used, obtaining in both cases a Cohen Kappa index superior to 0.96 in all the criteria and in both reliability tests (intra and inter). According to the Landis & Koch scale (1977), the level of agreement shown can be considered "almost perfect".

2.3.2 GENERALIZABILITY ANALYSIS

The generalizability analysis (Cronbach, Gleser, Nanda & Rajaratnam, 1972) was carried out to evaluate the goodness of the categories, determine the reliability of the observers and establish the minimum number of matches necessary to generalise with precision. A design of two facets was proposed: Matches / Category (M/C), in order to determine the homogeneity of the categories. Generalization coefficients close to zero were obtained: 0.20 the relative and 0.05 the absolute; these values indicate that the categories are adequate and comply with the requirement of being exhaustive and mutually exclusive. On the other hand, the design of two facets Category / Matches (C/P) obtained both absolute and relative generalization coefficients of 0.93, these values indicate that with the observation of 4 matches a high degree of generalization is obtained. Likewise, the analysis of the generalised linear model showed that most of the variance was explained by the category component (78.2%) and its interaction with the match component (21.8%), which demonstrates the interpretative reliability of the data recorded in the different categories in the different matches.

2.3.3 POLAR COORDINATES ANALYSIS

The polar coordinates analysis allows us to know the patterns of behaviour that emerge in team sports (Flores-Rodríguez & Anguera, 2018). As a previous step to the analysis of polar coordinates, it is required the calculation of the adjusted residuals through the application of the sequential analysis. The objective of the sequential analysis is to identify significant relationships, both prospectively and retrospectively, between different behaviours that are considered of interest by

researchers. Both perspectives have to be considered in order to graphically represent the relationships between the studied categories (Gorospe & Anguera, 2000). Among the categories under analysis, the focal behaviour is the one that is considered to generate "forward" (prospective perspective) and "backward" (retrospective perspective) associations with the other behaviours studied, which assume the role of conditioned behaviours (Tarragó et al., 2017). By means of a powerful data reduction technique, the statistical calculation $Z_{sum} = \frac{\sum Z}{\sqrt{n}}$ (Sackett, 1980), it is known both the strength of the association, indicated by the length of the vector, and the nature of the same one (activation or inhibition), indicated by the quadrant in which the association is located. When the association is represented in the quadrant I, it indicates a mutual activation relationship between the focal and conditioned behaviour; if the representation is located in the quadrant IV it indicates that the focal behaviour activates the conditioned one, while the latter inhibits the focal one; if the association is represented in the quadrant III, there is a mutual inhibition relationship between the studied behaviours; and, finally, when the graphic representation is made in the quadrant II, it implies that the focal behaviour inhibits the conditioned one and the latter activates the focal one (Anguera et al., 2011).

3 RESULTS

In the first section, a descriptive analysis will be presented on the percentage of positional attacks where the new rule has been used, the percentage of success obtained and the percentage of successful counterattacks (carried out by the defending team). Subsequently, in a second section, the patterns of behaviour that emerge in a situation of 6 vs. 6 played with empty goal (when the team analysed is in inferiority) and played without the substitution of the goalkeeper by a field player (both teams in equality) will be studied.

3.1 DESCRIPTIVE ANALYSIS

A total of 445 observation units have been analysed in this study. Table 2 shows the descriptive analysis regarding the use and success (goal completion, 7-meter signalling or exclusion of an opposing player) of the attack and counterattack obtained when the strategic resource of playing with an empty goal is used and when it is not used. The data are presented differentiating the numerical relationship between both teams (equality, superiority and inferiority) and considering the total of the actions as a whole.

We can observe how the total actions with empty goal suppose a 17.1% of the total analysed actions, obtaining a lower percentage of success in attack and a higher percentage of success in the received counterattacks, regarding the non-use of the empty goal. It also highlights the use of the new rule in the 100% of the actions that are played in numerical inferiority.

Table 2. Descriptive analysis of the use, success of the attack and success of the counterattack

N.R	N.A	No Empty Goal			Empty Goal		
		Use	S.A	S.C.	Use	S.A	S.C
Equality	348	(332) 95.4%	(130) 39.2%	(43) 13%	(16) 4.6%	(5) 31.3%	(3) 18.8%
Superiority	40	(37) 92.5%	(21) 56.8%	(0) 0%	(3) 7.5%	(2) 66.7%	(0) 0%
Inferiority	57	(0) 0%	(0) 0%	(0) 0%	(57) 100%	(20) 35.1%	(13) 22.8%
TOTAL	445	(369) 82.9%	(151) 40.9%	(43) 11.7%	(76) 17.1%	(27) 35.5%	(16) 21.1%

N.R, numerical relationship between both teams; N.A., number of total actions; S.A., success of the attack; S.C., success of the counterattack.

When analysing specifically the situation of 6 vs. 6 (table 3), it is noticed that the percentage of success of the attack is lower when the empty goal resource is used than when it is not used. It can also be seen that 23.6% of the attacks carried out with empty goal are followed by successful counterattacks, a situation that is reduced to 13% when the attacks are not played with empty goal.

Table 3. 6 vs. 6

No Empty Goal (NG6x6)			Empty Goal (G6x6)		
N.A	S.A.	S.C.	N.A	S.A	S.C
332	(130) 39.2%	(43) 13%	(55)	(18) 32.7%	(13) 23.6%

N.A., number of actions; S.A., success of the attack; S.C., success of the counterattack.

3.2 STUDY OF THE BEHAVIOUR PATTERNS

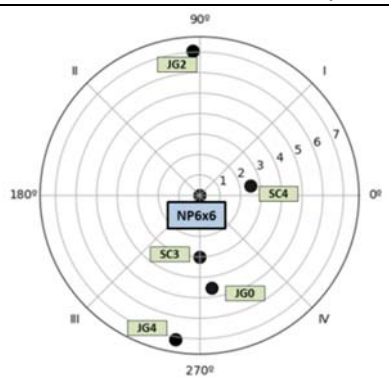
Furthermore, the behaviour patterns that emerge in a situation of 6 vs. 6 played with empty goal (when the attacking team is in numerical inferiority and substitutes the goalkeeper by a field player to compensate the absence of the excluded player) will be studied, comparing them with those that emerge in the same situation, of 6 vs. 6, without the substitution of the goalkeeper by a field player.

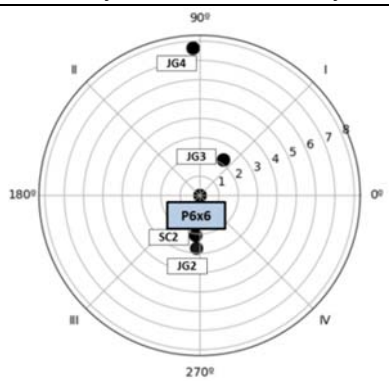
Through the analysis of polar coordinates, the significant associations are known and graphically represented, those with a length > 1.96 ($p<0.05$), between focal and conditioned behaviour. The polar coordinate maps are distributed in 4 tables. In order to facilitate the comparison between the different patterns of behaviour that emerge in the analysed situations, two maps will be presented in each table, the one on the left will have as focal behaviour NG6x6 (attacks not performed with an empty goal), while the one on the right will have as focal behaviour G6x6 (attacks played with an empty goal).

In table 4, the categories belonging to the criteria MOB (number of players exchanging their positions) and SQN (number of attempts) act as conditioned

conducts. When the selections play without substituting the goalkeeper (NG6x6) they show a reciprocal activation association (quadrant I) with the end of the attacks in their fourth attempt (SQ4) and with attacks where the players do not exchange their positions (PL0), but in this case the activation is not mutual (quadrant IV). On the other hand, in quadrant III, there is an association of mutual inhibition with: attacks where 4 players exchange their position (PL4) and with attacks that end in their third attempt (SQ3). Also, the focal behaviour NG6x6 inhibits the appearance of attacks where 2 players exchange their positions (PL2), but in this case the inhibition is not mutual (quadrant II).

Table 4. Polar coordinates maps. Behaviours conditioned by the criteria: MOB y SQN.





Focal behaviour: NG6x6 (not empty goal)				Focal behaviour: G6x6 (empty goal)			
C.C	Q.	V.	T.A.	C.C	Q.	V.	T.A.
SQ4	I	2.51	10.71	PL3	I	2.22	56.46
PL2	II	7.05	92.69	PL4	II	7.67	92.78
SQ3	III	3.01	269.61	SQ2	III	2.07	263.78
PL4	III	7.12	260.53	PL2	III	2.73	265.88
PL0	IV	4.55	277.58				

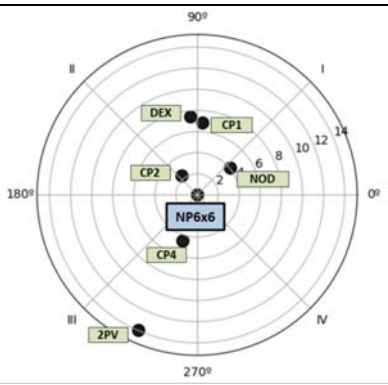
C.C., conditioned behaviour; Q., quadrant; V., vector length; T.A., transformed angle

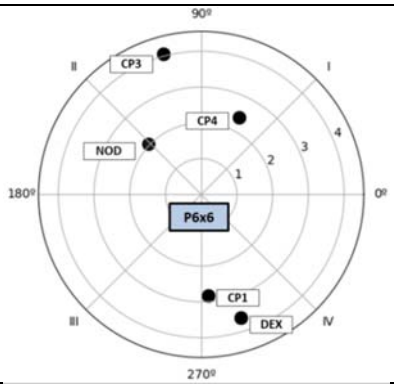
In the map on the right, when the game is played with the empty goal (G6x6), there is a mutual activation with the execution of attacks where 3 players exchange their positions (PL3). On the other hand, we can observe a mutual inhibition association (quadrant III) with attacks where 2 players exchange their positions (PL2) and with attacks that end in their second attempt (SQ2). Also, the presence of the focal behaviour inhibits the appearance of attacks where 4 players exchange their positions (PL4), although in this case the inhibition is not mutual (quadrant II).

In In table 5, the behaviours belonging to the SYS (attack systems) and C/S (crosses and swaps) criteria act as conditioned behaviours. On the left map, when the focal behaviour is NG6x6 (the goalkeeper is not substituted), a mutual activation association is shown (quadrant I) with attacks where no player (neither extremes nor first lines) abandons his position to occupy the pivot position (NOD) and with attacks where a crossing or swap is carried out (CS1). On the other hand, there is a relationship of mutual inhibition (quadrant III) with the use of an attack system that initially counts with 2 players in the pivot position (2PV) and with attacks where 4 crosses and/or swaps are carried out (CS4). We can also see in quadrant II how the focal behaviour inhibits the appearance of attacks where one of the wingers abandons its position to occupy the pivot position (DWI) and with attacks where 2 crosses or swaps are

carried out (CS2), although in this case the inhibition is not mutual. In the map on the right, when the game is played with empty goal (G6x6), there is a mutual activation (quadrant I) with attacks where 4 crosses or swaps are carried out (CS4). You can also see how the focal behaviour activates the attacks where one of the wingers circulates to the pivot position (DWI) and with attacks where 1 crossing or swap is carried out (CS1), but in this case the activation is not mutual (quadrant IV). On the contrary the focal behaviour inhibits the appearance of attacks that none of the wingers or first lines circulates to the pivot position (NOD) and with the execution of 3 crosses and/or swaps (CS3).

Table 5. Polar coordinates maps. Behaviours conditioned by the criteria: SYS and C/S



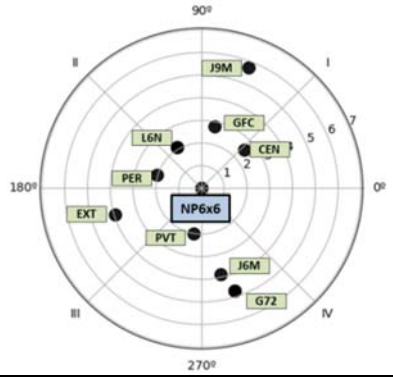


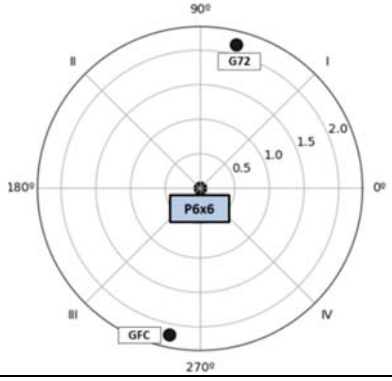
Focal behaviour: NG6x6 (not empty goal)				Focal behaviour: G6x6 (empty goal)			
C.C	Q.	V.	T.A.	C.C	Q.	V.	T.A.
NOD	I	4.00	39.45	CS4	I	2.40	63.74
CS1	I	6.85	86.07	NOD	II	2.04	136.22
CS2	II	2.36	127.56	CS3	II	4.07	105.00
DWI	II	7.43	95.29	CS1	IV	2.82	274.23
CS4	III	4.56	252.60	DWI	IV	3.60	287.74
2PV	III	13.98	246.33				

C.C., conditioned behaviour; Q., quadrant; V., vector length; T.A., transformed angle

In table 6 the categories belonging to the criteria ZON (zone of the field where the positional attack ends), ACT (action with which the attack ends) and RES (result of the positional attack) act as conditioned behaviours. When the focal behaviour is NP6x6 (the goalkeeper is not substituted), a mutual activation association is shown (quadrant I) with the attacks ending near the line of 9 meters (G9M), in the central zone (CEN) and with attacks ending with an interruption (FKC). Likewise, the focal behaviour also activates the end of attacks by means of feints or penetrations, carried out by the players who form the first line (G6M) and with the end of the attacks in goal, 7-meter mark or exclusion of a defender (G72), but in these cases the activation is not mutual (quadrant IV). On the other hand, the focal behaviour presents a mutual inhibition relationship (quadrant III) with attacks ending by means of pivot actions (PVT) or by means of winger actions (WIN). Focal behaviour also inhibits the appearance of attacks ending with a loss of the ball (LOS) and failed throws (T6N), although these inhibition associations are not reciprocal. In the map on the right, when actions are performed with the empty goal (G6x6), there is a mutual activation (quadrant I) with the end of the attacks in goal, 7-meter mark or exclusion of a rival defender (G72) and a reciprocal inhibition relationship (quadrant III) with the end of the attacks with an interruption (FKC).

Table 6. Polar coordinates maps. Behaviours conditioned by the criteria: ZON, ACT and RES



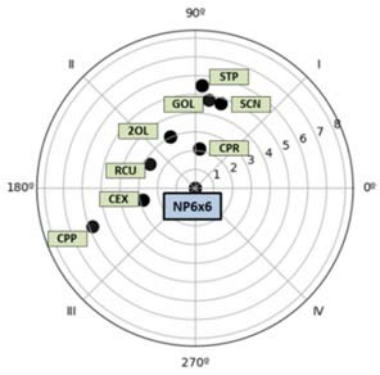


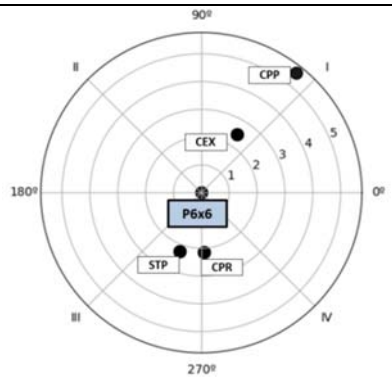
Focal behaviour: NG6x6 (not empty goal)				Focal behaviour: G6x6 (empty goal)			
C.C	Q.	V.	T.A.	C.C	Q.	V.	T.A.
CEN	I	2.55	42.27	G72	I	2.15	76.02
FKC	I	2.80	77.89	FKC	III	2.16	257,99
G9M	I	5.72	68.98				
LOS	II	2.05	163.77				
T6N	II	2.10	120.51				
PVT	III	2,00	259,77				
WIN	III	3.94	196.78				
G6M	IV	3.86	282,84				
G72	IV	4.73	287.79				

C.C., conditioned behaviour; Q., quadrant; V., vector length; T.A., transformed angle

Finally, in table 7, the categories belonging to the criteria related to the counterattack (carried out by the defending team) following the positional attack: BEG (counterattack start mode), TYP (type of counterattack carried out) and CAR (counterattack result) acted as conditioned conducts. On the left map, when the focal behaviour is NG6x6 (the goalkeeper is not substituted), a mutual activation association is shown (quadrant I) with the execution of fast kick-offs (KOFF) after receiving a goal (GOAL), ending counterattacks with a ball loss (CLO) and stopping a counterattack to start a positional attack (STP). On the other hand, there is a relationship of mutual inhibition (quadrant III) with counterattacks ending in a goal, 7 meters or exclusion of a defender (CEX) and with the execution of a shot to empty goal (EGS). We can also see in quadrant II how the focal behaviour inhibits the appearance of counterattacks that start after getting back the ball (BACK) and with the performance of counterattacks in second surge (2SU), although in this case the inhibition is not mutual. On the right map, when the focal behaviour is P6x6 (the goalkeeper is substituted), a mutual activation association is shown (quadrant I) with the execution of shots to empty goal (EGS) and with the end of the counterattacks in goal, 7-meter mark or exclusion of a rival player (CEX). Likewise, the focal behaviour activates the ending of counterattacks that result in ball loss, but in this case the activation is not mutual (quadrant IV). On the other hand, there is a relationship of mutual inhibition (quadrant III) with counterattacks that stop to start a positional attack (STP).

Table 7. Polar coordinates maps. Behaviours conditioned by the criteria: BEG, TYP and CAR





Focal behaviour: NG6x6 (not empty goal)				Focal behaviour: G6x6 (empty goal)			
C.C	Q.	V.	T.A.	C.C	Q.	V.	T.A.
CLO	I	2.11	84.00	CEX	I	2.47	58.68
KOFF	I	5.51	86.01	EGS	I	5.83	200,16
GOAL	I	4.75	80.94	STP	III	2.25	249.46
STP	I	5.51	86.01	CLO	IV	2.13	272.85
BACK	II	2.71	151.89				
2SU	II	3,05	115.36				
CEX	III	2.83	193.08				
EGS	III	5.83	200.16				

C.C., conditioned behaviour; Q., quadrant; V., vector length; T.A., transformed angle

4 DISCUSSION

This research aims to determine the impact of the new rule, which allows the substitution of the goalkeeper by an extra field player, assuming the risk of playing with an empty goal, in the matches corresponding to the final phase (semi-finals, final and match for third place) of the World Men's Championship held in Denmark and Germany in 2019. Due to the recent implementation of the rule, there are not many works with which to compare the results obtained in our research.

The descriptive analysis shows that the new rule is used in 17.1% of the attacks, a percentage slightly lower than the 19.98% used in the World men's Championship held in 2017 (Marczinka & Gál, 2018). When both teams are on equal numbers, the substitution of the goalkeeper by an extra outfield player to obtain a numerical advantage over the defence is only used in 4.6% of the attacks. It does not seem to be an advantageous resource, as the positional attack obtains a success percentage of 31.3% when playing with an empty goal, a percentage lower than the 39.2% obtained in attacks where the new rule is not used. Likewise, playing with empty goal penalizes the withdrawal phase, since in 18.8% of the attacks the subsequent counterattack is successful, being a percentage higher than the 13% obtained when not playing with empty goal.

In all the analysed situations of numerical inferiority the resource of the empty goal is used. Before the entry into force of the new rule, (Beiztegui-Casado et al., 2019) it was found that the substitution of the goalkeeper by a field player occurred in 16.6% of the attacks in inferiority, so we can verify that the new rule has boosted the use of this resource. According to Marczinka & Gál (2018), it seems that the teams mainly use the resource of empty goal, not with the aim of

playing the attacks in numerical superiority, but with the aim of compensating the absence of the excluded player.

On the other hand, the analysis of polar coordinates has shown that it is not the same to play a situation of 6 vs. 6 (six attackers against six defenders) with an empty goal (in numerical inferiority) than to play it with a goalkeeper (in numerical equality). The behaviour patterns that emerge in the positional attack differ considerably depending on whether or not the goal is empty. The condition of empty goal activated attacks with greater mobility: more players exchanged their positions, more crosses and swaps were made, and the appearance of attack was activated where one of the wingers circulated to the pivot position. Behaviours very different from those developed when 6 vs. 6 is played without the goal being empty, because in this situation the attacks are more direct: few crosses and/or swaps are carried out, behaviours related to the transformation of the 3:3 attack system to other systems with two pivots are not activated and there is a tendency to finish the attacks through first line actions, either with actions from 9 meters or 6 meters, in the central zone of the attack. These behaviours favour the execution of frank blows by the defence, at the same time as they inhibit the completions by actions of pivot or winger, behaviours that are not inhibited when playing with the empty goal.

With respect to the withdrawal phase, the situation of 6 vs. 6 with an empty goal penalises the withdrawal phase regarding the situation of 6 vs. 6 with a goalkeeper, since in the 23.6% of the attacks carried out with an empty goal, the team defending is successful in the counterattack, while in the situation of 6 vs. 6 with a goalkeeper the percentage is 13%. The analysis of polar coordinates reflects a very different development of the counterattacks in the two situations studied. When the goal is empty, it activates the successful completion and the distant throws to the goal without a goalkeeper. On the other hand, when 6 vs. 6 is played with a goalkeeper, the counterattacks initiated after scoring a goal are activated by means of a quick kick-off. Regarding the behaviours related to the completion, the appearance of counterattacks is activated and they are stopped so that the positional attack phase begins and the counterattacks that successfully end are inhibited. These results indicate that carrying out the withdrawal phase in numerical inferiority, together with the execution of, at least, a substitution of a field player by the goalkeeper, causes a very favourable situation for the counterattacking team, which supposes important differences with respect to the results found by Beiztegui-Casado et al., 2019. Similarly, it is striking that in situations of 6 vs. 6 with an empty goal the counterattacks initiated after the goal, through a quick kick-off, are not activated; the reason could be that the teams prefer to make a positional attack in numerical superiority, rather than assume the risks of this type of counterattack.

Coaches need time to respond tactically to the possibilities offered by the implementation of new rules. The teams, with the objective of adapting to the new contexts generated (new game dynamics), are strengthening certain behaviours (strategies, game systems, and tactics) and discarding others. Therefore, the obtaining of scientific knowledge that helps to understand where the game is heading can be of help for the coaches, whether they are at training

or performance stages, in the design of their training programmes, as well as to the researchers in their scientific work. Finally, we believe that it is necessary to carry out future studies that continue to deepen the impact of this rule in the development of the game, focusing the study on other phases of the game, such as defence for example, as well as the game phases analysed in this study to: check whether the trends found in this study are confirmed or changed in future championships, know the trends developed in the field of women's handball, know the specific trends presented by certain teams or selections, as well as know the influence of this rule in young players.

5 CONCLUSIONS

The most important conclusions, in relation to the proposed objectives, which can be deduced after the analysis of the matches corresponding to the final phase of the World Men's Championship 2019, are the following:

-The substitution of the goalkeeper by an extra field player is used in all the attacks that are played in numerical inferiority, to compensate the absence of the excluded player.

-In situations of equality, the percentage of success of the attacks carried out with empty goal is lower than the percentage of the attacks where the goalkeeper is not substituted by a field player.

-In situations of numerical equality, playing with the empty goal penalises the defensive withdrawal phase, with respect to attacks where this resource is not used.

-In a situation of 6 vs. 6, the attacks that are played with the empty goal (numerical inferiority) present a greater exchange of positions between players, crosses and/or swaps with respect to attacks played with goalkeeper (numerical equality), which are more direct, where fewer players exchange their positions and less crosses and/or swaps are made.

-In a situation of attack 6 vs. 6 played with the empty goal (numerical inferiority), the handicap of the excluded player, together with the realization of at least one substitution for the goalkeeper to enter, favours the success of the counterattacks.

-In a situation of 6 vs. 6 played with a goalkeeper, they end with actions carried out by the players who occupy the front line in the central zone of the attack, tendencies that do not appear when 6 vs. 6 is played with an empty goal.

6 SUGGESTED APPLICATIONS FOR TRAINING

Although the conclusions drawn are limited to the competition analysed, we suggest some proposals related to the attack and withdrawal phases. These are aimed at situations where the goalkeeper is replaced by an extra field player to play a situation of 6 vs. 6:

-In attack: to elaborate the game in a similar way to when playing without substituting the goalkeeper (reducing the number of crosses and swaps with no intention of attacking the goal); not to look exclusively for completions from the 6-meter line.

-In withdrawal: to reduce the number of attack-defence changes; to favour variability (different spaces and starts) in the proposed tasks; to encourage behaviours aimed at delaying or interrupting the counterattack in defensive numerical inferiority; to anticipate the substitution of the goalkeeper.

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