Water polo game-related statistics in Women's International Championships: Differences and discriminatory power

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Abstract

The aims of this study were (i) to compare women's water polo game-related statistics by match outcome (winning and losing teams) and phase (preliminary, classificatory, and semi-final/bronze medal/gold medal), and (ii) identify characteristics that discriminate performances for each phase. The game-related statistics of the 124 women's matches played in five International Championships (World and European Championships) were analyzed. Differences between winning and losing teams in each phase were determined using the chi-squared. A discriminant analysis was then performed according to context in each of the three phases. It was found that the game-related statistics differentiate the winning from the losing teams in each phase of an international championship. The differentiating variables were both offensive (centre goals, power-play goals, counterattack goal, assists, offensive fouls, steals, blocked shots, and won sprints) and defensive (goalkeeper-blocked shots, goalkeeper-blocked inferiority shots, and goalkeeper-blocked 5-m shots). The discriminant analysis showed the game-related statistics to discriminate performance in all phases: preliminary, classificatory, and final phases (92%, 90%, and 83%, respectively). Two variables were discriminatory by match outcome (winning or losing teams) in all three phases: goals and goalkeeper-blocked shots.

Key words: Performance analysis, discriminant analysis, goal, goalkeeper.

Introduction

The beach flags are a popular surf lifesaving event A century had to pass from the inclusion of men's water polo as an Olympic sport in 1900 until the incorporation of women's water polo in the Olympic program (Olympic Games, Sydney, 2000). This late addition of the women's game into the most important international competition has meant that it has been the subject of only very few specific studies (e.g., PubMed has only 69 studies containing the words "water polo" and "female" in the title; search made on 26 May 2012). Although superficially the men's and women's games may seem similar (Kirkendall, 2007), they involve clearly differentiating factors. To this must be added the influence the recent rule changes have had on the sport's requirements, both physiologically (Varamenti and Platanou, 2008) and technically and tactically (Platanou, 2009b). Thus, to understand the factors that contribute to success in women's water polo, studies are needed to analyze the current situation of this sport.

Women's water polo studies have frequently focused on the analysis of the anthropometric (Baramenti and Platanou, 2010), physiological (Tan et al., 2009), functional (McCluskey et al., 2010), swimming (Stevens et al., 2010), or decision-making (Steel et al., 2007) profiles, or some combination of them (Varamenti and Platanou, 2008). An interesting recent development in studies of the men's game has been the application of the technique known as "notational analysis" (Argudo et al., 2007, 2009; Escalante et al., 2011; Hughes et al., 2006; Lupo et al., 2009; 2010; Madera et al., 2007; Platanou, 2004; Smith, 2004; Vila et al., 2011). If this analysis uses data from Web sites, it can be denominated "performance analysis". It quantifies the technical and tactical playing aspects of a game through game-related statistics based mainly on frequencies and effectiveness percentages (Lozovina et al., 2004). It has already come to be regarded as a good instrument with which to interpret play in team sports (Hughes and Franks, 2004), and which should be incorporated into the process of constructing an integral profile of the elite water polo player (Tsekouras et al., 2005). However, only five works have analyzed separately or specifically women's water polo (Argudo et al., 2007; Enomoto et al., 2003; Escalante et al., 2011; Lupo et al., 2011; Takagi et al., 2005). These studied the differences between winning and losing teams according either to the situation of the match (Argudo et al., 2007; Lupo et al., 2011) or to game-related statistics (Enomoto et al., 2003; Escalante et al., 2011; Takagi et al., 2005). Differences have been found between winning and losing teams in coefficient of shots possibility, concretion, definition, resolution, precision and accuracy in counterattack, and defensive adjustment (Argudo et al., 2007). Another study (Lupo et al., 2011) finds that, in even play phase, the actions of the winning teams are quicker and more focused on scoring a direct goal or provoking an exclusion foul, and the winning teams make more shots from within the 5-m zone; in counterattack, their defence is more aggressive and is followed by more direct counter movements seeking a without opposition shot. Finally, the same study finds that, in power play phase, the variables that differentiate winning and losing teams are the number of quick passes and goals. In the same line as that study, a work on the game-related statistics in the Beijing 2008 Olympic Games discriminated the performance (win or loss) of the teams in 64% of a sample using only two variables: shots, and successful 5-m shots (Escalante et

al., 2011). These results run counter to previous studies which pointed to goalkeeper blocks (Enomoto et al., 2003) or counterattack situations (Takagi et al., 2005) as being variables differentiating between winning and losing teams.

However, no work applying performance analysis to water polo has studied the influence of the phase of the championship on game-related statistics. This type of information would allow coaches and researchers to define the technical and tactical aspects characterizing elite women's water polo and clarify which of them allow the team to pass the phases of each tournament successfully. Thus, the aims of this study were (i) to compare water polo game-related statistics by match outcome (winning and losing teams) and phase (preliminary, classification, and semi-final/bronze medal/gold medal), and (ii) to identify characteristics that discriminate performances for each phase.

Methods

Sample

The sample consisted of the results and game-related statistics of 124 matches played in the three FINA World Championships (Melbourne, Australia, 2007; Rome, Italy, 2009; Shanghai, China, 2011) and two European Water Polo Championships (Málaga, Spain, 2008; Zagreb, Croatia, 2010). Thus, 62 matches corresponded to the preliminary phases, 42 to the classificatory phases, and 20 to the semi-final/bronze medal/gold medal phases. The draw matches were not considering. All the data were retrieved from the official box scores on the Official Website of OMEGA Timing (http://www.omegatiming. com).

Procedures

The official box scores provide information on the game statistics analyzed both for each player individually and

Table 1. Definitions of dependent variables.

Variable	Definition
Goals	Percentage goals relative to the number of shots made
Action goals	Percentage of goals scored during Even action (i.e., playing situation performed by a number of offensive players relative to the ball position, which is equal or lower than that of the defense) relative to the number of shots made in this situation
Centre goals	Percentage of goals scored at the centre point of the mid-court line after each goal relative to the number of shots made*
Power-play goals	Percentage of goals scored during Power-play action (i.e., playing situation originating following an exclusion foul of a defensive player who has to go out of the court for 20 seconds of clock time) relative to the number of shots made in this situation
5-m goals	Percentage of goals at a distance greater than 5 m relative to the number of shots made from that distance
Penalty goals	Percentage of goals scored by means of a penalty relative to the number of performed penalty throw
Counterattack goals	Percentage of goals scored during Counterattack action (i.e., playing situations where the number of offensive players relative to the ball position is higher than that of the defense) relative to the number of shots made in this situation
Assists	Number of passes from one offensive player to another leading directly to a goal score
Offensive fouls	Number of losses of the ball due to committing a foul
Steals	Number of turnovers in favour of the defense due to anticipation and snatching of the ball
Blocked shots	Shots stopped or diverted by the defenders
Won sprints	Number of sprints won – possession of the first ball in each quarter – divided by four, i.e., the number of sprints per game
Timeouts	Number of timeouts used throughout the game
Exclusions	Number of players expelled from the game for 20 seconds for breaking the rules
Goalkeeper-blocked shots	Percentage of shots stopped by goalkeeper relative to the number of shots made by the opponent players
Goalkeeper-blocked Even shots	Percentage of shots stopped by goalkeeper during Even action relative to the number of shots made in this situation by the opponent players
Goalkeeper-blocked centre shots	Percentage of shots stopped by goalkeeper made from the centre point of the mid-court line after each goal relative to the number of shots made in this situation by the opponent players
Goalkeeper-blocked Inferiority shots	Percentage of shots stopped by goalkeeper during numerical inferiority (i.e., opponents' Power-play) relative to the number of shots made in this situation by the opponent players
Goalkeeper-blocked 5-m shots	Percentage of shots stopped by goalkeeper relative to the number of shots made by the attackers at a distance greater than 5 m by the opponent players
Goalkeeper-blocked penalty shots	Percentage of penalties stopped by goalkeeper relative to the number of penalties taken by the opponent players
Goalkeeper-blocked Counterattack shots	Percentage of shots stopped by goalkeeper during Counterattack action relative to the number of shots made by the attackers in this situation by the opponent players
Possessions	A team's total number of possessions of the ball in a game (in line with each re-starting of the 30 s clock time).
Possession time	A team's minutes of possession of the ball in a game

for the team collectively. These game-related statistics are already of general use among water polo coaches and technicians, and are those that have been used in earlier studies (Enomoto et al., 2003; Escalante et al., 2011; Madera et al., 2007). The data were retrieved by one of the authors (MM), and entered manually into an Excel file. They were then subjected to a random check by another of the authors (YE) in order to detect possible errors. Once the errors had been dealt with, the data were analyzed statistically. No informed consent was necessary because the information used is in the public domain on the Website.

Table 1 lists the dependent variables (game-related statistics) of the study. The independent variable was match outcome (winning or losing teams), with the analysis being performed for each phase (preliminary, classificatory, and semi-final/bronze medal/gold medal). The preliminary phase is that which starts the competition and, in which the teams face each other in a group league format. The next phase is the classificatory phase in which the teams are paired off in a knock-out format, with the winning team passing to the next round (initially, the last 16 or the quarter-finals, and eventually the semi-finals), while the loser eventually plays in matches for the 5th to 16th place classification. The semi-final/bronze medal/gold medal phase includes the two semi-finals of each championship, and the matches for the bronze and the gold medals.

Statistical analysis

Mean and standard deviation were calculated by match outcome (winning and losing teams) and phase (preliminary, classification, and semi-final/bronze medal/gold medal). To determine the variables which differentiate and predict the winning and losing teams, two types of analysis were made: a chi-squared analysis and a discriminant analysis. Chi-squared statistics were used to show the differences by match outcome in each of the three phases. This is the recommended technique when the descriptors are discrete frequency response variables (Nevill et al., 1999; 2002). The effect sizes of the differences were calculated by each phase (Cohen, 1988).

This basic statistical study was followed by a discriminant analysis using the sample-splitting method according to match outcome and phase. The criterion used to determine whether or not a variable was discriminatory was Wilks's lambda, which measures the deviations within each group with respect to the total deviations. The sample-splitting method included initially the variable that best minimized the value of Wilks's lambda, providing a larger F value with respect to certain critical threshold (F=3.84 to include). From that point on, the method combines the variables pairwise. The next step was pairwise combination of the variables with one of them being the variable included in the first step. Successive steps were performed in the same way, always with the condition that the F-value corresponding to the Wilks's lambda of the variable to select has to be greater than the aforementioned "include" threshold. If this condition was not satisfied, the process was halted, and no further variables were selected in the process. Before including a new

variable, an attempt was made to eliminate some of those already selected if the increase in the value of Wilks's lambda was minimal, and the corresponding F-value was below a critical value (i.e., F = 2.71 to remove). We then calculated Wilks's lambda, the canonical correlation index (deviations of the between-group discriminant scores relative to the total deviations), and the percentage of correctly classified matches for each phase (preliminary, classificatory, and semi-final/bronze medal/gold medal). This methodological approach has been used in studies on other aquatic disciplines such as swimming (Saavedra et al., 2010). A p-value < 0.05 was considered to be statistically significant. The statistical analysis was performed with the software package SPSS version 15.0 (SPSS Inc., Chicago, IL, USA).

Results

Table 2 presents the basic descriptors of the variables by match outcome (winning/losing teams) in each phase. The number of variables differentiating winners from losers in each phase was 13 in the preliminary phase, 1 in the classificatory phase, and 1 in the semi-final, bronze, and gold medal phase.

Table 3 gives the results of the discriminant analysis for each phase: Wilks's lambda, the canonical correlation index, and the percentage of teams correctly classified. The predictive models classified correctly 92% of the preliminary phase using three variables (goals, goalkeeper-blocked shots, goalkeeper-blocked penalty shots), 90% of the classificatory phase using five variables (goals, goalkeeper-blocked shots, won sprints, steals, offensive fouls), and 83% of the semi-final, bronze and gold medal phase using three variables (goals, goalkeeper-blocked even shots, goalkeeper-blocked shots).

Discussion

To the best of our knowledge, this is the first study to report the influence of game-related statistics on the outcome of women's water polo matches, followed by a discriminant analysis of those statistics that predict the winning/losing teams in the preliminary, classificatory, and semi-final, bronze, and gold medal phases. The results for the most important recent International Championships (2007–2011) have shown that the variables differentiating winners and losers are not the same from one phase of the competition to another. In particular, as the phase of the competition advanced, the number of these variables declined, passing from 13 differentiating variables in the preliminary phase (including defensive actions: steals, blocked shots, goalkeeper-blocked shots, goalkeeper-blocked inferiority goals, and goalkeeper-blocked 5-m shots; and offensive actions: centre goals, power play goals, 5-m goals, counterattack goals, and assists) to one action in the classificatory (won sprints) and semi-final, bronze, and gold medal (goalkeeper-blocked even shots) phases. Similarly, the predictive power of these variables also fell, with correct classification of 92%, 90%, and 83% in the preliminary, classificatory, and final phases, respectively. The variables selected

Table 2. Basic descriptors (mean and standard deviation), chi-squared statistic, p-value, and the effect sizes of the differences (Cohen's d) for each variable according to the context in each phase. Data are means (±SD).

Variable	Preliminary (n=62)					Classification (n = 42)					Semi-final / Bronze medal / Gold medal (n = 20)				
	Winners	Losers	X^2	p	ES	Winners	Losers	X^2	p	ES	Winners	Losers	X^2	p	ES
Goals (%)[a]	46.6 (12.3)	24.9 (8.7)	158.4	.092	2.04	40.3 (12.6)	28.2 (8.4)	98.7	.101	1.13	38.9 (11.3)	25.8 (9.7)	46.0	.349	1.24
Action goals (%)[a]	37.8±16.9)	21.5 (16.5)	87.8	.074	.98	33.7 (17.3)	20.8 (13.3)	42.5	.493	.84	35.9 (14.5)	16.8 (16.3)	30.9	.191	.65
Centre goals (%)[a]	48.6 (33.2)	19.1 (34.1)	52.8	**.002**	.88	48.8 (37.1)	27.1 (35.0)	23.5	.132	.60	31.5 (30.8)	25.7 (29.6)	12.7	.468	.19
Power-play goals (%)[a]	65.9±26.3)	46.9 (31.0)	59.9	**.004**	.66	62 (26.4)	45.9 (28.1)	39.0	.064	.59	53.6 (24.6)	44.1 (26.1)	15.8	.466	.37
5 m goals (%)[a]	31.2±24.4)	13.2 (12.5)	71.1	**.010**	.93	21.9 (20.5)	14.9 (15.0)	31.9	.785	.39	26.7 (18.4)	9.8 (10.7)	34.3	.192	1.12
Penalty goals (%)[a]	37.1 (45.0)	32.7 (45.6)	4.3	.371	.10	58.7 (48.0)	41.1 (45.7)	9.9	.193	.38	55.0 (51.0)	65 (46.2)	3.8	.147	-.21
Counterattack goals (%)[a]	45.7 (44.8)	11.6 (31.0)	35.0	**<.001**	.89	35.8 (45.3)	18.9 (36.6)	12.0	.099	.41	41.7 (48.2)	30 (44.1)	6.9	.139	.25
Assists (n)	5.6 (4.1)	2.3 (2.2)	49.5	**.001**	1.00	4.1 (2.7)	3 (2.4)	13.0	.293	.43	3.8 (1.8)	3.0 (1.8)	4.4	.886	.44
Offensive fouls (n)	12.8 (3.4)	17.8 (6.1)	46.9	**.005**	-1.01	13.7 (3.9)	15.8 (4.9)	13.9	.788	-.47	14.2 (4.4)	13.4 (3.9)	15.3	.431	.19
Steals (n)	8.8 (4.9)	5.5 (2.4)	38.7	**.003**	.86	8.4 (3.6)	6.3 (2.5)	18.2	.254	.68	6.7 (3.5)	5.7 (3.0)	15.8	.262	.31
Blocked shots (n)	2.4 (1.6)	1.5 (1.6)	26.6	**<.001**	.56	2.5 (1.8)	2.1 (1.5)	9.6	.294	.24	2.5 (2.1)	1.9 (1.7)	9.8	.200	.31
Won sprints (%)[b]	63.4 (29.3)	36.3 (29.6)	39.7	**<.001**	.92	60.6 (29.6)	36.8 (29.0)	18.2	**.011**	.81	57.5 (24.5)	42.5 (24.5)	9.2	.163	.61
Timeouts (n)	1.2 (.8)	1.5 (.5)	18.2	**<.001**	-.45	1.4 (.7)	1.6 (.6)	4.1	.249	-.31	1.3 (.8)	1.6 (.5)	5.3	.149	-.45
Exclusions (n)	.5 (.8)	.7 (.7)	8.6	.125	-.27	.7 (1.1)	.5 (.8)	2.8	.593	.21	1.0 (1.2)	.7 (1.0)	4.3	.358	.27
G.B. shots (%)[c]	59.3 (11.7)	37.7 (12.6)	143.1	**.039**	1.78	54.5 (12.0)	41.9 (15.5)	75.0	.446	.91	56.3 (14.2)	44.8 (13.6)	37.3	.454	.83
G.B. even shots (%)[c]	63.2 (27.1)	45.2 (23.4)	57.2	.073	.71	64.0 (23.5)	51.5 (22.8)	33.3	.3.55	.54	71.7 (28.7)	48.5 (21.3)	22.3	**.019**	.92
G.B. centre shots (%)[c]	33.7 (43.6)	34.6 (33.5)	40.5	.130	-.02	39.7 (42.2)	21.5 (30.1)	18.9	.126	.50	40.8 (41.4)	42.4 (38.3)	9.2	.513	-.04
G.B. inferiority s. (%)[c]	34 (33.7)	22.9 (23.7)	47.4	**.009**	.38	33.7 (31.1)	23.2 (26.3)	21.8	.295	.36	36.7 (31.4)	29.7 (27.6)	8.7	.731	.24
G.B. 5 m shots (%)[c]	75.3 (23.2)	43.4 (31.9)	74.8	**<.001**	1.14	64.3 (32.6)	55.3 (33.5)	29.3	.170	.27	79.6 (20.9)	57.7 (26.1)	16.0	.355	.93
G.B. penalty shots (%)[c]	4.0 (16.4)	14.5 (30.2)	5.4	.273	-.43	12.3 (26.8)	6.9 (23.3)	6.6	.475	.22	7.5 (24.5)	5.0 (22.4)	1.0	.600	.11
G.B. counterattacks (%)[c]	11.3 (31.9)	14.2 (29.9)	17.7	.168	-.09	13.6 (32.1)	6.3 (22.1)	7.0	.430	.26	7.5 (24.5)	0 (0)	5.2	.157	.43
Possessions (n)	43.5 (4.8)	42.0 (3.7)	18.9	.530	.35	42.1 (4.5)	41.9 (4.2)	22.1	.277	.05	40.1 (3.7)	40.7 (4.4)	10.4	.735	-.15
Possession time (min)	15.2 (1.4)	16.6 (1.4)	120.0	.356	-1.00	16.0 (1.2)	16.1 (1.4)	78	.511	-.08	15.9 (1.6)	15.6 (1.2)	40.0	.338	.21

[a] = number of shots converted / number of shots. [b] = number sprints won / number of sprints swum. [c] = number of shots saved / number of shots. G.B.= goalkeeper-blocked , s.=shot. ES= Effect sizes

Table 3. Discriminant analysis models for the different phases, giving the percentage correctly classified, Wilks's λ, canonical correlation index, and variables included in the model by order of selection.

Phase	Preliminary	Classificatory	Semi-final, bronze medal, gold medal
Percentage correctly classified	91.7	90.2	83.3
Wilks's lambda	.342	.439	.592
Canonical correlation index	.811	.749	.638
Variables selected	Goals, goalkeeper-blocked shots, goalkeeper-blocked penalty shots	Goals, goalkeeper-blocked shots, won sprints, steals, offensive fouls	Goals, goalkeeper-blocked even shots, goalkeeper-blocked shots

by the model were defensive and offensive, with those being discriminant in the three phases: goals, and goalkeeper-blocked shots. These results could help coaches plan and structure their training and competitions.

Differences for match outcome (winning/losing teams)
In the preliminary phase, there were 13 game-related statistics that differentiated winning and losing teams. The winning teams had higher values for offensive playing aspects (centre goals, power play goals, 5-m goals, counterattacks goals, and assists) and lower values for turnover fouls. Also the winning teams had higher values for defensive actions (steals, blocked shots, goalkeeper-blocked shots, goalkeeper-blocked inferiority shots, and goalkeeper-blocked 5-m shots). Timeouts and won sprints, can be seen as neutral or mixed actions given their offensive and defensive nature. This is suggestive of the importance of a balance between offensive and defensive actions. These data are consistent with those of a study of the 10th World Championship held in Barcelona, Spain, in 2003 (Argudo et al., 2007) in which there were similar values of offensive and defensive parameters differentiating the winning and losing teams. However, a recent study (Escalante et al., 2011) only found differences in offensive playing aspects (5-m goals and goals). In the same line, another study (Lupo et al., 2011) found a greater number of 5-m goals and fewer shots after pump fakes in even-play and counterattack phase. Counterattacks in the winning teams are more frequently preceded by steals or blocked shots. These findings concur with previous studies indicating that winning teams make more counterattacks (Lupo et al., 2011; Takagi et al., 2005) and blocked shots (Takagi et al., 2005). This latter technical aspect (blocked shots) is, however, that which leads to most injuries (Webster et al., 2009), so that it is necessary to train to perform it correctly. The centre goals and power-play goals are more frequent in the winning teams, a finding consistent with previous studies in the men's game (Madera et al., 2007; Platanou, 2004). Finally, there are three goalkeeper-related variables which differentiate winners and losers – goalkeeper blocked shots, goalkeeper-blocked Power-play shots, and goalkeeper-blocked 5-m shots, highlighting the importance of this player for the final outcome (Platanou, 2009a).

In the classificatory phase, only the sprints differentiated between the winning and losing teams. This coincides with a recent study indicating the influence on the final result of gaining first possession of the ball (Argudo et al., 2011). The sprints also differentiate the teams in the preliminary phase, suggesting that when there are greater

differences in skill levels between the teams, the first possession is of particular importance. However, apart from explaining the cause-and-effect connection of the sprint, it is an ability requiring both good physical condition (Tan et al., 2010) and technique (Aleksandrovic et al., 2007), so that there is a need to master both in order to gain the first possession of the ball in each quarter, especially when the difference between the teams is greatest (preliminary phase).

In the semi-final, bronze, and gold medal phase, only one defensive playing aspect differentiated between winning and losing teams – goalkeeper-blocked Even goals. This is consistent with previous studies of the men's game (Escalante et al., 2011), and is further evidence for the importance of the goalkeeper in determining the final result. The difference with the variables selected in the preliminary phase – goalkeeper-blocked shots, goalkeeper-blocked centre shots, goalkeeper-blocked Power-play shots, and goalkeeper-blocked 5-m shots– may reflect the equality of the teams in the final phase.

Discriminatory power
In the preliminary phase, the variables selected by the discriminant analysis model were goals, goalkeeper-blocked shots, and goalkeeper-blocked penalty shots, with 92% of the teams being correctly classified (winners and losers). The variable that most discriminated the outcome was goals, coherent with the findings of a study on the Beijing 2008 Olympic Games (Escalante et al., 2011). The goalkeeper's defensive ability are now very important, with the model selecting goalkeeper-blocked shots, reflecting the importance of both this playing aspect and of the player herself. In this sense, there is work indicating the importance of this specific position when it comes to "building" a good team (Platanou, 2009a). That in this phase the winning teams' goalkeepers are less effective than those of the losing team in stopping penalties may be due to random aspects. Indeed, this variable showed no significant differences between winners and losers in either the men's or the women's game in other studies (Escalante et al., 2011) or in the classificatory and final phases of the present study.

In the classificatory phase, 90% of the teams were correctly classified (winners and losers) on the basis of the variables goals, goalkeeper-blocked shots, won sprints, offensive fouls, and steals. In this phase, as well as defensive goalkeeper playing aspects (goalkeeper-blocked shots), defensive actions performed by other players, such as steals, are also important. This could indicate that the winning teams were able to perform

faster actions with more effective passes leading to goals (Lupo et al., 2011), especially if one considers that the variable which most discriminates between the winning and losing teams is that of the shots (Escalante et al., 2011). The variable won sprints also discriminates winning from losing teams, indicating that first possession of the ball is a variable that needs to be taken into account in the more equally matched phases of a championship. However, when the teams are presumably particularly evenly matched (in the final phase), this variable no longer discriminates winners from losers. Finally, the turnover fouls variable reflects the winning teams' ability to put pressure on the attacking teams and recover the ball, with the smaller number of such fouls that the winners themselves commit showing the importance of maintaining possession of the ball and avoiding the losing team's defensive pressure during offensive actions.

In the semi-final, bronze, and gold medal phase, 83% of the teams were correctly classified (winners and losers) on the basis of the variables goals, goalkeeper-blocked Even shots, and goalkeeper-blocked shots. As in the previous phases, shots were the most important playing aspect discriminating winners from losers, consistent with earlier studies (Escalante et al., 2011). To this must be added that goalkeeper-blocked shots in even-play situations is the second most important variable discriminating winning from losing teams in this phase. It thus seems advisable to increase emphasis on goalkeeper training to deal with the fast and accurate shots coming from areas close to goal (Alcaraz et al., 2011) as is the usual case for shots taken in situations of even play. The final variable discriminating performance in this phase is goalkeeper-blocked shots, a variable that was also selected by the model for the other two phases, highlighting the importance of the goalkeeper in achieving victory in all phases of the championship.

Limitations

This study has some limitations. First, the distribution of the total number of matches analyzed into the different phases was naturally uneven (preliminary phase, n=92; classificatory phase, n = 42; and semi-final, bronze, and gold medal phase, n = 20). Nevertheless, there stands out the large total size of the sample (n = 230) and the level of the competitions (the top international level). Second, in the preliminary phase there occur matches in which neither team any longer has any possibility of passing to the next round, which could well influence the corresponding game-related statistics. Third, the discriminant analysis used *post hoc* prediction. In interpreting the results, it needs to be borne in mind that this type of prediction usually gives higher values for the classification than *a priori* predictions.

Conclusion

This study has shown that women's water polo game-related statistics differentiate winners from losers in each phase of an International Championship. Nevertheless, it was only in the preliminary phase that more than one variable was involved in this differentiation, including both offensive and defensive aspects of the game. The game-related statistics were found to have a high discriminatory power in predicting the result of matches (92% of the preliminary phase, 90% of the classificatory phase, and 83% of the semi-final, bronze, and gold medal phase), with shots and goalkeeper-blocked shots being discriminatory variables in all three phases. Knowledge of the characteristics of women's water polo game-related statistics of the winning teams and their power to predict match outcomes will allow coaches to take these characteristics into account when planning training and match preparation.

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Key points

- The preliminary phase that more than one variable was involved in this differentiation, including both offensive and defensive aspects of the game.
- The game-related statistics were found to have a high discriminatory power in predicting the result of matches with shots and goalkeeper-blocked shots being discriminatory variables in all three phases.
- Knowledge of the characteristics of women's water polo game-related statistics of the winning teams and their power to predict match outcomes will allow coaches to take these characteristics into account when planning training and match preparation.

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