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Analysis of the differences in the technical-tactical performance indicators in The FIFA Women's World Cup 2023 according to the final classification

Análisis de las diferencias en los Indicadores de Rendimiento Técnico-Tácticos en la Copa Mundial Femenina de la FIFA 2023 según la clasificación final

Análise das diferenças nos Indicadores de Desempenho Técnico-Tático na Copa do Mundo Feminina FIFA 2023 de acordo com a classificação final

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Abstract

The Women's World Cup is the most important international tournament in women's soccer worldwide. Despite the various challenges women's soccer has faced throughout history, it has become a highly relevant sports discipline. The aim of this research was to analyze the Performance Indicators of the teams participating in the 2023 Women's World Cup. Specifically, it sought to identify the performance profiles of each group based on the final classification and analyze these indicators according to the final ranking of the 2023 Women's World Cup. Using *Z-scores*, performance profiles were constructed for the groups according to their final classification. Additionally, a linear mixed-effects model was conducted, controlling for the random factor of participating teams, revealing significant differences based on the final ranking in the attack, defense and referee-related action categories. Notably, differences were observed between the group that only participated in the Group Stage and the other groups. These findings provide specific information to the coaching staff of women's national soccer teams, offering an analysis of strengths, weaknesses and game trends in this sport. This insight enables more detailed preparation for future matches, tailored to the context of women's soccer.

Keywords: women's soccer; performance profiles; final classification.

Resumen

El Mundial de Fútbol Femenino corresponde al torneo internacional de Fútbol Femenino más importante del mundo. A pesar de los diferentes desafíos que ha enfrentado el Fútbol Femenino a lo largo de la historia, este ha logrado convertirse en una disciplina deportiva muy relevante. El objetivo de esta investigación fue analizar los Indicadores de Rendimiento de las selecciones participantes en el Mundial de Fútbol Femenino 2023. De manera específica, se buscó identificar los perfiles de rendimiento de cada grupo según la clasificación final y analizar dichos indicadores según el *ranking* final del Mundial de Fútbol Femenino 2023. Por medio de las puntuaciones Z, se construyeron los perfiles de rendimiento de los grupos según la clasificación final. Además, se realizó un modelo lineal mixto controlando el factor aleatorio de las selecciones participantes, encontrando diferencias significativas en función del *ranking* final en las categorías de análisis de ataque, defensa y acciones arbitrales, especialmente, entre el grupo que solo participó en Fase de Grupos y los demás grupos. Estos resultados brindan información específica para los cuerpos técnicos de selecciones nacionales de Fútbol Femenino, con un análisis de fortalezas, debilidades y tendencias de juego en de este deporte, lo que les permitiría una preparación más detallada para futuros partidos y acorde al ámbito del Fútbol Femenino.

Palabras clave: fútbol femenino; perfiles de rendimiento; *ranking* final.

Resumo

A Copa do Mundo de Futebol Feminino corresponde ao torneio internacional de Futebol Feminino mais importante do mundo. Apesar dos diferentes desafios enfrentados pelo Futebol Feminino ao longo da história, este conseguiu se consolidar como uma disciplina esportiva de grande relevância. O objetivo desta pesquisa foi analisar os Indicadores de Desempenho das seleções participantes na Copa do Mundo de Futebol Feminino 2023. Especificamente, buscou-se identificar os perfis de desempenho de cada grupo conforme a classificação final e analisar esses indicadores com base no ranking final da Copa do Mundo de Futebol Feminino 2023. Por meio das pontuações Z, foram construídos os perfis de desempenho dos grupos conforme a classificação final. Além disso, foi realizado um modelo linear misto, controlando o fator aleatório das seleções participantes, identificando diferenças significativas em função do ranking final nas categorias de análise de ataque, defesa e ações arbitrárias, especialmente entre o grupo que participou apenas da Fase de Grupos e os demais grupos. Esses resultados oferecem informações específicas para as comissões técnicas das seleções nacionais de Futebol Feminino, com uma análise das forças, fraquezas e tendências de jogo neste esporte, permitindo uma preparação mais detalhada para partidas futuras e alinhada ao contexto do Futebol Feminino.

Palavras chaves: futebol feminino; perfis de desempenho; classificação final

Introduction

The Women's World Cup (WWC) is the most important international Women's Soccer (WS) tournament, with its first edition held in China in 1991 (FIFA, 2022). However, there are records predating this date of WS matches and two unofficial world competitions not recognized by FIFA (Clarke, 2019). It was not until the most recent edition, held in Australia and New Zealand in 2023, that 32 teams participated for the first time, mirroring previous men's editions. Additionally, it was the first to be hosted in two different countries from separate confederations (FIFA, 2023a). Despite the various challenges WS has faced throughout history (Gómez, 2019; González, 2023), it has managed to establish itself as a highly significant sporting discipline and has become the new global sporting phenomenon due to the great interest of fans in the different tournaments. For this reason, there has emerged a need to analyze WS from its technical and tactical components to documenting various soccer-related events (Soroka, 2017).

In team sports, scientific evidence aimed at detailing game behavior to understand it has experienced growth in descriptive, comparative, and predictive studies on sports performance analysis. Additionally, there has been an increase in studies focused on situational variables to address the variability, instability and complexity that characterize team sports (Marcelino et al., 2011). For this reason, in Men's Soccer (MS), Performance Indicators (PI) have been studied based on competition formats (Lago-Peñas, 2007), the match outcome (Kubayi & Larkin, 2022), the influence of partial and final opposition quality on results depending on the stage of the season (Fernández-Cortés et al., 2022), the influence of location (Fernández-Cortés et al., 2024; Ugalde-Ramírez & Rivas-Borbón, 2023), playing styles across continents (Izquierdo & Redondo, 2022) and the relationship-prediction of sporting success in different competitions (Ramos et al., 2021).

Another variable studied within PI in MS is the analysis of differences based on the final ranking of a league tournament (Brito de Souza et al., 2019) and Men's World Cups (MWC) (Kautzner, 2015), aimed at comparing the best and worst teams in a competition according to the tournament's final standings. Longo et al. (2019), showed that in the Italian league, performing a higher number of sprints, creating more goal opportunities, total shots, on-target shots and assists predicted the probability of reaching the top positions in the final ranking. Similarly, in the Spanish league, teams that ranked lower covered greater total distances at lower intensities than higher-ranked teams, as the latter performed efforts at higher intensities (Clemente et al., 2019).

In the case of WS, although research analyzing PI at the technical, tactical, physical, and contextual levels is limited (Harkness-Armstrong et al., 2022), some studies have examined specific aspects of the sport. For instance, the influence of scoring first has been studied in European WS Leagues (Ibáñez et al., 2018; Sánchez-Murillo et al., 2021) and corner kick actions were compared between the 2015 WWC and the 2014 MWC to identify differences in regularity, effectiveness, impact and PI associated with the success of this game action (Maneiro et al., 2019). However, after a brief literature review, there is limited research in WS on differences based on the final rankings of a tournament. Ugalde-

Ramírez & Rodríguez-Porras (2021) indicated that in the 2019 WWC, the top four teams exhibited greater ball possession, performed a higher number of on-target shots and corner kicks than they received and received fewer yellow cards compared to the teams that did not reach the semifinals.

Identifying the playing trends of the highest-ranked teams allows for the analysis of the factors necessary to achieve better positions in the final standings of a World Cup and to address the deficiencies of lower-ranked teams, thereby improving sports performance for future global competitions. For this reason and given the lack of studies on PI based on the final rankings in WS, a general objective was established. This was to analyze the PI of the teams participating in the 2023 WWC, which was operationalized into two specific objectives: i) to identify the performance profiles of each group based on the final standings and ii) to analyze the PI of the teams participating in the 2023 WWC according to their final ranking.

Materials y Methods

Sample

A total of 64 matches from the 2023 Women's Soccer World Cup were analyzed, including both the group stage and the knockout stage, as well as matches that went into extra time. Data from both teams in each match were collected, resulting in a total of 128 cases. The complete match data were considered regardless of the total time played. These data were obtained from the official FIFA website for the 2023 WWC Australia-New Zealand (https://www.fifa.com/es/tournaments/womens/womensworldcup/australia-new-zealand2023/scores-fixtures?country=ES&wtw-filter=ALL) (FIFA, 2023).

Variables

For the independent variable, the participating teams were classified into four groups based on the final ranking of the 2023 WWC. These were organized as follows: Group Stage= teams that only played in the group stage (n= 16 teams, three matches each), Round of 16= teams that played in the group stage and the round of 16 (n= 8 teams, four matches each), Quarterfinals= teams that played in the group stage, round of 16 and quarterfinals (n= 4 teams, five matches each) and Finalists= teams that played in the group stage, round of 16, quarterfinals, semifinals and final or third/fourth place matches (n= 4 teams, seven matches each) (see Figure 1). On the other hand, the 47 dependent variables were defined based on prior literature (Liu et al., 2016; Mao et al., 2016) and were organized into three categories of analysis: attack, defense, and refereeing actions (see Figure 2).
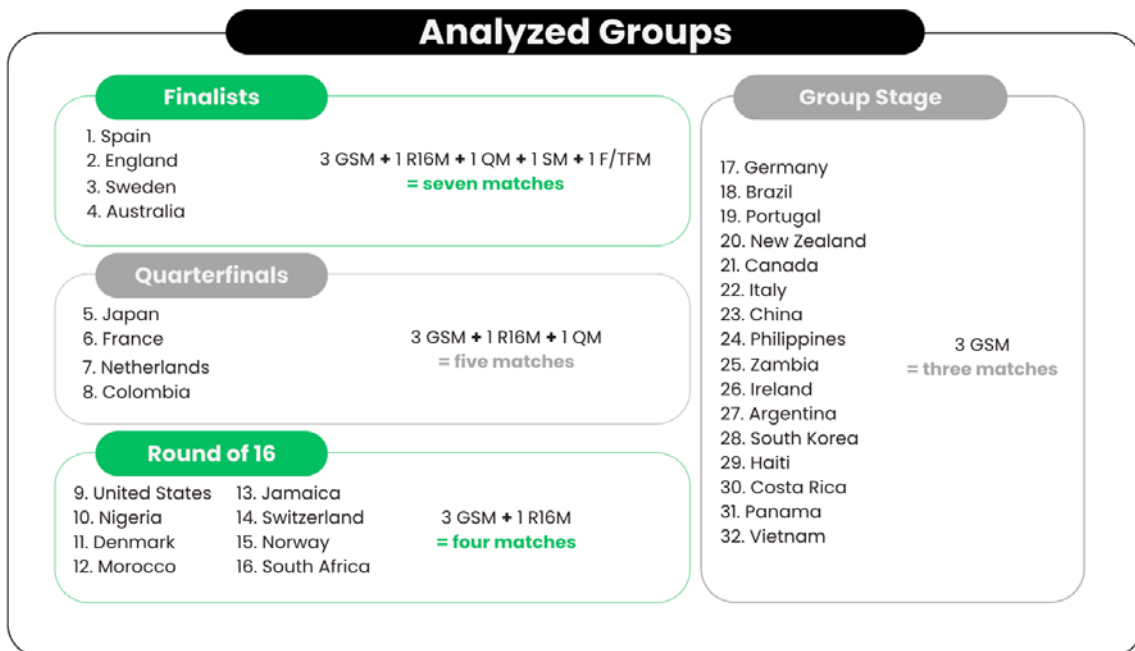
Notas. GSM= Group Stage Matches; R16M= Round of 16 Match; QM= Quarterfinal Match; SM= Semifinal Match; F/TFM= Final or Third-Fourth Place Match.

Figure 1. Classification of the teams participating in the 2023 WWC based on the final ranking.

Instruments

The instrument used was an Ad Hoc Microsoft Excel sheet. After data tabulation, the information was transferred to the statistical package Jamovi 2.4.7 to perform the respective analyses (The Jamovi Project, 2023; R Core Team, 2022).

Procedure

After collecting the data from the FIFA website and transferring it to the statistical software, its reliability was evaluated to analyze its consistency at two different time points (Field, 2024). It is recommended that this analysis be performed on 10-20% of the sample size, with no fewer than 50 units and no more than 300 units (Igartua, 2006). Therefore, data from six matches of the 2023 WWC were recollected from the FIFA website two months after the initial collection. The intra-observer reliability test reported very good and high values (>.932) (Kappa Coefficient and Intraclass Correlation Coefficient, respectively) (Altman, 1991; Vincent, 1999).

For the statistical analyses, the data were normalized to the total number of matches played in the World Cup according to each established group (Finalists= seven matches; Quarterfinals= five matches; Round of 16= four matches; Group Stage = three matches).

Subsequently, the visual tool of performance profiles was used, which facilitates the comparison of PI among comparable elements, such as players, teams or seasons. Through a graphical representation or image, physical, tactical or technical values are displayed, highlighting the main differences or similarities between the elements. The data were normalized using the Z-score (Gómez-Ruano & Lago-Peñas, 2018).
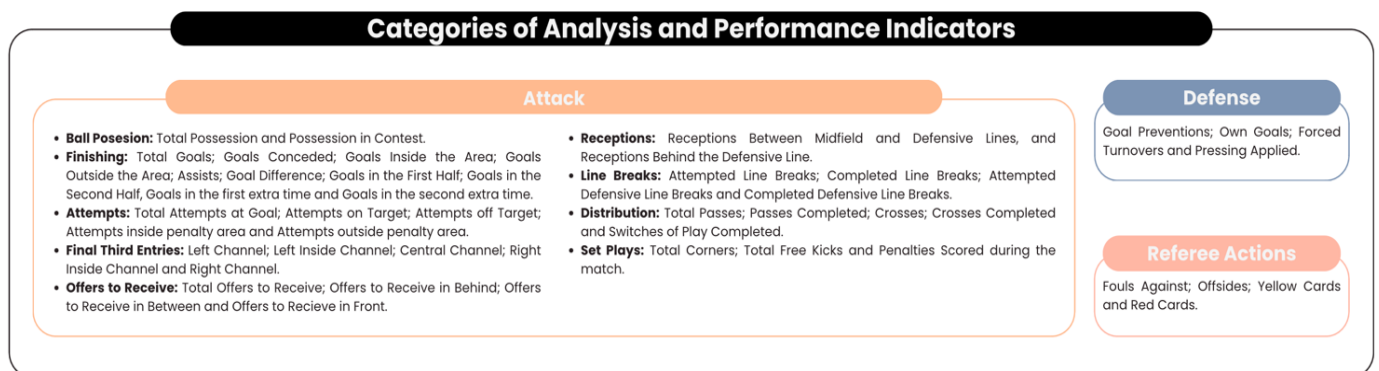

Figure 2. Categories of Analysis and PI analyzed.

Stadistical Analysis

The assumptions of the criteria were tested. The distribution of the dependent variables was evaluated using the Shapiro-Wilk test (p>.05) and their homogeneity was tested using Levene's test (p>.05). Secondly, a Mixed Linear Model (MLM) was performed, adjusting for the random factor (identifier for each team) and the fixed factor of final ranking. The model fit was assessed based on the AIC values, the marginal R^2 and the conditional R^2. Additionally, for each analysis, the ICC values and their significance were reported to determine if the random effect of the teams was significant (Correa & Salazar, 2016; Waterman et al., 2012).

Thirdly, for pairwise comparisons, the Bonferroni post-hoc test was used. The effect size of the model was obtained using partial eta squared (ηp^2) (<0.01= Trivial; 0.01-0.06= Small; 0.06-0.14= Moderate; >0.14= Large) (Cohen, 1988). Cohen's d was used to determine the effect size of pairwise comparisons (<0.2= Trivial; 0.2-0.6= Small; 0.6-1.2= Medium; 1.2-2.0= Large; >2.0= Very Large) (Batterham & Hopkins, 2006), and statistical power was calculated (O'Donoghue, 2012).

Fourthly, to create the performance profiles, the data were transformed to Z-scores and standardized using the same scale (Gómez & Lago-Peñas, 2018). The significance level was set at p<.05. All results were generated using the Jamovi 2.4.7 data analysis software (The Jamovi Project, 2023), which uses the R programming language (R Core Team, 2022).

Results

The descriptive results (mean and standard deviation) of the 2023 WWC can be found in Appendix 1 and are visually represented as performance profiles in Figure 3 (attack) and Figure 4 (defense and referee actions).

The results of the MLM for the random factor (team) and the fixed factor (final ranking of the World Cup) were statistically significant in 21 PI, with 16 variables related to attack, three related to defense and two related to referee actions (p<.05). The AIC values ranged from 36 to 1279. Effect sizes ranged from 0.08 (moderate effect) for variables such as goal difference and offsides, up to 0.76 (large effect) for the variable possession in contest. Of the 21 significant variables, 16 showed a large effect and 5 showed a moderate effect. Statistical power was >.95 for all variables, indicating high power and a very low probability of Type II error, which increases the confidence in detecting real effects.

The adjusted model for the random factor of final ranking was statistically significant in 11 variables, with marginal R^2 values ranging from 0.14 to 0.58, conditional R^2 values ranging from 0.35 to 0.70, and ICC values ranging from 0.22 to 0.56 (p<.05), indicating that the individual responses of the teams differed. Improvements in the conditional R^2 over the marginal R^2 reflect how the adjusted factors explain the variability of the PI. The marginal R^2 indicates how much of the variability is solely attributed to the final ranking, highlighting its influence throughout the tournament. Meanwhile, the conditional R^2 shows how much of the variability is explained by the final ranking while accounting for the random factor (each team's identifier), revealing that the individual response of each team was different. This suggests that the differences between the established groups and teams influenced the variability of the PI. This behavior indicates that such variability could be attributed to different factors. In the case of offensive PI, it might be due to the style and dynamics of offensive play, which can vary between teams or phases of the tournament analyzed. For defensive PI, it might stem from defensive strategies employed or tactical decisions made. Additionally, the influence of contextual variables, such as opponent quality, match conditions or weather, pitch surface or even the physical fatigue experienced by the players throughout the tournament, could also play a role.

Post-hoc Bonferroni tests revealed statistically significant differences between the Group Stage and Round of 16 groups in three PI, two of which belong to the attack category (possession in contest and attempted line breaks) and one from the defense category (forced turnovers) (*p*<.05). Between the Group Stage and Quarter-Final groups, significant differences were found in five PI, two of which belong to the attack category (possession in contest and attempted line breaks), two from the defense category (forced turnovers and pressing applied) and one from the referee actions category (fouls against) (*p*<.05). Between the Group Stage and Finalist groups, significant differences were found in 20 PI, with 16 belonging to the attack category (ball possession, contested ball possession, goals conceded, goal difference, shots outside the penalty area, penetrations into the last third of the left flank, total passing lines, passing lines in the middle, receptions between midfielders and defenders, total attempts to break lines, successful line breaks, attempted line breaks, total passes, and total free kicks), three from the defense category (goal preventions, forced turnovers and pressing applied)and two from the referee actions category (fouls against and offsides) (*p*<.05) (see Appendix 2).
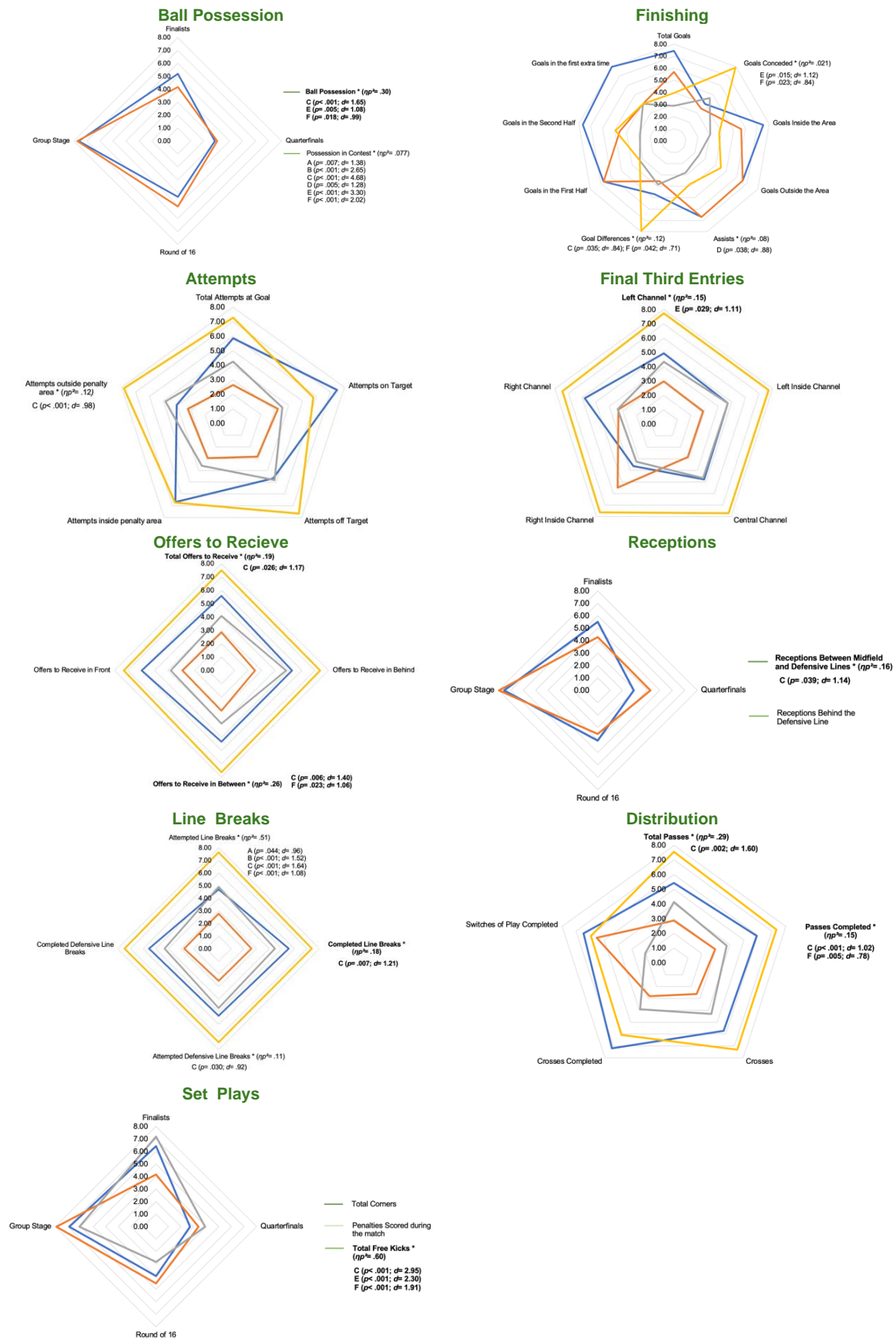
Figure 3. Performance Profiles at the PI level in attack according to the final ranking of the MFF 2023.
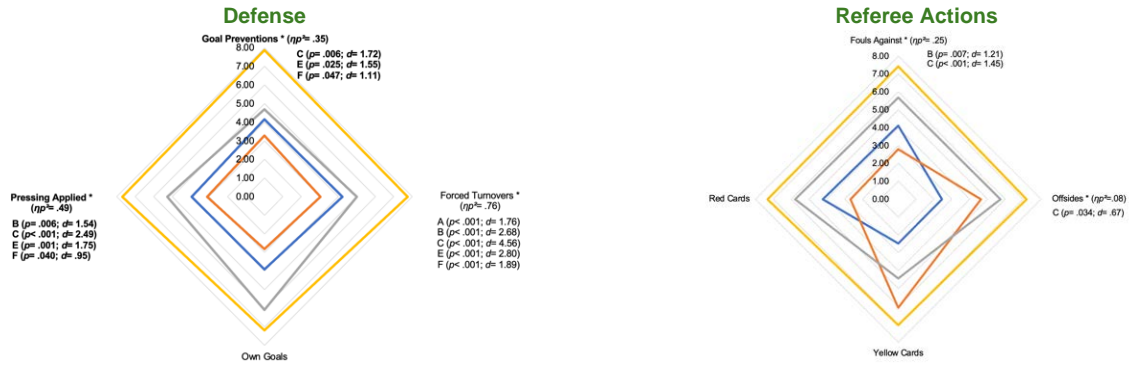
Notes. *= *p*≤.05; Bold= necessary to control variability; F= Finalists; Q= Quarterfinals; R16= Round of 16; GS= Group Stage; A= differences between F and Q; B= differences between F and R16; C= differences between F and GS; D= differences between Q and R16; E= differences between Q and GS; F= differences between R16 and GS; *d* = Cohen's *d*; ━ = GS; ━ = R16; ━ = Q ; ━ = F.

Notes. *= *p*≤.05; Bold= necessary to control variability; F= Finalists; Q= Quarterfinals; R16= Round of 16; GS= Group Stage; A= differences between F and Q; B= differences between F and R16; C= differences between F and GS; D= differences between Q and R16; E= differences between Q and GS; F= differences between R16 and GS; *d* = Cohen's *d*; — = GS; — = R16; — = Q ; — = F.

Figure 4. Performance Profiles at the PI level in defense and referee actions according to the final ranking of the MFF 2023.

Significant differences were also observed between the Round of 16 and Quarter-Final groups in two PI from the attack category (total possession and assists) (*p*<.05). Between the Round of 16 and Finalist groups, significant differences were found in eight PI, of which five belong to the attack category (total possession, possession in contest, goals conceded, attempted line breaks and total free kicks) and three belong to the defense category (goal preventions, forced turnovers and pressing applied) (*p*<.05). Furthermore, significant differences were found between the Quarter-Final and Finalist groups in 11 PI, of which eight belong to the attack category ((total possession, possession in contest, goals conceded, goal difference, offers to receive in between, attempted line breaks, passes completed and total free kicks) and three belong to the defense category (goal preventions, forced turnovers and pressing applied).

Discussion

The general objective of this study was to analyze the PI of the teams participating in the 2023 FIFA WWC. Specifically, it aimed to identify the performance profiles of each group according to their final ranking and analyze the PI of the teams participating in the 2023 WWC based on the final ranking. Significant differences were found based on the final ranking, across all groups analyzed, formed by the participating teams in the 2023 WWC, in PI from the categories of attack, defense and referee actions. The highest number of differences was observed between the group of teams that only participated in the Group Stage and the other established groups.

In the performance profiles of each analysis category, different behaviors were observed based on the established groups. The teams that only participated in the Group Stage displayed a higher number of actions in most of the PI from the three analyzed categories. The teams that participated in the Round of 16 and Quarterfinals had a balanced number of actions compared to the other groups. Lastly, the Finalists stood out for performing more actions in terms of completed variables or those closer to the opponent's goal. Liu et al. (2015b) identified different performance profiles in goalkeepers from La Liga during the 2012-13 season, which varied according to factors such as match location, level of opposition, and final result. Also, Enciso-Mota and Lago-Peña (2020) reported distinctive behavior in the performance profiles identified in forwards from La Liga during the 2019-20 season. In this case, forwards from teams with better performance excelled in offensive actions associated with scoring and playmaking. Regarding team performance, Liu et al. (2015a) analyzed the UEFA Champions League from the 2009-10 to 2012-13 seasons and reported that, regardless of the degree of opposition, the final result or match location, higher-level teams showed better stability in their performance. On the other hand, teams with intermediate and lower levels showed greater variation in their performance based on the analyzed variables. These results show that performance profiles reflect the behavior of the participating teams, based on the number of actions employed during the matches of the 2023 WWC. Additionally, these findings highlight the

importance of considering contextual characteristics when analyzing playing trends, which can be key to optimizing performance and achieving better results.

This study revealed significant differences in 16 attack-related PI, with the teams that only participated in the Group Stage showing more offensive actions. In contrast to this study, in the Chinese Superleague of the 2019 season, Kong et al. (2022), indicated that the play style of the top five teams, based on final ranking, was technically and physically balanced, while the bottom five teams showed less intensity and less ball possession. Also, Fernández-Cortés et al. (2023), found that the highest-ranked teams in La Liga from the 2014-15 to 2020-21 seasons had better statistics in ball possession and total passes, which were the most influential PI in their final ranking, allowing them to execute more offensive actions like shots, thus increasing their chances of winning. Additionally, Sánchez-Murillo et al. (2021), indicated that the higher-ranked teams scored first in their matches during the 2018-19 season of three European WS tournaments, generating an advantage that conditioned the game dynamics, tactics and tournament planning, a factor that also influenced the final result and the total goals scored. It seems that in soccer, there is an offensive play pattern where higher-ranked teams tend to perform more attacking actions. However, in the 2023 WWC, the efficiency of offensive play was a determining factor in performance and final ranking, surpassing even the total number of offensive actions made. This is evident in that the lower-ranked teams performed more offensive actions but with lower efficiency, such as in assists, direct shots on goal, shots inside the área and missed shots. This suggests that, although better-ranked teams performed fewer offensive actions throughout the World Cup, they made more effective use of attacking opportunities to score. This ability to generate goal-scoring chances may have given them a strategic advantage by scoring first, thereby conditioning the flow of the game and ensuring their success.

On the other hand, in this study, the PI of the defensive variables category showed significant differences in three PI. According to Delgado-Bordonau et al. (2013), in the 2010 MWC, teams that did not reach the semifinals received more shots and goals against, although they had a higher percentage of defensive effectiveness. In contrast, the higher-ranked teams were those that scored more goals and conceded fewer (Clemente, 2012). Likewise, Ugalde-Ramírez & Rodríguez-Porras (2021) observed in the 2019 WWC that teams that did not advance to the semifinals received more direct, off-target and blocked shots. Furthermore, Longo et al. (2019), pointed out that during the 2016-17 Italian Serie A season, the best predictors of success were sprints, goal attempts, total shots, shots on target and assists, which increased the chances of achieving higher positions in the final ranking. These results explain how certain PI are related to the success of teams in soccer tournaments. While studies focusing on the defensive aspects of teams are limited, the findings suggest that both offensive and defensive factors are crucial for understanding performance and success in different competitive contexts. Specifically, the results of this study indicate that a greater participation in defensive actions is indicative of a lower level of performance, as lower-ranked teams faced greater defensive pressure due to the offensive dominance exerted by their opponents.

In the case of the PI related to referee actions in this study, significant differences were found in two PI. Similar to the present study, Ugalde-Ramírez & Rodríguez-Porras (2021), pointed out that in the 2019 WWC, the teams that did not reach the semifinals were the ones that committed and received the most fouls. Regarding offside calls, the results of this study were contrary to those reported by Brito de Souza et al. (2019), in La Liga from the 2010-11 to 2017-18 seasons, where the highest-ranked teams committed more offsides compared to lower-ranked teams. Furthermore, Pappalardo et al. (2021), after comparing the 2018 MWC Cup with the 2019 WWC, highlighted that the pace of play between men and women was similar. However, women committed fewer fouls and offsides than men. On the other hand, men were more accurate in passing and struck the ball from greater distances than women. These results indicate that referee actions such as fouls and offsides can provide key insights into the dynamics of the matches and the competitive level of the teams. In this study, the less successful teams, which occupied lower final positions, faced greater defensive pressure and situations that led to fouls, reflecting their vulnerability against more dominant rivals. Moreover, the behavior of offsides varied across competitions, suggesting that this variable may be influenced by other

tactical or strategic factors specific to each context and could serve as a good indicator of the effectiveness of a team's offensive phase of play. On the other hand, similarities and differences between the Men's and Women's Soccer World Cups are evident, which enriches the understanding of the specific characteristics of sports performance in WS. Therefore, the need to continue investigating the particularities of this sport becomes clear.

Another key aspect to consider is the format of the analyzed tournament, composed of the group stage and the knockout stage. According to Lago-Peña (2007), this structure significantly influences the results. The group stage corresponds to a league format and offers stronger teams the opportunity to demonstrate better sports performance over the established competition period. In contrast, the knockout stage is characterized by direct elimination and introduces a high degree of uncertainty, as a single match can define qualification, allowing teams with lower performance to progress to the next stages. Furthermore, Lago-Peña (2005) notes that luck can influence the outcome of a match, and in some cases, a small set of matches. However, when a significant number of matches are accumulated, performance becomes the determining factor that explains the number of points obtained. Therefore, it is evident that the competition format directly influences the analysis of sports performance. In the case of a World Cup, by analyzing the group stage, teams that qualify for the Round of 16 may have done so due to a high level of sports performance, even though they only played three matches. On the other hand, in the knockout stage, there is a possibility that luck plays a crucial role, affecting teams with higher performance levels, as they could lose the match that determines their qualification to the final. This demonstrates that while accumulated performance is the main determinant of success in tournaments like these, luck and the unique dynamics of single-elimination matches can allow teams with lower performance to progress in the competition.

Although the results of this study contribute to the scientific evidence on WS and provide valuable information about the teams participating in the 2023 WWC, they should be interpreted with caution and not generalized to other soccer modalities, competitions or gender categories. It is important to consider that this study only analyzed one competition format (mixed: the Group Stage corresponds to a regular tournament, while the Knockout Stage is a direct elimination format) and a single edition of the WWC (ninth edition). Furthermore, WS lacks historical comparison, as results are not often compared to previous editions due to the lack of scientific evidence on the WWC. Additionally, soccer is a multifaceted sport that involves more components than the technical-tactical variables analyzed in this study, such as physical variables that include fatigue, players' physical levels, changes in direction, different speeds and other factors. It is also necessary to consider other variables such as the level of preparation, the tactical decisions of the coaching staff and the previous experience of the participating teams, along with other factors, such as environmental influences like weather, travel distance and time, time zone changes, among others, which could have affected the teams' performance. Therefore, future research could delve deeper into these aspects and explore the interaction of technical-tactical and physical variables in joint analyses or include external factors such as the context of each match or the conditions of play.

Conclusions

The general objective of this study was to analyze the PI of the national teams participating in the 2023 WWC. The analysis of the performance profiles of the teams in the analyzed World Cup revealed significant differences according to the final classification groups. Teams eliminated in the Group Stage performed more actions in most PI across the three studied categories, whereas teams that advanced to the Round of 16 and Quarterfinals showed greater balance in their actions. Finalist teams stood out for their effectiveness in key actions near the opponent's goal. It can be concluded that understanding performance profiles helps to grasp team behavior, which is essential for optimizing performance and improving results in future tournaments.

After analyzing the PI of the teams in the 2023 WWC according to their final ranking, this study showed that teams participating only in the Group Stage performed more offensive actions compared to teams that advanced to later stages. However, these results contrast with the findings reported in other MS tournaments, where higher-ranked teams tend to

perform better than those with lower rankings. Thus, it can be concluded that during the 2023 WWC, offensive efficiency was decisive. Higher-ranked teams with fewer offensive actions made better use of attacking opportunities, providing them with a crucial strategic advantage for success in their matches.

In terms of defensive PI, lower-ranked teams were the ones that performed more defensive actions. These findings reinforce the results of previous research in MS, which suggest that lower-ranked teams require more defensive actions compared to higher-ranked teams. In this regard, it can be concluded that greater involvement in defensive actions may indicate lower performance. This highlights the importance of balancing both offensive and defensive aspects to achieve strong performance in high-level competitions.

Regarding referee actions, lower-performing teams were the ones receiving more fouls and offsides. These results align with previous studies in WS, although they do not match findings from earlier research in MS. Therefore, it can be concluded that the behavior of these actions differs between the two genders, suggesting that referee actions are not only related to the athletic performance of the teams but can also be influenced by specific tactical strategies employed by each team and their competitive context.

Additionally, it can be concluded that creating performance profiles is an easy-to-use and comprehensible tool that clearly reflects the playing behavior of teams or players. Finally, it is recommended to continue using the mixed linear model to identify differences, as this approach effectively controls variability among participating teams.

The findings obtained have significant implications for the development of WS. Understanding the behavior of offensive, defensive and refereeing actions according to the final ranking is a valuable tool for identifying both strengths and areas for improvement, facilitating the design of specific training programs for WS. Additionally, it allows for the optimization of strategic decision-making to achieve a balance between the phases of the game. This approach helps reduce the gap between women's and men's soccer, promoting sustainable development of the sport.

Practical Applications

These results provide valuable information for coaching staff and performance analysts of national WS teams. They offer a detailed analysis of the strengths, weaknesses and trends in the tactical and technical actions of teams according to the phases of the 2023 FIFA WWC (Australia-New Zealand). This information can be key for planning and evaluating the performance of the ninth edition in preparation for Brazil 2027. Furthermore, these performance profiles emphasize the importance of considering the context of each match, the competition phase, and the level of opposition, allowing teams to adjust strategies and maximize their chances of success.

These findings suggest that coaches should focus not only on increasing the quantity of attacks during matches but also on improving the quality and effectiveness of plays, prioritizing finishing opportunities, ideally leading to goals. Therefore, teams aiming to improve their performance should design training sessions focused on enhancing the quality of their actions, rather than just their quantity. Additionally, it is crucial to consider the importance of scoring first, as this factor can change the dynamics of the game and provide a strategic advantage to secure the final result. In practical terms, coaches could apply these findings through training tasks focused on improving offensive efficiency, emphasizing the quality of actions and finishing effectiveness. It is crucial that each task is designed with a goal or framework in which the players must score, to ensure a clear and measurable focus. Some examples could be:

1. **Possession and Finishing after Recovery Task:** Once the playing area is defined, four goal should be placed, one at each corner of the área and the players should be divided into two groups. One team will aim to maintain possession of the ball. If the ball is intercepted by the opposing team, they must quickly score in one of the four goals.

2. **Progression and Finishing Task:** The playing space should be divided into two sections, with a goal placed in the final zone. The players will be arranged as follows: the attacking team will position four players in the farthest area from the goal and two in the closest. The defending team will position two players in the farthest

area and one in the closest to the goal. As the attacking team, with numerical superiority in the distant zone, tries to progress toward the closest zone, the defending team must stop them. Once the ball enters the closest zone to the goal, a player from the previous zone can join the attack. The attacking players must attempt to score as quickly as possible while the defending team works to prevent it.

3. **Finishing Task:** After a corner kick, the goalkeeper must throw the ball to her teammates to create a 3 vs 1 situation. The attacking team must finish as quickly as possible, while the defending team works to prevent the goal.

Regarding defensive outcomes, coaches of national women's teams could use these results to adjust their strategic approaches, aiming to reduce the need for constant defensive actions. This can be achieved through more effective offensive control, focused on increasing the quality of actions that create scoring opportunities while minimizing the risk of counterattacks.

The results regarding referee actions can be valuable for coaches of higher-ranked teams, seeking to reduce unnecessary fouls and increase pressure on the opponent to create opportunities for mistakes and recover the ball for attack. Similarly, for these teams, offside actions could reflect the quality of the offensive phase, so improving timing in plays to avoid offside would increase goal-scoring opportunities. For teams in lower positions, recognizing patterns related to fouls highlights the importance of training exercises that encourage quicker escapes from offensive pressure. Additionally, improving game reading could allow them to use the offside trap as a defensive strategy to neutralize opponents' attacks.

As previously mentioned, these results provide valuable insights for the preparation of the upcoming 2027 WWC in Brazil, as they allow teams to focus on key factors to maximize their performance. Below are some examples of how these findings can be used to optimize preparation for the tournament:

1. **Identification of Offensive and Defensive Elements:** Analyzing these trends allows teams to assess their own patterns and identify weaknesses observed in the last WWC. This provides a clear starting point to address areas for improvement, using the performance trends of the highest-ranking teams in the last tournament as a reference.

2. **Analysis of Future Rivals:** These results offer a detailed view of the strategies employed by participating teams in the last WWC, enabling teams to develop tactics tailored to what has been observed. This helps anticipate the approaches of future opponents, thereby enhancing strategic preparation.

3. **Study of Refereeing Actions:** Identifying the pattern of teams that committed more fouls, as observed in this study with the lower-ranked teams, shows that some teams not only seek to take the initiative in the game but also press their opponents to force turnovers, even provoking fouls through their defensive intensity. On the other hand, for higher-ranked teams, identifying that they commit more fouls highlights the importance of applying pressure effectively while avoiding serious fouls that could lead to yellow cards or expulsions, potentially putting key players' availability at risk.

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Appendices

Appendix 1. Mixed Linear Model Results According to the Final Match Outcome of the Group Stage of the 2023 WWC (1=Mixed Linear Model and Descriptive Statistics)

Analysis Categories	Performance Indicators	Linear Mixed Model										ANOVA					Descriptive							
																	Finalists		Quarterfinals		Round of 16		Group Stage	
		Con R²	Mar R²	AIC	ICC	p	F	p	ηp²	Type	Power	Type	Mar x	sd	Mar x	sd	Mar x	sd	Mar x	sd				
1. Attack																								
Ball Possession	Total Possession	0.47	0.29	692.91	0.26	0.010	9.65	<.001	0.30	Large	0.95	High	6.87	1.05	9.04	1.17	9.37	0.87	12.93	0.65				
	Possession in Contest	0.79	0.77	276.18	0.09	0.278	106.33	<.001	0.77	Large	0.96	High	2.11	0.15	3.02	0.18	3.87	0.13	5.23	0.11				
Finishing	Goals Conceded	0.29	0.20	178.97	0.11	0.320	8.20	0.002	0.21	Large	0.95	High	0.12	0.11	0.14	0.12	0.27	0.09	0.65	0.07				
	Assists	0.08	0.08	36.45	0.00	0.999	3.76	0.031	0.08	Moderate	0.95	High	0.18	0.05	0.35	0.06	0.12	0.05	0.15	0.04				
	Goal Difference	0.15	0.12	185.34	0.04	0.684	4.95	0.014	0.12	Moderate	0.95	High	0.27	0.10	0.39	0.11	0.34	0.09	0.67	0.07				
Attempts	Attempts outside penalty area	0.12	0.12	276.67	0.00	1.000	5.69	0.001	0.12	Moderate	0.95	High	0.64	0.13	1.13	0.15	1.09	0.12	1.30	0.10				
Final Third Entries	Left Channel	0.38	0.14	565.53	0.27	0.007	3.66	0.028	0.15	Large	0.95	High	2.74	0.64	3.95	0.72	3.85	0.53	5.11	0.40				
Offers to Receive	Total Offers to Receive	0.50	0.18	1279.05	0.38	<.001	4.45	0.012	0.19	Large	0.95	High	59.35	12.68	74.10	14.11	74.03	10.28	105.95	7.61				
	Offers to Receive in Between	0.53	0.25	1058.05	0.38	<.001	6.47	0.002	0.26	Large	0.95	High	25.30	5.21	32.61	5.80	31.39	4.23	47.97	3.13				
Receptions	Receptions Between Midfield and Defensive Lines	0.51	0.16	919.82	0.41	<.001	3.19	0.041	0.16	Large	0.95	High	16.01	3.06	23.89	3.40	21.43	2.47	26.61	1.82				
Line Breaks	Attempted Line Breaks	0.51	0.50	940.00	0.01	0.865	40.06	<.001	0.51	Large	0.96	High	25.52	1.91	34.90	2.24	40.29	1.76	50.83	1.43				
	Completed Line Breaks	0.35	0.17	914.68	0.22	0.018	5.00	0.008	0.17	Large	0.95	High	16.24	2.45	21.26	2.74	21.99	2.04	27.02	1.55				
	Attempted Defensive Line Breaks	0.19	0.10	544.52	0.10	0.317	3.63	0.033	0.11	Moderate	0.95	High	2.65	0.46	3.55	0.52	3.77	0.40	4.46	0.31				
Distribution	Total Passes	0.58	0.28	1252.72	0.42	<.001	7.23	0.001	0.29	Large	0.95	High	71.43	11.73	94.85	13.11	93.11	9,52	128.74	7.01				
	Passes Completed	0.52	0.15	1259.34	0.44	<.001	3.21	0.040	0.15	Large	0.95	High	58.18	12.29	76.42	13.67	68.99	9.91	96.60	7.28				
Set Plays	Total Free Kicks	0.67	0.58	370.71	0.22	0.032	35.03	<.001	0.60	Large	0.95	High	1.47	0.27	2.06	0.31	2.45	0.23	4.32	0.17				
2. Defense	Goal Preventions	0.70	0.31	570.07	0.56	<.001	7.08	0.001	0.35	Large	0.96	High	1.62	0.86	1.90	0.95	2.86	0.69	5.30	0.50				
	Forced Turnovers	0.77	0.75	676.34	0.09	0.251	97.42	<.001	0.76	Large	0.96	High	11.74	0.77	17.72	0.88	20.79	0.67	27.13	0.53				
	Pressing Applied	0.64	0.47	1124.15	0.33	<.001	17.63	<.001	0.49	Large	0.95	High	28.85	6.47	43.86	7.21	60.31	5.28	79.73	3.94				
3. Referee Actions	Fouls Against	0.34	0.25	394.90	0.13	0.110	9.02	<.001	0.25	Large	0.95	High	1.37	0.27	2.10	0.30	2.69	0.23	2.95	0.18				
	Offsides	0.08	0.08	122.71	0.00	1.000	3.50	0.018	0.08	Moderate	0.95	High	0.17	0.07	0.45	0.08	0.40	0.06	0.41	0.05				

Notes. Con *R²*= Conditional *R²*; Mar *R²*= Marginal *R²*; Mar x̄= marginal mean; *sd* = standard deviation; *ηp²* = partial eta squared; Dif x̄ = difference of means; *d* = Cohen's *d*; PI with gray = variability needs to be controlled; PI with gray and bold = variability needs to be controlled and significant differences were found.

Appendix 2. Mixed Linear Model Results According to the Final Match Outcome of the Group Stage of the 2023 WWC (2=Post Hoc).

Analysis Categories	Performance Indicators	Finalists - Quarterfinals				Finalists - Round of 16				Finalists - Group Stage				Quarterfinals - Round of 16				Quarterfinals - Group Stage				Round of 16 - Group Stage			
		Dif x	p	d	Type	Dif x	p	d	Type	Dif x	p	d	Type	Dif x	p	d	Type	Dif x	p	d	Type	Dif x	p	d	Type
1. Attack																									
Ball Possession	Total Possession	-2.17	1.000	0.57	Small	-2.50	0.490	0.66	Medium	-6.06	**<.001**	1.65	Large	-0.33	1.000	0.09	Trivial	-3.89	**0.050**	1.08	Medium	-3.56	**0.018**	0.99	Medium
	Possession in Contest	-0.91	0.007	1.38	Large	-1.76	<.001	2.65	Very Large	-3.12	<.001	4.68	Very Large	-0.85	0.005	1.28	Large	-2.21	<.001	3.3	Very Large	-1.36	<.001	2.02	Very Large
Finishing	Goals Conceded	-0.02	1.000	0.05	Trivial	-0.15	1.000	0.33	Small	0.53	0.007	1.17	Medium	-0.13	1.000	0.28	Small	0.51	0.015	1.12	Medium	0.38	0.023	0.84	Medium
	Assists	-0.17	0.240	0.67	Medium	0.06	1.000	0.21	Small	0.03	1.000	0.13	Trivial	0.23	0.038	0.88	Medium	0.20	0.042	0.8	Medium	-0.03	1.000	0.08	Trivial
	Goal Difference	-0.12	1.000	0.25	Small	-0.07	1.000	0.13	Trivial	0.40	0.035	0.84	Medium	0.05	1.000	0.12	Trivial	0.28	0.317	0.59	Small	0.33	0.042	0.71	Medium
Attempts	Attempts outside penalty area	-0.49	0.087	0.73	Medium	-0.45	0.072	0.66	Medium	-0.66	<.001	0.98	Medium	0.04	1.000	0.07	Trivial	-0.17	1.000	0.25	Small	-0.21	1.000	0.32	Small
Final Third Entries	Left Channel	-1.21	1.000	0.57	Small	-1.11	1.000	0.52	Small	-2.37	0.029	1.11	Medium	-0.10	1.000	0.05	Trivial	-1.16	0.615	0.54	Small	-1.26	0.410	0.59	Small
Offers to Receive	Total Offers to Receive	-14.75	1.000	0.33	Small	-14.68	1.000	0.33	Small	-46.60	0.026	1.17	Medium	0.07	1.000	0	Trivial	-31.85	0.350	0.83	Medium	-31.92	0.113	0.84	Medium
	Offers to Receive in Between	-7.31	1.000	0.42	Small	-6.09	1.000	0.34	Small	-22.67	0.006	1.4	Large	1.22	1.000	0.08	Trivial	-15.36	0.171	0.98	Medium	-16.58	0.023	1.06	Medium
Receptions	Receptions Between Midfield and Defensive Lines	-7.88	0.591	0.84	Medium	-5.42	1.000	0.57	Small	-10.60	0.039	1.14	Medium	2.46	1.000	0.27	Small	-2.72	1.000	0.3	Small	-5.18	0.18	0.58	Small
Line Breaks	Attempted Line Breaks	-9.38	0.044	0.96	Medium	-14.77	<.001	1.52	Large	-25.31	<.001	2.6	Very Large	-5.39	0.47	0.55	Small	-15.93	<.001	1.64	Large	-10.54	<.001	1.08	Medium
	Completed Line Breaks	-5.02	1.000	0.55	Small	-5.75	0.514	0.63	Medium	-10.78	0.007	1.21	Large	-0.73	1.000	0.08	Trivial	-5.76	0.484	0.66	Medium	-5.03	0.58	0.57	Small
	Attempted Defensive Line Breaks	-0.90	1.000	0.46	Small	-1.12	0.519	0.57	Small	-1.81	0.030	0.92	Medium	-0.22	1.000	0.1	Trivial	-0.91	0.922	0.46	Small	-0.69	1.000	0.35	Small
Distribution	Total Passes	-23.42	1.000	0.62	Medium	-21.68	0.991	0.57	Small	-57.31	0.002	1.6	Large	1.74	1.000	0.05	Trivial	-33.89	0.189	0.99	Medium	-35.63	0.33	1.04	Medium
	Passes Completed	-18.24	1.000	0.45	Small	-10.73	1.000	0.23	Small	-38.42	<.001	1.02	Medium	7.51	1.000	0.1	Small	-20.18	1.000	0.57	Small	-27.69	**0.005**	0.78	Medium
Set Plays	Total Free Kicks	-0.59	1.000	0.65	Medium	-0.98	0.077	1.04	Medium	-2.85	<.001	2.95	Very Large	-0.39	1.000	0.9	Small	-2.26	<.001	2.3	Very Large	-1.87	<.001	1.91	Large
2. Defense	Goal Preventions	-0.28	1.000	0.17	Trivial	-1.24	1.000	0.61	Medium	-3.68	0.006	1.72	Large	-0.96	1.000	0.4	Small	-3.40	0.025	1.55	Large	-2.44	0.47	1.11	Medium
	Forced Turnovers	-5.98	<.001	1.76	Large	-9.05	<.001	2.68	Very Large	-15.39	<.001	4.56	Very Large	-3.07	0.065	0.91	Medium	-9.41	<.001	2.8	Very Large	-6.34	<.001	1.89	Large
	Pressing Applied	-15.01	0.819	0.73	Medium	-31.46	0.006	1.54	Large	-50.88	<.001	2.49	Very Large	-16.45	0.475	0.8	Medium	-35.87	0.001	1.75	Large	-19.42	0.40	0.95	Medium
3. Referee Actions	Fouls Against	-0.73	0.502	0.66	Medium	-1.32	0.007	1.21	Large	-1.58	<.001	1.45	Large	-0.59	0.03	0.54	Small	-0.85	0.37	0.79	Medium	-0.26	1.000	0.21	Small
	Offsides	-0.28	0.50	0.78	Medium	-0.23	0.087	0.64	Medium	-0.24	0.034	0.67	Medium	0.05	1.000	0.14	Trivial	0.04	1.000	0.11	Trivial	0.01	1.000	0.03	Trivial

Notes. Con R^2= Conditional R^2; Mar R^2= Marginal R^2; Mar $\bar{x}$= marginal mean; *sd* = standard deviation; ηp^2 = partial eta squared; Dif $\bar{x}$ = difference of means; *d* = Cohen's *d*; PI with gray = variability needs to be controlled; PI with gray and bold = variability needs to be controlled and significant differences were found.