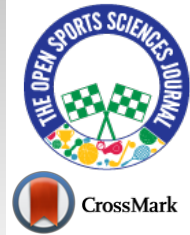




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PERSPECTIVE

Rule Changes in Water Polo – History, FINA 2018 New Rules, and Literature Review

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Abstract:

Water polo has recently encountered extensive challenges, including possible banishment from the Olympics. To meet the challenges, major rule changes have been implemented. This perspective is to provide a literature review of the impact of rule changes on water polo gameplay. An emerging and relatively small body of research has demonstrated significantly enhanced game dynamics and outcomes as intended by recent rule changes. The water polo community needs more analytical research on the impact of the latest rule changes approved in 2018.

Keywords: Water polo, Rule changes, Impact, Gameplay, Performance, FINA.

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1. INTRODUCTION

WATER POLO is a team sport regulated by a complex set of rules that have shaped the gameplay and have undergone significant changes, as shown in Table 1 [1, 2].

As the governing body of water polo, Fédération Internationale de Natation (FINA) revises its rules every four years. Under the highly competitive environment of sports, water polo is losing its fan base, media coverage, and global market and has even been threatened with banishment from the Olympics [3]. Many coaches and FINA officials have criticized that the game has become both less interesting for spectators and excessively rough plays [4, 5]. The recent FINA revisions are expected to improve the game dynamics by speeding up the game, favoring offensive play, and creating games with higher goal counts [6]. The impact of rule changes on water polo has not been comprehensively reviewed, despite extensive studies on this topic for a variety of other sports [7, 8].

2. SUMMARY OF PREVIOUS RESEARCH

Over the past decade, an emerging body of performance research literature started to show that certain aspects of the water polo game have been consistently altered by the recent FINA rule changes. Two articles examined the effects of one major change introduced by the FINA 2005: changing the penalty shot distance from 4 meters to 5 meters [9, 10]. Both studies analyzed World Championships years before and after

the modification and found that the longer distance for penalty shots did not result in a lower success rate. Penalty goals contributed double to all goals scored under the new regulation, but the proportion of penalties that affected the final outcomes (win/loss/tie) stayed the same. Other changes in water polo game dynamics and outcomes were also associated with the new FINA 2005 rules, including an increase in the duration of swimming, a decrease in the duration of contact, more total goals and throws attempts, and more throws from peripheral positions [11, 12]. Along the same line of inquiry, Argudo *et al.* further studied the influence of the new FINA 2005 and 2009 rules, with a detailed focus on shot dynamics under different situational frameworks [13]. The new rules impacted men's and women's categories differently. In women's games, there were fewer successful goals despite more attempts during counterattacks. There was no alternation in men's games under the new rules. The difference was attributed to the following rule modification: reducing the length of the playing field from 30 to 25 meters in only the women's category. Some of the above findings were consistent with those shown by Madera *et al.* [2]. In the longitudinal study, box scores were retrieved from men's matches from Olympic Games since 1936 and all of the World Championship games. Rule modifications have been associated with changes in outcomes throughout the history of water polo. For example, there was an increase in the number of goals when possession time was decreased from 45 to 35 seconds (FINA 1977) and 35 to 30 seconds (FINA 2005), suggesting that the reduction in possession time has sped up the pace of the game and enhanced competitiveness. Moreover, the

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FINA 2005 rule change of increasing the total game time from 28 to 32 minutes was followed by a larger number of goals in winning teams but not in losing teams. The lack of direct effects on losers' goals indicates a discrepancy in adaptation to new regulations. The more recent rule changes in FINA 2013 were investigated by Sahrom *et al.* [14]. Under the new rules, exclusion fouls and the number of passes nearly doubled, suggesting more dynamic movements and explosive swimming speed as intended by the FINA 2013 modification. An exclusion foul is a good indicator for game dynamics as it is characterized by intensive fighting for positions before an exclusion foul is committed and a resultant "man-up" situation when the offensive team tries to exploit the advantage by enhanced swimming, frequent passing, and creative tactics and techniques. Unexpectedly, the study also found that the increased dynamics related to more exclusion fouls was partially offset by exclusion fouls per se which involve significantly extended pauses and consequent longer static durations, contradicting the intention of reducing static situations in the FINA 2013 rule change.

3. EXPLANATION OF SUBJECT MATTER

In light of the latest challenges, including possible banishment from the Olympics, the current FINA 2018 rule changes were voted and accepted in December 2018 to further transform water polo into a much more dynamic and spectacular sport [15]. The major FINA 2018 rule changes include the following: decreasing possession time from 30 to 20 seconds: after: i) a corner throw ii) a rebound after a shot which does not cause change of possession iii) after an exclusion, 2) decreasing the half time length from 5 to 3 minutes, 3) decreasing the number of timeouts to two per game from one per quarter, 4) allowing goalies to move past the center pool line, 5) increasing the substitution area from the goal line to the center pool line, 6) rewarding a penalty shot if a player is attacked from behind while attempting to shoot inside 6 meters, 7) allowing the ball to be put in play when taking a corner throw, 8) allowing the ball to be put in play after a foul outside 6 meters, and 9) taking free throws from the location of the ball [16 - 18].

To our knowledge, there have been only three published articles studying the impact of the FINA 2018 rule change on water polo games. In April 2019, LEN Europa Cup became the first official international match in which the FINA 2018 regulations were implemented [3]. In a review article, Lozovina and Lozovina concluded that the FINA 2018 rule changes were essentially "cosmetic actions" without significant improvement in game attractiveness [6]. Saavedra *et al.* investigated the next major match: the 18th FINA World

Championship in July 2019 [19]. When compared to historical data, throw effectiveness increased by 12% among winning teams and remained the most predictive variable for wins under the new FINA 2018 regulations. The new rules did not change the pivotal role of a good goalkeeper for winning teams. In January 2020, the 34th European Championship was the latest match as the COVID-19 pandemic crisis resulted in the cancelation of all the following major water polo matches, including the 2020 Tokyo Olympics. Argudo *et al.* compared shot indicators in balanced matches from male European Championships in 2020 and 2006 [20]. In the matches where the new regulations were implemented, the study showed more shots in man-up situations and fewer shots during counterattacks. In terms of throw position, more shots were observed from the left side and fewer from the center and right side.

4. PROBLEMS AND CONTRADICTIONS

The literature has demonstrated that most of the alterations in gameplay are consistent with FINA's intention to make water polo a more dynamic and attractive sport. Unexpectedly, some of the gameplay changes are in the opposite direction of FINA's intentions. For example, the increased dynamics related to more exclusion fouls were partially offset by exclusion fouls per se which involve significantly extended pauses and consequent longer static durations, contravening the intention of reducing static situations in the FINA 2013 rule change [14]. Furthermore, the resulted changes in gameplays are more diverse and complex than initially anticipated. For example, reducing ball possession from 35 to 30 seconds (FINA 2005) has a significant impact on shot dynamics in female games but not in male games [13]. When possession time was further decreased from 30 to 20 seconds after reset (FINA 2018), men's games started to show an increase in the number of throws and effectiveness of throws [20]. Different teams also had different responses to the rule changes, with swifter adjustments among stronger teams [2]. The influence of rule changes has gone beyond athletes and coaches to referees. A time-lapse was found between the implementation of the new rules and adaptation by referees in their umpiring styles [14]. Of note, the FINA 2018 rule changes were regarded by some as essentially "cosmetic actions" despite the significant impact shown in the literature [6]. Lastly, although the literature has suggested associations between FINA rule changes and several alternations in different aspects of gameplay, none of the results have met the criteria to prove a causal relationship. Given the limited literature, we could not perform deeper investigations such as a meta-analysis that may provide more definitive information on the cause-effect relationship.

Table 1. Summary of the major rule changes in water polo from 1942 to 2005 [2].

Year of Change	Structural Rules		Functional Rules			
	Period × Time (Game)	Swimming Pool Dimensions	Possession Time (s)	Exclusion Time (s)	Timing	Minimum Distance (Direct Shot)
≤1942	2 × 10 min (20 min)	30 × 20 m	-	-	Static	4 m
1949	4 × 5 min (20 min)	-	-	-	No static	-
1961	-	-	-	-	-	-
1971	-	-	45	60	-	-
1977	-	-	35	45	-	-

(Table 3) *contd....*

Year of Change	Structural Rules		Functional Rules			
	Period × Time (Game)	Swimming Pool Dimensions	Possession Time (s)	Exclusion Time (s)	Timing	Minimum Distance (Direct Shot)
1981	4 × 7 min (28 min)	-	-	-	-	-
1986	-	-	-	35	-	-
1991	-	-	-	20	-	-
1996	-	-	-	-	-	7 m
2005	4 × 8 min (32 min)	30 × 20 m (men) 25x 20 m (women)	30	-	-	5 m

CONCLUSION

Overall, the existing literature has provided quantitative evidence that FINA rule changes have been associated with measurable and significant changes in certain aspects of the gameplay such as increased shot frequency and diversity, total goals, and players' swimming movements. Most of the alterations in gameplay are consistent with FINA's intention to make water polo a more dynamic and attractive sport.

SUGGESTIONS FOR FURTHER RESEARCH

Further research on the impact of FINA 2018 rule changes is challenged by limited data available for analysis as the COVID 19 pandemic crisis has resulted in the cancelation of all the following major water polo matches, including the 2020 Tokyo Olympics. Furthermore, training schedule and intensity may have been substantially altered during the COVID-19 pandemic, introducing a potential confounding factor for analysis of post-pandemic games. Despite the difficulties, it is necessary for the water polo community to have more data-driven investigations of the impact of the FINA 2018 rule changes. Such research may need to explore the following questions: 1) Which gameplay factors are associated with or affected by the rule modifications? Evidently, variables related to shot dynamics are strong indicators of game outcome and game attractiveness to spectators. These variables have been the foci of most of the studies discussed above. Future research will be more productive if it extends the scope of the investigation to a variety of other factors, such as changes in training and substitute strategy. Under the new FINA 2018 rule which was intended to enhance water polo game dynamics, higher physical demand probably has changed coaches' substitution strategy. The FINA 2018 rules also have extended the substitution area from the goal line to the center pool line, making the substitution process quicker and without interrupting game rhythm. In addition, future research can include the study of potential impact of rule changes on training, particularly in the setting of the COVID-19 pandemic. Madera *et al.* has indirectly suggested that different water polo teams had different approaches, including training, of adapting to rule changes [2]. 2) Which one of regulation changes have generated the most significant impact in gameplay? and 3) Are the consequent alterations in gameplay in line with FINA's intentions? Answers from the analytics research may help players and coaches interpret the effect of the 2018 FINA rule changes and apply the findings to training and water polo strategies. Results from such investigations will also provide quantitative evidence to guide future revisions of the current rules.

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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