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Effects of rules changes on shots dynamics in Water polo World Championship 2003-2013.

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Abstract:

The aim of this study was to analyze the influence of rules changes in water polo on throws dynamics in numerical equality, counterattack and powerplay. The performance indicators observed in the Women's and Men's World Championships of 2003 and 2013 were compared. The observational design was nomothetic, multidimensional and follow-up. 8765 throws were analyzed, 4112 in the 2003 championship and 4372 in the 2013. In the women's competition, the rules changes influenced the following performance indicators of the numerical equality: frequency ($p < .001$) and technique ($p = .001$); in counterattack: frequency ($p < .001$), distance ($p < .001$) and efficacy ($p = .003$); and in numerical desequality: frequency ($p < .001$), distance ($p < .001$), position ($p = .016$) and technique ($p = .001$). In the men's competition the indicators that showed dependence with the rules changes were the distance in counterattack ($p = .001$) and powerplay ($p < .001$), and the technique in powerplay ($p = .036$). In conclusion, the observational methodology allowed to verify the different effects in the throws dynamics caused by the new rules in both gender.

Key Words: - Team Sport, Performance, Analysis, Tactic.

Introduction

The sport of Water polo, from its origin to half s. XIX in England to the present, has undergone great changes in the gaming actions dynamics due to multiple factors. These include the implementation of new training methods, the professionalization of waterpolo players athletes and technical staff, the training and selection of young talents or the institutional support of the federations. However, one of the most influential factors has been the evolution of the rules that have shaped this sport.

The rules changes and their consequent influence on the game have allowed to classify the evolution of water polo in several stages. Thus, Donev and Aleksandrović (2008) identified four periods: 1) Origin and formation (1869-1876); 2) Unification of rules and their use at international level (1877-1907); 3) Creation of international estates that regulate the evolution of the game (1908-1969); and 4) Development of the game worldwide (1970- ...). Similarly, Lloret (1998) established three great moments of change that gave rise to three revolutions, physics (1949), when players were allowed to move while the stopwatch was stopped; the technique (1966), by prioritizing the handling and control of the ball over physical abilities; and the tactic (1977), motivated mainly by the introduction of temporal exclusion.

Water polo is a collaborative sport with opposition whose particular characteristic is that it is played in the water. That it is aquatic makes the displacements of players across the playing field slower than in other sports and that many of the technical-tactical actions are not visible to the public when developing below the surface. Consequently, many of the rules modifications seek to make water polo a more spectacular, dynamic and attractive sport for fans and spectators (Lozovina and Lozovina, 2009). However, rule changes can produce different results than expected due to the complexity of the variables that interact in the game, as well as the unpredictable adaptation of the players to them (Arias, Argudo and Alonso, 2011). The effects on the dynamics of emerging gaming actions can not be assessed at a glance and require the use of objective techniques such as observational methodology (Arias et al., 2011).

Every four years, the International Amateur Swimming Federation (FINA) organizes a congress in which the rules of the sport are reviewed and updated. Those held in 2005 and 2009 introduced major changes

that could have altered the dynamics of the throwing actions, such as increasing the total time of the game from 28 to 32 minutes, reducing the time of ball possession from 35 to 30 seconds, the possibility of throwing behind the line after 5 meters, the limitation of defending or blocking the ball with both hands out of the water or reducing the length of the playing field from 30 to 25 meters in the women's category (FINA, 2005, FINA 2009). On the other hand, the throw in water polo is the technical-tactical action that makes it possible to score a goal and directly influence the outcome of a game (Platanou and Varamenti, 2011, Vila et al., 2011). In competitions of international level, usually it is executed in conditions of fatigue due to the defensive pressure of the opponents (Platanou, 2009) and to the intermittent efforts of high intensity that characterize this sport (Smith, 1998).

In the performance research in water polo, the indicators related to the throw have been the most studied (Tucher et al., 2014) by allowing discrimination between the winners and losers of the games (Escalante et al., 2012; García-Marín and Argudo, 2017; Lupo, Condello and Tessitore, 2014; Mirvić, Kazazović and Aleksandrović, 2011) or between the first and the last classified in a championship (García-Marín and Argudo, 2015; Takagi, Nishijima, Enomoto and Stewart, 2005). Also have made it possible to compare the throw dynamics depending on the players specific positions in attack (Özkol, Turunç and Dopsaj, 2013) or those of national leagues of different levels (Lupo et al., 2012b, Prieto, Gómez and Pollard, 2013).

All these antecedents, together with others (Alcaraz et al., 2011, Lupo et al., 2010, Lupo et al., 2011, Lupo et al., 2012a, Smith, 2004, Smith, 2011), have allowed knowing the throws number per game, their distribution in each situational framework, the characteristics of the teams with the highest throw frequency, the most common positions, types and throwing directions, efficiency achieved, etc. However, there are hardly any studies that have focused on analyzing the effects of rules changes on the throws dynamics in this sport. To date, the only background that has been found in the literature has focused on evaluating the modifications of the rules introduced in 2005 (Platanou, Grasso, Cufino and Giannouris, 2007), the effects on the statistics of winners and losers of the games (Madera, Tella and Saavedra, 2017), and the change in the distance of the penalty throw from 4 to 5 meters (Argudo, Ruiz-Barquín and Borges, 2016).

Based on the aforementioned background, the aim pursued in this study is to verify the effects of the rules changes of 2005 and 2009 on the game action of throws dynamics and goals in numerical equality, counterattack and powerplay by comparing the X and the XV World Championships held in Barcelona in 2003 and 2013.

Material & methods

The FINA and the Organizing Committees of the X and XV Water polo World Championships gave their consent to film the games of the men's and women's competitions in order to investigate the influence of the rules changes on water polo throws in numerical equality, counterattack and powerplay of international category players. For this, the throw indicators (distance, position, technical gesture, situational framework and result) of the World Championships held in Barcelona in 2003 and 2013 were compared. In the period that covers the two championships, FINA introduced important rules changes that they were approved in the congresses that this organism organized in 2005 and 2009.

The observational design used was nomothetic, multidimensional and follow-up. The nature of the data was of frequency (Anguera, Blanco, Hernández and Losada, 2011). Given the differences found in other studies between women's and men's (García-Marín, Argudo and Alonso, 2013, Escalante et al., 2011), the competitions of each gender were analyzed independently.

Notational Analysis and Participants

All the throws made in the World Championships of 2003 and 2013 were analyzed by means of notational analysis except those of penalties. Thus, the sample consisted of 4112 throws made in the 96 games of the 2003 Championship (1943 of the women's and 2169 of the men's competition) plus the 4373 quantified in the 88 games of the 2013 Championship (2206 of the women's and 2167 of the men's).

To do the notational analysis, a field format was designed with LINCE software (Gabin, Camerino, Anguera and Castañer, 2012) that contained the following variables:

- Frecuence: number of throws made.
- Distance of throw: 1) Near: Inside 4 metres area (rules 2003) or 5 metres area (rules 2013); 2) Far: Behind the 4 or 5 metres line according to championship.
- Position of throw: 1) Central: Made at the middle area of the width of play field within the area that delimit the goalposts; 2) Lateral: From areas outside the area that delimit the goalposts.
- Technical gesture: 1) Drive shot: The ball follows a trajectory parallel to the water; 2) Drive shot with rebound: The ball follows a downward trajectory and then ascends after rebounding off of the water; 3) Reverse shot: The player with their back to the goal turns around at the same time as she releases the ball; 4) Lob shot: The ball follows a parabolic trajectory, first ascending and then descending. 5) Others: Gestural forms distinct from those previously described and that appear with lower frequency in the game.
- Situational framework: Set of motor behaviors determined by the factors of team symmetry, organization of tactical game systems, and ball possession (Argudo, Alonso, García-Marín and Ruiz, 2007). 1) Numerical

equality: Both teams have the same number of players and play on one side of the field; 2) Counterattack: Numerical advantage of the attacking team originated by changing ball possession and swimming towards the other field; 3) Powerplay: Numerical advantage of the attacking team caused by the temporary expulsion of one or more defensive players for serious misconduct.

- Result: 1) Goal; 2) No goal.

Regarding the characteristics of the participants, it was estimated that the training frequency of the world's elite players ranges between five and eight sessions of 120 min / week, in both the male and female categories (Lupo et al., 2014).

Design and Procedures

To do the analysis, all the matches of both championships were filmed with a video camera (JVC, GZ-MG50E, JAPAN) placed on one side of the pool, taking as a reference the midfield line, at a height and distance greater than 10 meters, so that in all the possessions the thrower and the goalpost could be observed clearly. In the 2013 championship, the frontal plane images emitted by Spanish Radio Television through its website were also obtained, which were combined with the horizontal planes of the video camera to improve the reliability of the observation.

The observation and quantification of the selected indicators to analyze the throws were made by two people with previous experience in water polo observational methodology. The inter and intra-observer reliability was checked by Cohen's Kappa coefficient by analyzing the throws of four randomly selected games of the World Championship held in Montreal-05.

The two women's games were Canada vs. Italy (preliminary stage) and Hungary vs. Germany (round of 16), while in the men's category were China vs. Greece (previous phase) and Croatia vs. Serbia and Montenegro (semi-finals). Each game was analyzed twice with a difference of one week between the two sessions, reaching inter- and intra-observer reliability values higher than .86 and .92 respectively. Likewise, Cohen's Kappa coefficients calculated for each variable of the field format were: frequency ($k = .98$); distance ($k = .96$); position ($k = .93$); technical gesture ($k = .94$); situational framework ($k = .98$); result ($k = 1$). After the study, the interobserver reliability test was repeated, reaching $k = .96$.

Statistical Analysis

First, the descriptive statistics (frequencies and percentages) of all the throw indicators of the women's and men's competitions of the 2003 and 2013 World Championships were calculated. In order to determine the influence of the rules changes, the independence of the throw indicators with respect to the rules used in each championship using Chi-Square. The finished goal throws were analyzed independently. As a requirement, it was found that 20% of the expected frequencies were not less than 5. The corrected standardized residuals were used to identify the squares in the classification table with a difference greater than ± 1.96 between the observed and expected frequencies. Finally, the intensity of the dependence level between the variables was calculated with the Cramer V. The critical level for all contrasts was set at $p \leq .05$. The software used for the statistical analysis was the SPSS, version 21.0 (SPSS Inc., Chicago, IL, USA).

Results

In the women's category, the throws number in numerical equality in the 2013 championship (1322, 59.9%) was 2.6 times lower than what would be expected compared to the 2003 championship (1242, 63.9%), 7.2 times higher in counterattack (2003, $n = 164$, 8.4%, 2013, $n = 349$, 15.8%) and 2.5 times lower in powerplay (2003, $n = 537$, 27.6%, 2013, $n = 535$, 24.3%) ($X^2 = 53.756$; $gl = 2$; $p < .001$; $V = .113$).

Regarding the effectiveness, no significant differences were found in the goals scored in numerical equality in 2003 (338, 27.2%) and 2013 (332; 25.1%) ($X^2 = 1.464$, $df = 1$; $p = .226$), neither in powerplay (2003, $n = 235$, 43.8%, 2013, $n = 249.46.5\%$) ($X^2 = .837$, $df = 1$, $p = .360$). However, they scored 2.9 times fewer goals in counterattack than would be expected in the 2013 championship (160, 45.8%) compared to 2003 (98, 59.8%) ($X^2 = 8.636$, $df = 1$, $p = .003$; $V = .130$).

Table 1 shows the results of the throw indicators in the women's category for the two championships analyzed. The rules changes influenced the game actions dynamics by increasing drive shots with rebound and decreasing lob shots in numerical equality ($p < .001$; $V = .132$); increasing far throws in counterattack ($p < .001$; $V = .157$); and increasing the near throws ($p < .001$; $V = .222$), from the lateral ($p = .016$; $V = .073$) and with rebound ($p = .001$; $V = .116$) in powerplay, as well as decreasing other types of throw technique ($p = .001$; $V = .116$).

Table 1. Frecuences, percentages, corrected waste and Chi-square test of shots indicators in women's championships.

Variables	Categories	2003		2013			X ²	p	
		n	%	Res	n	%			Res
Numerical equality									
Distance	Near	421	33.9	1.0	423	32.0	-1.0	1.047	.306
	Far	821	66.1	-1.0	899	68.0	1.0		
Position	Lateral	608	49.0	-.9	671	50.8	.9	.833	.361
	Central	634	51.0	.9	651	49.2	-.9		
Technical gesture	Drive shot	709	57.1	.2	750	56.7	-.2	44.34 9	<.001
	Drive shot with rebound	195	15.7	-5.4	320	24.2	5.4		
	Reverse shot	105	8.5	1.2	95	7.2	-1.2		
	Lob shot	233	18.8	4.9	157	11.9	-4.9		
Result	Goal	338	27.2	1.2	332	25.1	-1.2	1.464	.226
	No goal	904	72.8	-1.2	990	74.9	1.2		
Counterattack									
Distance	Near	136	82.9	3.6	237	67.9	-3.6	12.68 2	<.001
	Far	28	17.1	-3.6	112	32.1	3.6		
Position	Lateral	92	56.1	-.7	207	59.3	.7	.474	.491
	Central	72	43.9	.7	142	40.7	-.7		
Technical gesture	Drive shot	77	47.0	-.6	173	49.6	.6	3.408	.182
	Drive shot with rebound	40	24.4	-1.1	101	28.9	1.1		
	Others	47	28.7	1.8	75	21.5	-1.8		
Result	Goal	98	59.8	2.9	160	45.8	-2.9	8.636	.003
	No goal	66	40.2	-2.9	189	54.2	2.9		
Numerical inequality									
Distance	Near	319	59.4	-7.3	427	79.8	7.3	52.74 8	<.001
	Far	218	40.6	7.3	108	20.2	-7.3		
Position	Lateral	279	52.0	-2.4	317	59.3	2.4	5.780	.016
	Central	258	48.0	2.4	218	40.7	-2.4		
Technical gesture	Drive shot	397	73.9	1.3	377	70.5	-1.3	14.42 4	.001
	Drive shot with rebound	116	21.6	-2.5	151	28.2	2.5		
	Others	24	4.5	3.1	7	1.3	-3.1		
Result	Goal	235	43.8	-.9	249	46.5	.9	.837	.360
	No goal	302	56.2	.9	286	53.5	-.9		

Table 2 includes the results of the finished in goal in the women's championships.

The rules introduced between 2003 and 2013 led to more goals executed from a distance ($p = .018$, $V = .091$), lateral goals ($p = .021$, $V = .089$), and with rebound ($p = .006$; $V = .136$) in numerical equality, but less lob shot ($p = .006$; $V = .136$). Likewise, in powerplay, more goals were achieved near ($p < .001$; $V = .221$), lateral ($p = .020$; $V = .106$), and with rebound ($p = .009$; $V = .140$), although less using other technical gestures ($p = .009$, $V = .140$).

Table 2.

Frecuences, percentages, corrected waste and Chi-square test of shots finished in goal in women's championships.

Variables	Categories	2003			2013			X^2	p
		n	%	Res	n	%	Res		
Numerical equality									
Distance	Near	166	49.1	2.4	133	40.1	-2.4	5.554	.018
	Far	172	50.9	-2.4	199	59.9	2.4		
Position	Lateral	133	39.3	-2.3	160	48.2	2.3	5.323	.021
	Central	205	60.7	2.3	172	51.8	-2.3		
Technical gesture	Drive shot	176	52.1	.8	162	48.8	-8	12.45 6	.006
	Drive shot with rebound	67	19.8	-3.0	99	29.8	3.0		
	Reverse shot	33	9.8	-.1	33	9.9	.1		
	Lob shot	62	18.3	2.5	38	11.4	-2.5		
Counterattack									
Distance	Near	82	83.7	.0	134	83.8	.0	.000	.987
	Far	16	16.3	.0	26	16.2	.0		
Position	Lateral	49	50.0	-.9	89	55.6	.9	.773	.379
	Central	49	50.0	.9	71	44.4	-.9		
Technical gesture	Drive shot	41	41.8	-.3	70	43.8	.3	5.183	.075
	Drive shot with rebound	26	26.5	-1.6	58	36.3	1.6		
	Others	31	31.6	2.1	32	20.0	-2.1		
Numerical inequality									
Distance	Near	162	68.9	-4.9	217	87.1	4.9	23.60 6	<.00 1
	Far	73	31.1	4.9	32	12.9	-4.9		
Position	Lateral	112	47.7	-2.3	145	58.2	2.3	5.427	.020
	Central	123	52.3	2.3	104	41.8	-2.3		
Technical gesture	Drive shot	160	68.1	1.2	157	63.1	-1.2	9.479	.009
	Drive shot with rebound	63	26.8	-2.1	89	35.7	2.1		
	Others	12	5.1	2.5	3	1.2	-2.5		

In the men's championship, the number of throws did not vary significantly between the two championships neither in numerical equality (2003, n = 1398, 64.5%, 2013, n = 1392, 64.2%), nor in counterattack (2003, n = 145, 6.7%; 2013, n = 113, 5.2%), nor in powerplay (2003, n = 626, 28.9%, 2013, n = 662, 30.5%) ($X^2 = 4.987$, $df = 2$, $p = .083$). The goals in numerical equality (2003, n = 322, 48.2%, 2013, n = 348, 47.9%), counterattack (2003, n = 79, 11.8%, 2013, n = 73, 10.0%) and powerplay (2003, n = 267, 40.0%, 2013, n = 306, 42.1%) did not differ significantly either ($X^2 = 1.407$, $df = 2$, $p = .495$).

Table 3 shows the results of the men's category throw indicators for the two championships analyzed. Rules changes influenced the game action dynamics by increasing near throws in counterattack ($p = .001$; $V = .213$) and in powerplay ($p < .001$; $V = .312$). In addition, in powerplay, the throws other than the drive shot and the drive shot with rebound increased ($p = .036$; $V = .072$).

Table 3.
Frecuences, percentages, corrected waste and Chi-square test of shots indicators in men's championships.

Variables	Categories	2003		2013			X^2	p	
		n	%	Res	n	%			Res
Numerical equality									
Distance	Near	436	31.2	-1.6	473	34.0	1.6	2.476	.116
	Far	962	68.8	1.6	919	66.0	-1.6		
Position	Lateral	627	44.8	-1.6	666	47.8	1.6	2.516	.113
	Central	771	55.2	1.6	726	52.2	-1.6		
Technical gesture	Drive shot	914	65.4	-2.1	961	69.0	2.1	7.191	.066
	Drive shot with rebound	265	19.0	.3	258	18.5	-.3		
	Reverse shot	107	7.7	1.1	91	6.5	-1.1		
	Lob shot	112	8.0	2.2	82	5.9	-2.2		
Result	Goal	322	23.0	-1.2	348	25.0	1.2	1.479	.224
	No goal	1076	77.0	1.2	1044	75.0	-1.2		
Counterattack									
Distance	Near	114	78.6	-3.4	106	93.8	3.4	11.659	.001
	Far	31	21.4	3.4	7	6.2	-3.4		
Position	Lateral	78	53.8	-.6	65	57.5	.6	.357	.550
	Central	67	46.2	.6	48	42.5	-.6		
Technical gesture	Drive shot	72	49.7	-1.7	68	60.2	1.7	2.839	.242
	Drive shot with rebound	54	37.2	1.4	33	29.2	-1.4		
	Others	19	13.1	.6	12	10.6	-.6		
Result	Goal	79	54.5	-1.6	73	64.6	1.6	2.687	.101
	No goal	66	45.5	1.6	40	35.4	-1.6		
Numerical inequality									
Distance	Near	400	63.9	-11.2	596	90.0	11.2	125.33	<.001
	Far	226	36.1	11.2	66	10.0	-11.2	3	1
Position	Lateral	344	55.0	-.5	373	56.3	.5	.263	.615
	Central	282	45.0	.5	289	43.7	-.5		
Technical gesture	Drive shot	497	79.4	.0	525	79.3	.0	6.630	.036
	Drive shot with rebound	123	19.6	.8	118	17.8	-.8		
	Others	6	1.0	-2.5	19	2.9	2.5		
Result	Goal	267	42.7	-1.3	306	46.2	1.3	1.662	.197
	No goal	359	57.3	1.3	356	53.8	-1.3		

Table 4 includes the results of the finishes in goal in the men's championships. The rules introduced between 2003 and 2013 led to fewer reverse shot goals ($p = .002$, $V = .149$) in numerical equality. Likewise, goals were increased from positions near to the goalpost both in counterattack ($p = .001$, $V = .271$) and in powerplay ($p < .001$; $V = .294$).

Table 4.
Frecuences, percentages, corrected waste and Chi-square test of shots finished in goal in men's championships.

Variables	Categories	2003			2013			X^2	p
		n	%	Res	n	%	Res		
Numerical equality									
Distance	Near	170	52.8	1.2	167	48.0	-1.2	1.546	.214
	Far	152	47.2	-1.2	181	52.0	1.2		
Position	Lateral	124	38.5	-1.8	158	45.4	1.8	3.260	.071
	Central	198	61.5	1.8	190	54.6	-1.8		
Technical gesture	Drive shot	190	59.0	-1.8	229	65.8	1.8	14.806	.002
	Drive shot with rebound	71	22.0	-.5	82	23.6	.5		
	Reverse shot	43	13.4	3.8	17	4.9	-3.8		
	Lob shot	18	5.6	-.1	20	5.7	.1		
Counterattack									
Distance	Near	63	79.7	-3.3	71	97.3	3.3	11.147	.001
	Far	16	20.3	3.3	2	2.7	-3.3		
Position	Lateral	38	48.1	-.7	39	53.4	.7	.430	.512
	Central	41	51.9	7.	34	46.6	-.7		
Technical gesture	Drive shot	37	46.8	-1.3	42	57.5	1.3	2.196	.333
	Drive shot with rebound	31	39.2	.6	25	34.2	-.6		
	Others	11	13.9	1.1	6	8.2	-1.1		
Numerical inequality									
Distance	Near	185	69.3	-7.0	282	92.2	7.0	49.458	<.001
	Far	82	30.7	7.0	24	7.8	-7.0		
Position	Lateral	139	52.1	-.6	167	54.6	.6	.363	.547
	Central	128	47.9	.6	139	45.4	-.6		
Technical gesture	Drive shot	210	78.7	1.3	227	74.2	-1.3	2.604	.272
	Drive shot with rebound	54	20.2	-.9	71	23.2	.9		
	Others	3	1.1	-1.3	8	2.6	1.3		

Dicussion

This study was designed to investigate the influence of rules changes proposed by the FINA in 2005 and 2009 on the throws dynamics in water polo by comparing the performance indicators selected in the 2003 and 2013 World Championships. They have been used in other previous studies (Alcaraz et al., 2011; Escalante et al., 2011, 2012; García-Marín and Argudo, 2017; Lupo et al., 2010, 2011, 2012a, 2014; Vila et al., 2011). Likewise, is the first research that analyzes the effects of the rules modifications differentiating the competitions of men and women.

The results related to the throws number in each situational framework indicate that the rules changes influenced differently in the women and men's championships of 2013. In the case of women, they caused an increase in the throws frequency in the counterattack to the detriment of throws in equality and powerplay. On the one hand, this change could be motivated by the reduction of the ball possession time from 35 to 30 seconds (FINA, 2005), which would force the women's teams to increase the swim speed after gaining ball possession to throw before exhausting the possession time. On the other hand, it could also be influenced by the reduction of the size of the playing field from 30 to 25 meters (FINA, 2009), favoring the intensity of the displacements to be shorter and shorter. In any case, the increase of throws in counterattack in the women's category would support the intention of FINA to make a faster and more dynamic water polo (Lozovina and Lozovina, 2009), since it would necessarily imply an increase in the number of ball possessions in counterattack. In the case of the men's competition, the same did not happen in the women's competition, that is, the rules changes did not alter the throws frequency in any situational frameworks and the game actions dynamics were maintained from one championship to another despite the increase in the game duration from 28 to 32 minutes. Similar results were

found in the study by Madera et al. (2017). It must be borne in mind that the reduction of playing field length was only modified for women's competition, so we interpreted that the decrease in possession time was not enough to increase the possessions and the counterattacks. Another possible explanation to the previous result could have to do with the physical capabilities of players if we take into account that, in order for the counterattack to occur, one or more players of the team with ball possession have to swim faster than the opponents and get numerical superiority in the middle attack field. From this point of view, it would be inferred that the level of physical condition in the men's category would be more equal than in the women's category, thus decreasing the chances of counterattacking. However, although there is evidence of the greater physical performance of players at international level over those of national level for the same sex (Botonis, Toubekis and Platanou, 2018) these types of differences have not been found for the same category of championship, so we will have to deepen this issue in future studies. With regard to the situational framework of the penalty, the study of Argudo et al. (2016) obtained that the throws frequency increased when expanding the area in which the fouls could be received to achieve it from 4 to 5 meters.

Regarding the throws effectiveness, the results also differed between gender. On the one hand, in the men's category, the rules changes did not alter the goals achieved in any of situational frameworks, in line with the study by Madera et al. (2017). However, taking into account that the throws frequency was also similar in both championships, this result responded to the expected logic. Conversely, in women's category, no correspondence was found between the throw frequency variation and the goals achieved in each situational framework. It would have been expected that in counterattack, more goals would have been scored by making more throws, and that in equality and powerplay would be less scored when they decreased. However, the only change influenced by the new rules was the smaller number of counterattacking goals. We can not attribute this result to the lack of adaptation to the rules (Escalante et al., 2011, Smith, 2011), since in the 2013 championship the players had already been playing with the same rules for four years. Nor can we explain it by a deficit in the preparation of this game situation, since in a World Championship participate the maximum international level players. The only way to justify the reduction of counterattack goals is based on another result. In this situational framework more throws were made from positions further away from goalpost, although in the 2013 championship the line taken as a reference for this indicator was delayed from 4 to 5 meters. However, the reasons for increase the throwing distance are unknown when it is known that the most effective positions are nearest to goalpost (Alcaraz et al., 2011, 2012; Lupo et al., 2012b; Özkol et al., 2013). What is clear, by the results, is that the rule that limited the use of both hands to defend and block the ball in defense (FINA, 2005) did not achieve the desired effect of increasing the goals frequency in the games and provide more spectacular water polo (Lozovina and Lozovina, 2009). In relation to efficiency in the penalty, Argudo et al. (2016) found that the goals in this situation framework decreased as a consequence of increase the distance from 4 to 5 meters to throw it.

One of the most important structural rules changes introduced in 2005 was to replace the 4 and 7 meter lines with the 5 meter lines. This change involved increasing the distance to throw the penalties and the zone to obtain it for the infringement of a defender, but also decrease the distance of free throw after fault. As a consequence of rule change and the categorization used in this study, was found that in the men's championship in 2013 the throws and the goals in positions nearest the goalpost (≤ 5 m.) in counterattack and powerplay increased. In a similar way it happened in the women's championship in powerplay. However, we must take these results with caution because the throws between 4 and 5 meters were quantified differently in both championships analyzed due to the field references that could be used to perform the observation. In any case and in line with Escalante et al. (2011), the highest number of goals in equality behind 5 meters in the 2013 women's championship would indicate greater efficiency in the free throws after fault compared to the 2003 championship. Similar results were found in the study by Madera et al. (2017). In consequence, it can be interpreted that the new rules expanded the chances of achieving goal in numerical equality, compensating the habitual tendency to finish the possessions by throwing from the centre forward position.

Regarding the throwing position in width, in the women's category, more throws (equality) and goals (equality and powerplay) were observed from the laterals, possibly due to time ball possession reduction. The same results were found in the study by Platanou et al. (2007). It follows that the women's teams, having less time to find throw positions with low levels of opposition in the central positions, would tend to throw more and get more goals from the lateral positions. However, in men's category the same results were not found, so it is interpreted that their adaptation to the rule was different to women (Arias, Argudo and Alonso, 2011).

In relation to the throwing technique, as in the rest of the variables, the actions dynamics varied more in women's category than in men's. Specifically, in the women's championship in 2013, more drive shot with rebound were used and more goals were scored with this technical gesture, both in equality and in powerplay. Generally, this type of throw is chosen because it generates considerable uncertainty to the goalkeeper and the opposing defenses, due to the unpredictable ball trajectory after bouncing on the water surface (García-Marín and Argudo, 2017). In addition, to be able to execute correctly and get a goal, a free space in the water is required to send the ball with sufficient strength and angle so that it can be fired with great speed after the boat. For this reason, this type of throw is more complex to execute in powerplay, since defenses tend to be more

closed around the goalpost. Therefore, a good ball circulation that causes the defense to swing and that generates those spaces before the throw is required.

In the women's category, there were also fewer throws and goals of lob shot in equality in the 2013 championship. Possibly, the low efficiency achieved with this type of throw (García-Marín and Argudo, 2017) and the increase of throws far observed were the causes of its lower use. The correct execution of this type of throw requires more precision than strength. In addition, in order to succeed it is necessary to deceive the goalkeeper (Lloret, 1998).

In the case of the men's category, the rules changes caused that the reverse shots decreased in numerical equality and the drive shot increased slightly. These results suggest that the men's teams looked for fewer throws since the centre forward, the main player who usually executes the reverse shot. In addition, it supports the idea that the change of the free throw after fault from 7 to 5 meters induced the teams to use this resource more, especially when the time ball possession was nearing completion. Taking into account the intentionality of the changes proposed by the FINA to make a water polo more attractive to the spectators (Lozovina and Lozovina, 2009), this change is positively valued by increasing the variability in the game actions dynamics.

Conclusions

The rules introduced by the FINA in 2005 and 2009 induced the following changes in the game action dynamics in the XV World Water Polo Championship (2013) with respect to the X World Championship (2003): In the women's competition, in numerical equality, the throws frequency decreased, more throws with rebound and less lob shot were used, more goals were scored by throwing from distance, from the sides and with rebound, as well as fewer goals of lob shot. In counterattack, the throws frequency increased, although fewer goals were scored, throws from a distance were also increased. And in powerplay, the throws frequency decreased, more throws were executed and more goals were scored from near, from sides and with rebound, fewer throws were used and fewer goals of another type were scored (tap and lob shot).

In the men's competition, in numerical equality, fewer goals were scored by reverse shot. In counterattack and in powerplay, the throws and the goals increased from positions near to goalpost. And increased other types of throws (tap and lob shot) in powerplay.

In conclusion, the rules changes influenced more in the throws dynamics on women's competition than in the men's one. Likewise, the new rules did not affect the same performance indicators, reinforcing the differences found between both gender in other studies (García-Marín, Argudo and Alonso, 2013, Escalante et al., 2011). Future rules changes should consider studies of this type or similar that support or justify the modifications made. Hence the importance of it for future regulatory changes.

Conflicts of interest - There is any conflicts of interest to declare.

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