ANALYSIS OF TECHNICAL AND PHYSICAL VARIABLES ACCORDING TO THE RESULT OF THE MATCH IN 2018 FIFA WORLD CUP RUSSIA

ANÁLISIS DE VARIABLES TÉCNICAS Y FÍSICAS ACORDE AL RESULTADO DEL PARTIDO EN LA COPA MUNDIAL RUSIA FIFA 2018

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RESUMEN

El fútbol es el deporte más popular en todo el mundo, con un número creciente de jugadores profesionales cada año, y asociado a esto, es complejo e impredecible, con múltiples problemas físicos, técnicos, tácticos y psicológicos críticos para el rendimiento. En la década de 1990, el análisis del rendimiento basado en herramientas incluye sistemas de posicionamiento global y sistemas de seguimiento óptico para cada jugador. Por esta razón, este estudio tuvo como objetivo analizar variables físicas y técnicas relacionadas con el resultado de un partido y el hecho de que un equipo se clasifique para las diferentes fases de la Copa Mundial de la FIFA Rusia 2018. El análisis abarcó todos los partidos jugados durante la Copa Mundial de la FIFA Rusia 2018, hasta 64 partidos de los 32 equipos nacionales participantes. El gol podría ser insuficiente para definir el éxito de un equipo, ya que esta variable depende de diferentes y múltiples factores. Los equipos que se clasificaron para la fase de eliminación mostraron un rendimiento significativamente mejor en algunas variables técnicas. Y, por otro lado, en cuanto a las variables físicas, los equipos más exitosos recorrieron distancias más cortas con y sin el balón, presentando distancias más significativas en las zonas de intensidad 1 y 5 y posesión del balón. Estos aspectos merecen ser analizados para definir su relación con el éxito en el juego.

Palabras clave: Copa Mundial FIFA (2018: Rusia), estadísticas de fútbol, rendimiento, deportes grupales.

ABSTRACT

Soccer is the most popular sport worldwide, with an increasing number of professional players every year, and associated with it, it is complex and unpredictable with multiple physical, technical, tactical and psychological problems critical to performance. In the 90s, performance analysis based on tools included global positioning systems and optical tracking systems for each player. For this reason, this study aimed to analyze physical and technical variables related to the result of a match and the fact that a team qualifies for the different phases of the 2018 FIFA World Cup Russia. The analysis covered all matches played during the 2018 FIFA World Cup Russia, up to 64 matches of the 32 participating national teams. The goal could be insufficient to define a team's success, as this variable depends on different and multiple variables. Teams that qualified for the knockout phase showed significantly better performance in some technical variables. On the other hand, regarding the physical variables, the most successful teams traveled shorter total distances, presenting more significant distances in intensity zones 1 and 5 and possession of the ball. These aspects deserve to be analyzed to define their relationship with success in the game.

Keywords: FIFA World Cup (2018: Russia), soccer statistics, performance, sports teams.

INTRODUCTION

Soccer is the most popular sport globally, with an increasing number of professional players every year (D'Orazio & Leo, 2010). However, it is a complex and unpredictable sport with multiple physical, technical, tactical, and psychological issues critical to performance (Bradley et al., 2009; Drust et al., 2007; Mackenzie & Cushion, 2013; Rampinini et al., 2008). Soccer matches involve complex interactions between players, making a random transition between short periods of high-intensity, multi-directional movements and long periods of low-intensity movements (Bangsbo & Mohr, 2006; Carling et al., 2008; Drust et al., 2007; Rampinini et al., 2009).

A discipline derived from sports science emerged in the 90s, focusing on performance analysis (Coutts, 2014; Hughes & Franks, 2004a; Sarmento et al., 2014) to increase the likelihood of success. Research in this field has facilitated the development of different tools that allow simultaneous data collection based on electronic performance and tracking systems. These tools include global positioning systems (GPS) and optical

tracking systems for each player. Thus, to collect data, static or dynamic cameras are used in the field (D'Orazio & Leo, 2010; Hughes & Franks, 2004b, 2005). In this manner, there is access to information on different variables. Analyze them allows us to seek strategies to improve individual and collective sports performance (Coutts, 2014). In the case of the 2018 FIFA World Cup Russia, the TRACAB® optical tracking system was used (https://chyronhego.com/content_tags/optical-tracking/)

The variables obtained can be classified as physical variables such as distance traveled, speed and acceleration, and techniques such as shots on target, goals, passes and pass accuracy. These variables can be analyzed in groups or individually and related to the game's results to determine their impact (Rumpf et al., 2017).

Most of the research work has focused on the physical variables during clubs soccer matches, mainly in the English Premier League (Bradley et al., 2009; Di Salvo et al., 2009), the Italian Serie A (Mohr et al., 2003), and the Spanish League (Castellano et al., 2011). These studies showed that soccer players run 10 to 13 km per match. 10% to 15% of this distance traveled is at a speed higher than 19 km.h-1. These high-intensity activities occur primarily when the team is in possession of the ball (Bradley et al., 2009; Di Salvo et al., 2009, 2010; Jones & Vanhatalo, 2017).

However, the impact of these variables on the outcome of the game is controversial. This controversy is probably due to the high variability of the parameters between matches, especially regarding high-intensity activities, such as maximum speed or the number of sprints. The team's tactical aspects of a particular game can also influence those parameters (Carling, 2013).

There is less information about the technical variables of the game. Though, these variables show an association between the number of passes, the percentage of success in the passes of over 70%, the number of tackles made, the amount of ball recovery and the shots on goal made by a team with the fact of winning a match (Barnes et al., 2014; Bradley et al., 2013; Russell et al., 2013; Yi et al., 2018). This is why analyzing these aspects is plausible since they could offer information on how some of those variables can become critical in the game's outcome.

Although most of the information derives from studies on soccer clubs, few studies are on the FIFA World Cup. They show similarities concerning technical variables and the game's outcome, as described by Clemente (2012) and Rumpf et al. (2017). They analyzed the 2010 and 2014 World Cups in South Africa and Brazil, respectively, and found that technical aspects contribute more to the outcome of the game when compared with physical variables. Thus, the winning teams, as expected, scored more goals per game and showed more efficiency in the number of shots on goal that turned into goals. This last

variable is the one that showed the most extraordinary impact on the outcome of the game (Clemente, 2012; Rumpf et al., 2017).

Since the FIFA World Cup is the most important tournament in the sport, as it brings together the best players and teams globally, analyzing the physical and technical variables might indicate the factors that influence the success of a soccer team. Thus, this study aimed to analyze those physical and technical variables concerning the result of a match (win, draw, or lose) and the fact that a team qualifies for the different phases of the 2018 FIFA World Cup in Russia.

MATERIALS AND METHODS

A descriptive study of secondary data analysis was performed. The independent variables were those described in Table 1 and 2, i.e., the variables related to physical and technical aspects. The dependent variables were the result of the match and the stage of the tournament that the team reached.

The analysis covered all matches played that had data available during the 2018 FIFA World Cup in Russia. Data from matches of the group phase of the Uruguayan, Egyptian, and Peruvian teams, were excluded from the analysis as the information was not available on the FIFA website. A total of 56 soccer games were analyzed.

The tournament included a group phase organized into four teams, in which all members of each group played against each other. The top two teams in each group qualified for the knockout phase. Eight matches were held in the round of 16, in which all 16 teams competed. The winners of each match (eight teams) faced each other in the quarter-finals, a stage in which four matches were held. Four teams qualified for the semi-finals played in two matches. The losers participated in a game for third place, while the winners played a match for the championship.

Information on physical and technical variables (table 1 and 2, respectively) was obtained through the publicly accessible online website (FIFA, 2018), whose data were provided by the TRACAB® optical tracking system from ChyronHego Corporation (https://tracab.com) and STATSports® Group (https://statsports.com). These are real-time optical tracking systems that operate at 25 frames per second and provide details of player activities on the field. These systems have been previously verified to measure the quality of their data and have quality approval from FIFA (Linke et al., 2020). For previous applications of FIFA databases, see the examples provided by Nassis et al. (2015) and Da Mota et al. (2015).

Table 1.

Description of physical variables.

PHYSICAL VARIABLES	DEFINITION
Total distance (m)	It is the sum of the total distance in meters traveled by each player, including the goalkeeper during a soccer game.
Distance traveled in intensity zone 1 (m)	It is the sum of the distance in meters traveled by each player of the team to a speed equal to or less than 7 $km.h^{-1}$
Distance traveled in intensity zone 2 (m)	It is the sum of the distance in meters traveled by each player of the team to a speed greater than 7 $km.h^{-1}$ and less than or equal to 15 $km.h^{-1}$
Distance traveled in intensity zone 3 (m)	It is the sum of the distance in meters traveled by each player of the team to a speed greater than 15 $km.h^{-1}$ and less than or equal to 20 $km.h^{-1}$
Distance traveled in intensity zone 4 (m)	It is the sum of the distance in meters traveled by each player of the team to a speed greater than 20 $km.h^{-1}$ and less than or equal to 25 $km.h^{-1}$
Distance traveled in intensity zone 5 (m)	It is the sum of the distance in meters traveled by each player of the team to a speed greater than 25 $km.h^{-1}$
Sprint number	Sudden change in a player's speed, reaching a higher speed at 25 $km.h^{-1}$ in a minimum of 0.5 seconds.
Maximum speed ($km.h^{-1}$)	It is the average of the maximum speed reached by each player during a match

Source: the authors

Table 2.

Description of technical variables.

TECHNICAL VARIABLES	DEFINITION
Ball possession (%)	Percentage of total game time during which one team possesses the ball.
Long-distance passes completed (n)	Action in which a player sends the ball to a teammate more than 30 meters away, and the teammate successfully receives the ball.
Long-distance pass attempts (n)	Action in which a player sends the ball to a teammate more than 30 meters away, but the teammate does not successfully receive the ball.
Mid-range passes completed (n)	Action in which a player sends the ball to a teammate between 15 and 30 meters away, and the teammate successfully receives the ball.
Mid-range pass attempts (n)	Action in which a player sends the ball to a teammate between 15 and 30 meters away, but the teammate does not necessarily receive the ball.
Short-distance passes completed (n)	Action in which a player sends the ball to a teammate less than 15 meters away, and the teammate successfully receives the ball.
Short-distance pass attempts (n)	Action in which a player sends the ball to a teammate less than 15 meters away, but the teammate does not necessarily receive the ball.
Total passes completed (n)	Total passes completed by a team during a match.
Total pass attempts (n)	Total attempted passes made by a team during a match, regardless of whether they are completed.
Pass completion rate (%)	The ratio of passes completed to total pass attempts.
Clearances made (n)	Number of attempts to clear the ball away from the defensive area made by all players during a match.
Successful clearances (n)	Number of successful clearances made from the defensive area during a match.
Clearance success rate (%)	The proportion of successful clearances relative to total clearance attempts during a match.
Ball recoveries (n)	Game action that causes the opposing team to lose possession of the ball.
Turnovers (n)	The moment when possession of the ball is taken over by the opposing team.
Successful tackles (n)	A defensive action where a player extends their leg to touch the ball and take it away from the opponent.
Balls in the attacking third (n)	Action in which the ball is played into the final third of the opponent's field.
Balls into the penalty area (n)	Action in which the ball is played into the penalty area of the opponent's field.
Dribbles in the attacking third (n)	Action in which a player successfully dribbles past an opponent with the ball at their feet in the final third of the opponent's field.
Dribbles into the penalty area (n)	Action in which a player successfully dribbles past an opponent with the ball at their feet in the penalty area.
Yellow cards (n)	Number of yellow cards assigned by the referee to a team during a match.
Red cards (n)	Number of red cards assigned by the referee to a team during a match.
Goals scored (n)	Number of goals scored by a team during a match.
Goals conceded (n)	Number of goals conceded by a team during a match.
Total shots on goal (n)	Number of shots made by a team's players toward the opposing goal.
Shot success rate (%)	Percentage of goals scored relative to the total number of shots on target by a team.

Source: the authors.

The first analysis compared the physical and technical variables with the result of each match (win, draw, or lose). In the case of the knockout phase matches, in which the classification was defined in the penalties, the result was defined as a draw. The second analysis compared each variable, grouping the teams according to whether they qualified for the knockout phase (16 teams) or were eliminated in the group phase (16 teams). Finally, the third analysis compared the physical and technical variables according to the phase reached by each team. Four phases were defined: the group phase (16 teams), the round of 16 (eight teams), the quarter-finals (four teams), and the finals (four teams). The round defined as "final" includes the teams that played in the semi-final, the match for third place, and the match in the final.

Statistical Analysis

Descriptive statistics represent the mean and standard deviation. Since there was n > 30, the assumption of normality was accepted (Akritas and Papadatos, 2004; Clemente et al., 2013). A t-test was used for independent samples to establish the statistical differences between the two groups. One-way ANOVA allowed the comparison of more than two groups. The Levene test allowed homogeneity analysis. The SPSS statistical package for Windows, version 24.0®, was used to analyze the data. Statistical significance was established with a p-value < 0.05.

RESULTS

On the one hand, of the 64 World Cup matches, 48 (83.3%) featured a winning team. Of the 16 teams that qualified for the knockout phase, seven (43.7%) qualified for this phase, obtaining at least a draw in the group phase. Of these teams, four (25%) qualified with two draws. Of the 16 matches played in the knockout phase, 12 of them had a winner, corresponding to 75%.

Physical variables according to the outcome of the match (win, draw, or lose)

Teams that tied tended to have increased variables numbers in the distance traveled in intensity zones 1, 2, 3, and 4 (p-value < 0.05), and in the total distance (no statistical significance). Variables "sprint number" and "maximum speed" showed no statistical differences in the comparisons (Table 3).

Table 3.
Comparison of physical variables according to outcome of the match

Variable	Won				Tied				Lost				p-value between Win/Draw	p-value between Won/Lost	p-value between Draw/Lost
	Mean	SD	95% IC		Mean	SD	95% IC		Mean	SD	95% IC				
			Inferior	Superior			Inferior	Superior			Inferior	Superior			
Total distance (m)	105285.8	7300.2	103232.5	107339	111707.6	26425.8	101034	122381.2	104990.7	8286.6	102660.1	107321.3	0.156	0.994	0.132
Distance traveled with the ball (m)	24198.4	16857.7	19407.5	28989.3	27035.7	15531.9	20762.2	33309.2	27684.8	14472.5	23527.8	31841.8	0.756	0.544	0.986
Distance traveled without the ball (m)	24542.2	17225.9	19646.6	29437.7	29353.8	17247.7	22387.3	36320.3	31736.7	17422.1	26732.5	36741	0.518	0.122	0.851
Distance traveled in Zone 1 (m)	40773.2	2592.9	40043.9	41502.5	43791.1	7006.8	40961	46621.2	39891.1	2926.4	39068	40714.2	0.009	0.538	< 0.001
Distance traveled in Intensity Zone 2 (m)	43293.4	3823.5	42218	44368.7	48356.4	7614.6	45280.7	51432	43456.2	4544.2	42178.1	44734.3	< 0.001	0.987	0.001
Distance traveled in Intensity Zone 3 (m)	13661.4	1744.6	13170.7	14152.1	15286.8	215305	14417	16156.6	14010.9	1757.4	13516.7	14505.2	0.002	0.632	0.018
Distance traveled in Intensity Zone 4 (m)	5541.8	855.5	5301.2	5782.4	6069.5	987.2	5670.8	6468.3	5556.4	782.1	5336.5	5776.4	0.041	0.996	0.049
Distance traveled in intensity zone 5 (m)	2074.8	395.6	1963.6	2186.1	2165.4	475.7	1973.2	2357.5	2056.4	403.2	1943	2169.8	0.666	0.975	0.555
Sprint number (n)	330.9	50.1	316.8	345	358.6	62.2	333.5	383.7	331.9	47.1	318.7	345.2	0.088	0.995	0.105
Maximum speed (km.h ^{1})	31.8	1.1	31.5	32.1	32.1	1.2	31.6	32.5	32	1	31.7	32.3	0.517	0.542	0.972

Source: the authors

Physical variables of group stage vs. knockout phase

The teams that did not qualify for the knockout phase covered a more considerable distance, along with a smaller distance in the intensity zone 1 (p-value < 0.05) (Table 4). The total distance traveled was more outstanding in the teams with better performance (knockout phase) but no statistical differences were found. There were no tendencies in the other variables.

Table 4.
Comparison of physical variables of group stage vs. knockout phase

Variable	Group Stage				Knockout Phase				p-value
	Mean	SD	95% IC		Mean	SD	95% IC		
			Inferior	Superior			Inferior	Superior	
Total distance (m)	103146.19	14595.26	11345	117647	108468.49	13116.12	93361	147901	0.350
Distance traveled with the ball (m)	35406.33	10661.76	698	57999	20768.47	15603.84	1156	56977	<0.001
Distance traveled without the ball (m)	42424.24	11324.63	975	64036	20175.85	15063.12	753	53208	<0.001
Distance traveled in zone 1 (m)	39933.92	1943.71	35299	43965	41695.24	5017.46	34222	56251	0.006
Distance traveled in zone 2 (m)	43551.37	3951.33	34515	50809	44887.83	6100.9	35634	66689	0.178
Distance traveled in zone 3 (m)	14038.21	1607.22	9820	17480	14186.4	2096.38	11064	21622	0.675
Distance traveled in zone 4 (m)	5655.9	734.18	3636	6999	5654.2	953.5	4073	8741	0.992
Distance traveled in zone 5 (m)	2091.79	318.71	1350	2765	2082.33	464.6	1309	3470	0.892
Sprint number (n)	337.42	43.73	207	414	336.61	57.2	236	530	0.933
Maximum speed ($km.h^{-1}$)	31.98	0.86	29.92	33.77	31.89	1.16	29.02	33.98	0.628

Source: the authors

Physical variables according to round reached

The same trend of the two previous comparisons was found according to the phase reached. The teams that advanced the furthest in the tournament traveled a shorter distance, along with a more considerable distance in intensity zones 1 and 5 (with statistical evidence, Table 5 and 6). Total distance traveled was again more significant for the teams that advanced the furthest in the tournament but with no statistical differences. There were no trends in the other variables.

Table 5.
Comparison of physical variables according to round reached

Variable	First Round				Round of 16				Quarter-finals				Final			
	Mean	SD	95% IC		Media	SD	95% IC		Mean	SD	95% IC		Media	SD	95% IC	
			Inferior	Superior			Inferior	Superior			Inferior	Superior			Inferior	Superior
Total Distance Traveled (m)	103146.2	14595.3	98908.2	107384.2	106290.5	10739.9	102418.3	110162.6	109384.0	13768.6	102940.1	115827.9	110303.7	15092.4	104451.5	116156.0
Distance Traveled with the Ball (m)	35406.3	10661.8	32240.2	38572.5	28863.1	10164.5	25198.4	32527.8	12989.7	12768.6	6835.5	19144.0	16795.9	18424.6	9651.5	23940.2
Distance Traveled without the Ball (m)	42424.2	11324.6	39061.2	45787.2	25946.3	11540.1	21785.6	30106.9	15961.8	13500.6	9454.7	22468.9	16440.6	17738.0	9562.6	23318.7
Distance Traveled in Intensity Zone 1 (m)	39933.9	1943.7	39369.5	40498.3	41195.0	4583.7	39542.4	42847.6	40954.5	3988.2	39088.0	42821.0	42796.0	6031.9	40457.1	45135.0
Distance Traveled in Intensity Zone 2 (m)	43551.4	3951.3	42404.0	44698.7	43668.5	5084.4	41835.4	45501.6	46416.5	7023.5	43129.4	49703.6	45189.5	6397.2	42708.9	47670.1
Distance Traveled in Intensity Zone 3 (m)	14038.2	1607.2	13571.5	14504.9	13936.4	1432.3	13420.0	14452.8	14445.1	2700.0	13180.5	15709.7	14287.3	2287.3	13400.4	15174.2
Distance Traveled in Intensity Zone 4 (m)	56559	734.2	5442.7	5869.1	5498.6	652.4	5263.4	5733.8	5650.1	1240.1	5069.7	6230.5	5835.0	1013.2	5442.2	6227.9
Distance Traveled in Intensity Zone 5 (m)	2091.8	318.7	1999.3	2184.3	1992.0	382.9	1853.9	2130.0	1917.9	480.3	1693.1	2142.7	2303.0	469.8	2120.9	2485.2
Sprint Count (n)	337.4	43.7	324.7	350.1	328.1	40.4	313.6	342.7	326.8	70.0	294.1	359.5	353.3	61.7	329.4	377.3
Maximum Speed (km/h)	32.0	0.9	31.7	32.2	31.8	1.2	31.4	32.3	31.6	1.2	31.1	32.2	32.1	1.1	31.7	32.6

Source: the authors.

Table 6.
p-value for the comparison of physical variables according to round reached

Variable	p-value between First Round/Round of 16	p-value between First Round/Quarterfinals	p-value between First Round/Finals	p-value between Round of 16/Quarterfinals	p-value between Round of 16/Finals	p-value between Quarterfinals/Finals
Total Distance Covered (m)	0.799	0.408	0.192	0.890	0.735	0.997
Distance Covered with the Ball (m)	0.194	<0.001	<0.001	0.001	0.006	0.808
Distance Covered without the Ball (m)	<0.001	<0.001	<0.001	0.090	0.620	0.999
Distance Covered in Intensity Zone 1 (m)	0.618	0.834	0.041	0.998	0.525	0.511
Distance Covered in Intensity Zone 2 (m)	0.999	0.265	0.650	0.363	0.754	0.894
Distance Covered in Intensity Zone 3 (m)	0.997	0.891	0.961	0.838	0.921	0.994
Distance Covered in Intensity Zone 4 (m)	0.892	0.999	0.864	0.947	0.535	0.915
Distance Covered in Intensity Zone 5 (m)	0.752	0.445	0.179	0.935	0.032	0.015
Number of Sprints (n)	0.894	0.899	0.649	0.999	0.326	0.391
Maximum Speed (m/s)	0.937	0.677	0.942	0.939	0.727	0.450

Source: the authors.

Technical variables according to the outcome of the match (won, draw, or lost)

None of the technical variables showed statistical differences between the three possible match outcomes. However, the same trend was observed: the tied matches showed more significant numbers (without statistical significance) (Table 7).

Table 7.
Comparison of technical variables according to outcome of the match

Variable	Won				Draw				Lost				p-value between Win/Draw	p-value between Won/Lost	p-value between Draw/Lost
	Mean	SD	95% IC		Mean	SD	95% IC		Mean	SD	95% IC				
			Inferior	Superior			Inferior	Superior			Inferior	Superior			
Ball Possession (%)	51.1	9.6	48.4	53.8	50	13.6	44.5	55.5	48.9	9.6	46.2	51.6	0.907	0.561	0.907
Long-Distance Passes Completed (n)	39.8	11.7	36.4	43.1	43.3	17.1	36.4	50.2	37.7	8.5	35.3	40.1	0.473	0.696	0.159
Long-Distance Pass Attempts (n)	63.7	13.4	59.9	67.5	71.9	21.6	63.2	80.6	63.9	11.2	60.7	67.1	0.074	0.997	0.085
Mid-Range Passes Completed (n)	252.8	96.1	225.5	280.2	282.9	142.2	225.4	340.3	234.9	86.7	210.3	259.6	0.492	0.691	0.166
Mid-Range Pass Attempts (n)	282.6	99.5	254.3	310.9	315.5	149.2	255.3	375.7	266.1	90	240.5	291.7	0.445	0.748	0.172
Short-Distance Passes Completed (n)	96.9	41	85.2	108.6	105.9	51.9	84.9	126.8	89.9	35.3	79.8	99.9	0.672	0.697	0.283
Short-Distance Pass Attempts (n)	115.2	44.8	102.5	128	124.3	54.2	102.4	146.2	107	39.7	95.7	118.3	0.706	0.661	0.286
Total Passes Completed (n)	389.5	135.3	351	427.9	432	203.3	349.9	514.1	362.5	118.5	328.8	396.2	0.486	0.653	0.148
Total Pass Attempts (n)	461.5	138.4	422.1	500.8	511.7	211	426.5	597	437	122.6	402.2	471.9	0.389	0.720	0.126
Pass Completion Rate (%)	83	6.1	81.3	84.7	82.5	7.4	79.5	85.5	81.8	5.3	80.3	83.4	0.936	0.638	0.915
Clearances Made (n)	25.2	10.2	22.4	28.1	24.7	10.8	20.3	29	24.1	10.9	21	27.1	0.976	0.859	0.973
Successful Clearances (n)	20.3	8	18	22.5	20.2	10.2	16.1	24.3	18.9	7.8	16.7	21.1	0.999	0.713	0.812

Clearance Success Rate (%)	80.7	8.7	78.2	83.1	80	11.3	75.4	84.6	80.2	8.8	77.7	82.7	0.957	0.971	0.995
Ball Recoveries (n)	42.1	7	40.2	44.1	43.3	10	39.2	47.3	41.2	8.3	38.8	43.5	0.849	0.839	0.572
Turnovers (n)	3.3	2.1	2.7	3.9	2.6	1.9	1.8	3.3	3.1	2.1	2.5	3.7	0.34	0.912	0.535
Successful Tackles (n)	3.2	2.1	2.6	3.8	2.6	1.9	1.8	3.3	3.3	2.1	2.7	3.9	0.508	0.945	0.356
Balls in the Attacking Third (n)	37.1	12.9	33.4	40.7	43.4	21.8	34.5	52.2	35.4	12.8	31.8	39	0.228	0.856	0.095
Balls into the Penalty Area (n)	9.8	4.5	8.6	11.1	10	4.7	8.1	11.9	9.3	5.2	7.8	10.8	0.989	0.858	0.832
Dribbles in the Attacking Third (n)	14.3	7.1	12.3	16.2	15.4	9.1	11.7	19	13.8	8.4	11.5	16.2	0.844	0.964	0.724
Dribbles into the Penalty Area (n)	4.5	2.9	3.6	5.3	3.9	3.5	2.5	5.3	3.4	3.1	2.5	4.2	0.781	0.220	0.764
Yellow Cards (n)	1.4	1.1	1.1	1.7	1.9	1.7	1.2	2.5	1.9	1.3	1.6	2.3	0.382	0.143	0.971
Red Cards (n)	0	0.1	0	0.1	0	0	0	0	0	0.2	0	0.1	0.867	0.810	0.567
Goals Scored (n)	2.1	1.1	1.8	2.4	1.4	0.8	1.1	1.7	0.5	0.7	0.3	0.7	0.004	< 0.001	< 0.001
Goals Conceded (n)	0.5	0.7	0.3	0.7	1.4	0.8	1.1	1.7	2.1	1.1	1.8	2.4	< 0.001	< 0.001	0.004
Total Shots on Goal (n)	13.4	4.7	12.1	14.7	13.1	5.7	10.8	15.4	11.6	5.4	10	13.1	0.965	0.201	0.480
Shot Success Rate (%)	17.5	11.9	14.2	20.8	12.5	9.8	8.6	16.5	4.7	7.3	2.7	6.8	0.117	< 0.001	0.005

Source: the authors

Technical variables according to group stage vs. knockout phase

In Table 8, most technical variables tended to be significantly higher in the teams that qualified for the knockout phase.

Table 8.
Comparison of technical variables according to group stage vs. knockout phase.

Variable	First Round				Direct Elimination				p-value
	Mean	SD	95% IC		Mean	SD	95% IC		
			Inferior	Superior			Inferior	Superior	
Ball Possession (%)	46.73	10.44	28	71	51.96	10.01	25	75	0.006
Long-Distance Passes Completed (n)	36.45	10.28	20	65	41.61	12.65	19	92	0.019
Long-Distance Pass Attempts (n)	62.98	10.34	42	91	66.94	17.03	38	138	0.107
Mid-Range Passes Completed (n)	214.45	92.1	65	459	274.23	105.64	73	697	0.002
Mid-Range Pass Attempts (n)	242.4	96.99	87	494	306.87	108.89	93	746	0.001
Short-Distance Passes Completed (n)	83.17	35.69	24	197	103.56	43.03	32	248	0.007
Short-Distance Pass Attempts (n)	99.74	40.82	31	221	122.23	45.65	40	278	0.006
Total Passes Completed (n)	334.02	128.97	127	633	419.37	148.54	143	1031	0.001
Total Pass Attempts (n)	405.17	134.34	190	719	496.04	152.38	212	1137	0.001
Pass Completion Rate (%)	80.87	5.9	66	91	83.35	6.03	67	94	0.260
Clearances Made (n)	25.71	9.45	10	48	24	11.14	4	52	0.376
Successful Clearances (n)	20.58	7.57	8	39	19.16	8.82	3	41	0.355
Clearance Success Rate (%)	80.6	7.8	62	93	80.2	10.08	42	100	0.812
Ball Recoveries (n)	42.63	7.64	26	66	41.6	8.49	27	63	0.494
Turnovers (n)	3.1	2.08	0	11	3.09	2.09	0	9	0.965
Successful Tackles (n)	3.19	1.91	1	9	3.04	2.16	0	11	0.692
Balls in the Attacking Third (n)	33.56	13.54	9	73	40.14	15.76	18	113	0.018
Balls into the Penalty Area (n)	8.98	5.24	1	24	10.05	4.5	3	25	0.223
Dribbles in the Attacking Third (n)	12.6	7.22	3	34	15.34	8.33	2	45	0.061
Dribbles into the Penalty Area (n)	2.88	2.2	0	9	4.54	3.43	0	18	0.001
Yellow Cards (n)	1.9	1.43	0	6	1.59	1.22	0	6	0.197
Red Cards (n)	0.02	0.14	0	1	0.03	0.16	0	1	0.881
Goals Scored (n)	0.81	0.79	0	2	1.62	1.24	0	6	<0.001
Goals Conceded (n)	1.65	1.25	0	6	1.12	1.06	0	4	0.013
Total Shots on Goal (n)	11.23	5.13	4	26	13.43	5.18	3	26	0.021
Shot Success Rate (%)	8.35	9.89	0	50	13.21	11.79	0	50	0.018

Source: the authors

Technical variables according to round reached

A strange trend was found: the teams in the round of 16 and in the final performed more game actions in most of the variables, some with and without statistical differences.

Table 9.
Comparison of technical variables according to the round reached.

Variable	First Round				Round of 16				Quarter-finals				Final			
	Mean	SD	95% IC		Mean	SD	95% IC		Mean	SD	95% IC		Mean	SD	95% IC	
			Inferior	Superior			Inferior	Superior			Inferior	Superior			Inferior	Superior
Ball Possession (%)	46.7	10.4	43.7	49.8	55.8	10.0	52.2	59.4	45.5	10.3	40.6	50.3	52.3	7.4	49.4	55.2
Long-Distance Passes Completed (n)	36.5	10.3	33.4	39.5	42.3	11.7	38.1	46.5	34.8	10.4	29.8	39.9	45.4	13.6	40.2	50.7
Long-Distance Pass Attempts (n)	63.0	10.3	59.9	66.0	68.4	13.4	63.6	73.2	59.0	13.5	52.4	65.5	70.7	21.2	62.5	78.9
Mid-Range Passes Completed (n)	214.5	92.1	187.4	241.5	300.9	111.7	260.7	341.2	209.0	106.3	157.7	260.2	288.0	79.6	257.1	318.9
Mid-Range Pass Attempts (n)	242.4	97.0	213.9	270.9	333.8	116.0	291.9	375.6	240.5	108.4	188.3	292.8	321.2	82.5	289.2	353.2
Short-Distance Passes Completed (n)	83.2	35.7	72.7	93.7	112.8	49.7	94.9	130.7	84.2	38.9	65.5	102.9	106.1	33.8	93.0	119.2
Short-Distance Pass Attempts (n)	99.7	40.8	87.8	111.7	130.6	53.1	111.5	149.7	103.2	40.1	83.9	122.6	125.6	36.9	111.3	139.9
Total Passes Completed (n)	334.0	129.0	296.2	371.9	456.0	162.9	397.3	514.8	328.0	144.7	258.2	397.8	439.5	106.8	398.1	480.9
Total Pass Attempts (n)	405.2	134.3	365.7	444.6	532.7	168.0	472.2	593.3	402.7	141.9	334.3	471.1	517.5	114.3	473.2	561.8
Pass Completion Rate (%)	80.9	5.9	79.1	82.6	84.8	4.5	83.1	86.4	79.2	8.1	75.3	83.1	84.6	4.7	82.8	86.4
Clearances Made (n)	25.7	9.5	23.0	28.5	21.4	9.4	18.0	24.8	27.7	12.5	21.8	33.5	24.4	11.6	19.9	28.9
Successful Clearances (n)	20.6	7.6	18.4	22.8	17.3	8.0	14.4	20.1	21.9	9.9	17.3	26.5	19.4	8.7	16.0	22.8
Clearance Success Rate (%)	80.6	7.8	78.3	82.9	80.3	9.9	76.7	83.9	79.7	9.3	75.4	84.0	80.5	11.2	76.1	84.8
Ball Recoveries (n)	42.6	7.6	40.4	44.8	39.4	7.8	36.6	42.2	45.3	8.0	41.6	49.1	41.5	8.9	38.0	44.9

Turnovers (n)	3.1	2.1	2.5	3.7	2.8	2.0	2.1	3.6	3.0	1.9	2.1	3.9	3.4	2.4	2.5	4.4
Successful Tackles (n)	3.2	1.9	2.6	3.7	3.4	2.3	2.6	4.3	2.6	2.0	1.7	3.5	2.9	2.1	2.1	3.7
Balls in the Attacking Third (n)	33.6	13.5	29.6	37.5	41.4	19.3	34.4	48.3	36.3	13.4	30.0	42.6	41.5	12.5	36.6	46.3
Balls into the Penalty Area (n)	9.0	5.2	7.5	10.5	9.2	4.7	7.5	10.9	10.2	3.9	8.4	12.0	10.9	4.6	9.1	12.7
Dribbles in the Attacking Third (n)	12.6	7.2	10.5	14.7	16.9	9.7	13.4	20.4	12.9	8.5	8.9	16.9	15.3	6.2	12.9	17.7
Dribbles into the Penalty Area (n)	2.9	2.2	2.2	3.5	4.1	3.0	3.0	5.2	5.0	4.5	2.8	7.1	4.8	3.0	3.6	6.0
Yellow Cards (n)	1.9	1.4	1.5	2.3	1.8	1.5	1.3	2.3	1.2	0.8	0.8	1.6	1.6	1.1	1.2	2.1
Red Cards (n)	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.1	0.1	0.2	-0.1	0.2	0.0	0.0	0.0	0.0
Goals Scored (n)	0.8	0.8	0.6	1.0	1.3	0.9	1.0	1.7	1.6	1.2	1.0	2.2	2.0	1.5	1.4	2.6
Goals Conceded (n)	1.7	1.3	1.3	2.0	1.4	1.1	1.0	1.8	0.9	1.0	0.4	1.3	1.0	1.0	0.6	1.4
Total Shots on Goal (n)	11.2	5.1	9.7	12.7	12.8	5.3	10.9	14.7	13.3	5.9	10.5	16.0	14.3	4.5	12.6	16.0
Shot Success Rate (%)	8.4	9.9	5.5	11.2	12.2	10.5	8.4	15.9	12.7	10.9	7.6	17.8	14.8	13.9	9.4	20.2

Source: the authors

Table 10.
p-value for the comparison of technical variables according to the round reached.

Variable	p-value between First Round/Round of 16	p-value between First Round/Quarterfinals	p-value between First Round/Finals	p-value between Round of 16/Quarterfinals	p-value between Round of 16/Finals	p-value between Quarterfinals/Finals
Ball Possession (%)	0.001	0.970	0.129	0.004	0.596	0.129
Long-Distance Passes Completed (n)	0.183	0.966	0.016	0.177	0.771	0.025
Long-Distance Pass Attempts (n)	0.458	0.792	0.181	0.178	0.943	0.065
Mid-Range Passes Completed (n)	0.003	0.998	0.021	0.016	0.996	0.063
Mid-Range Pass Attempts (n)	0.002	0.999	0.016	0.020	0.972	0.071
Short-Distance Passes Completed (n)	0.017	0.999	0.126	0.110	0.935	0.334
Short-Distance Pass Attempts (n)	0.026	0.993	0.107	0.197	0.997	0.395
Total Passes Completed (n)	0.002	0.999	0.018	0.018	0.974	0.061
Total Pass Attempts (n)	0.002	0.999	0.013	0.020	0.981	0.062
Pass Completion Rate (%)	0.038	0.768	0.068	0.014	0.999	0.023
Clearances Made (n)	0.351	0.921	0.963	0.223	0.742	0.769
Successful Clearances (n)	0.383	0.949	0.948	0.283	0.803	0.787
Clearance Success Rate (%)	0.999	0.998	0.999	0.997	0.999	0.994
Ball Recoveries (n)	0.383	0.668	0.946	0.091	0.806	0.450
Turnovers (n)	0.960	0.998	0.935	0.995	0.761	0.921
Successful Tackles (n)	0.964	0.768	0.948	0.571	0.793	0.972
Balls in the Attacking Third (n)	0.162	0.925	0.184	0.703	0.999	0.709
Balls into the Penalty Area (n)	0.997	0.821	0.423	0.915	0.611	0.970
Dribbles in the Attacking Third (n)	0.133	0.999	0.566	0.371	0.890	0.786
Dribbles into the Penalty Area (n)	0.405	0.092	0.077	0.789	0.838	0.998
Yellow Cards (n)	0.985	0.262	0.880	0.485	0.982	0.717
Red Cards (n)	0.993	0.916	0.954	0.980	0.891	0.742
Goals Scored (n)	0.250	0.060	<0.001	0.830	0.112	0.656
Goals Conceded (n)	0.776	0.077	0.166	0.450	0.718	0.957
Total Shots on Goal (n)	0.631	0.543	0.109	0.992	0.738	0.926
Shot Success Rate (%)	0.529	0.556	0.121	0.999	0.837	0.931

Source: the authors+¿

DISCUSSION

Given the nature of soccer, whose objective is to score goals and prevent the opposing team from scoring (Delgado-Bordonau et al., 2013; Lago, 2007), it was expected that both goals scored and conceded would be a differentiating variable in all the comparisons made. This is typical in this type of tournament and like what was recorded in the 2002, 2006, 2010, and 2014 World Cups (Castellano et al., 2012; Dufour et al., 2017; Delgado et al., 2013), with mean values similar to those of this study.

However, the analysis of goals scored and conceded to define teams' success has some difficulties. One is the low number of goals scored per game and the low variance they have, which makes their association with other types of variables difficult. Therefore, it was crucial to analyze the number of shots on goal taken and their percentage of effectiveness to define team performance (Dufour et al., 2017; Göral, 2015; Lago & Martín, 2007; Rumpf et al., 2017; Szwarc et al., 2004). In the 2002 (Szwarc et al., 2004) and 2014 (Dufour et al., 2017; Rumpf et al., 2017) World Cups, these variables allowed for differentiating a successful team from an unsuccessful. In this study, the number of shots on goal did not show significant differences between the three outcomes studied, but the percentage of effectiveness of these shots did. The teams that won and tied were more effective than those that lost. The teams that tied did not differ from those that won.

In the context of the World Cup, evaluating a team's success is not necessarily subject to the number of shots on goal and its ability to convert them into goals. This variable could be explained by the fact that the teams participating in the knockout phase have a higher competitive level, with little difference between them. However, if these teams are compared with those only played in the group stage, the difference is more significant. In addition, the difference in the qualification criteria in both phases (group phase vs. knockout phase) makes the importance of a draw in the group phase more significant than in the knockout phase. Because of this difference in qualification criteria between these two phases, it was expected that goals scored and conceded, shots on goal, and the success of these shots would show a different pattern.

This study showed that the qualified teams performed more shots on goal per match, with a higher success rate, scoring more and conceding fewer goals. Nevertheless, according to the phase played in the analysis, the only difference observed was the higher average number of goals per match by the teams that played the finals compared to those in the group phase. These results are in line with those reported for the 2006 World Cup (Lago et al., 2007), where the number of shots on goal was significantly higher for teams that won during the group phase but not for the winners of the knockout phase. Also, in the 2010 World Cup, Delgado et al. (2013) found no difference between the teams in the group

phase compared with the ones in the knockout phase, but they did observe significant differences when comparing the teams that reached the last two phases of the tournament with those that only played the group phase. Therefore, these results suggest that the goal could be insufficient to define a team's success, as this variable depends on different and multiple variables, as mentioned before. When comparing these findings with previous studies, Konefał et al. (2019) found that the evolution of position-specific technical activity in the German Bundesliga showed a decrease in the total number of shots by central midfielders in won or drawn matches, while the number of passes and pass accuracy increased in various positions, indicating a trend towards greater technical accuracy rather than a higher quantity of shots. Similarly, Chmura et al. (2018) analyzed player performance in the Bundesliga and found that midfielders and forwards in won matches covered significantly greater distances at high intensities, highlighting that physical capacity and game intensity are also critical for success. Additionally, Konefał et al. (2019) emphasized the importance of technical activities such as passes and duels won, suggesting that success depends not only on shots on goal but also on effectiveness in other areas of play. Konefał et al. (2018) in their analysis of technical and physical performance in Bundesliga matches, found that winning teams performed more passes and had higher pass accuracy, supporting the notion that team success relies on multiple technical and tactical variables. Furthermore, Andrzejewski et al. (2017) showed that defenders and central midfielders in won matches covered shorter distances at high intensity compared to lost matches, indicating that defensive efficiency and strategy are also crucial. Bush et al. (2015), in their study on the English Premier League, found an evolution towards a greater number of passes and higher pass accuracy, especially among central defenders and midfielders, underscoring the importance of possession and control of the game. These studies collectively underscore that success in professional football cannot be attributed solely to the number of shots on goal, but rather depends on a combination of technical, tactical, and physical factors.

Technical variables

Teams that qualified for the knockout phase showed significantly better performance in some technical variables. These can be considered performance indicators since the evolution of some of these variables has been observed over time (Barnes et al., 2014; Wallace et al., 2014), and their analysis has allowed differentiating successful from unsuccessful teams (Castellano et al., 2012). For example, in this study, the passing success rate was over 80%, and Premier League players recorded over 70% effectiveness

(Barnes et al., 2014). This difference might be expected as the best players from each country go to the World Cup.

This research demonstrated that, in general, the teams that advanced to the knockout phase tended to make a higher number of short-, medium-, and long-distance passes compared to those that only participated in the group stage. These findings are similar to those reported for the 2014 World Cup and for the top-level teams in Europe, where the most successful teams showed a higher number of passes, along with a higher success rate (Göral, 2015; Paixão et al., 2015). In the 2010 World Cup, the most successful teams made more short- and medium-distance passes, while the less successful teams made more long-distance passes (Clemente et al., 2012). However, in the 2002 World Cup, the passes were not a differentiating parameter for the teams' success (Scoulding et al., 2004).

In addition, analyzing results by match and specific phase yielded an unclear trend in passing patterns. Perhaps this depends on the tournament analyzed because there is no discrimination against game conditions. For example, when the 2008-2009 UEFA Champions League finalists lost or tied the match, they showed a more significant sequence of long-distance passes, whereas when they won, they showed a more notable sequence of short-distance passes (Paixão et al., 2015). This fact could be because modern soccer focuses more on controlling matches and creating attacking space, increasing the number and accuracy of short- and medium-distance passes rather than focusing on long-distance passes to the opponent's area. The same was concluded by Yi et al. (2020) when analyzing matches from nine UEFA Champions League seasons (2009/2010 to 2017/2018).

Moreover, teams that qualified for the knockout phase had a more significant number of balls sent to the last third of the field, along with a more significant number of dribbles in the penalty area, which corresponds to the attacking areas, and these are the zones of the field where the most significant number of goals are scored (Çobanoğlu, 2019). However, this did not occur in the other two analyses. Plus, in the 2014 World Cup, there were no differences in the plays made in the attacking areas or the penalty area between the teams in the group phase and the teams in the knockout phase (Dufour et al., 2017).

In the 2014 World Cup analysis, Dufour et al. (2017) compared group-phase and knockout-phase teams, excluding matches tied, whose technical variables may differ from those observed in the other two possible outcomes (Paixão et al., 2015). If the success of soccer teams depended on whether or not the team qualifies for the knockout phase, it is essential to consider the matches that resulted in a draw, as this outcome allows the team to score points and define whether or not qualification is achieved (Gómez et al., 2012). In this study, about 44% of the qualified teams had at least one draw in the first round. Plus,

the team's way of playing would condition the characteristics of the players' technical actions, incorporating themselves more or less into offensive tasks, and making retreats of greater or lesser distance. Therefore, players were asked to make some physical or other demands depending on the game mode, with substantial differences in many cases (Barrero & Cabrera, 2019). This could be one reason that may explain the differences in the results.

Physical variables

One of the most studied aspects within the physical variables is the total distance covered in a match. However, its association with performance in soccer is not clear (Balyan et al., 2007; Dufour et al., 2017). In the Premier League, the evolution of the distance traveled from the 2006-2007 season to the 2012-2013 season only showed an increase of 2%, being different from other physical variables, such as the distance traveled while sprinting, which showed an increase of 35% in this same period (Barnes et al., 2014). In this study, no difference was observed in the total distance traveled by the teams in none of the analyses performed. These results are in line with those reported in the 2010 and 2014 World Cups when the total distance traveled did not allow for rating the performance and success of the participating teams (Clemente et al., 2013; Dufour et al., 2017). Even some Italian soccer Serie A and English Premier League studies have suggested that less successful teams have more total distance traveled (Di Salvo et al., 2009; Rampinini et al., 2009).

In this study, even though the total distance traveled was not significantly different, the teams that tied, those that did not qualify to the knockout stage and those who advanced the most in the tournament covered the most distance on average. The teams that only reached the group phase and those that lost the most had a more significant total distance. This tendency decreased as the tournament progressed. Some of those comparisons explained above presented statistical differences.

Different factors might explain these findings concerning physical variables. Firstly, the behavior of players and the tasks they must accomplish during a match depends mainly on the style of play and the tactical disposition of each team, whose tendency might change in each tournament (Balyan et al., 2007; Di Salvo et al., 2009). In addition, each player's playing position and role could also influence accomplishing tasks during a match (Lago-Preñas et al., 2010; Bojkowski et al., 2015). Another critical aspect to bear in mind may be the hig-her probability of winning a match (75%) when the first goal is scored (Çobanoğlu, 2019). Scoring that first goal might cause players to adopt a more conservative behavior in the game, making them travel a shorter distance (Çobanoğlu, 2019). This fact could also

explain the pattern of distance traveled at different intensities, where the most successful teams traveled a more significant distance in the lower intensity zone (zone 1). This may reflect conservative behavior during the game (Çobanoğlu, 2019) and more distance covered in the zone of higher intensity (zone 5). The latter is related to critical game actions in the outcome of a match (Bangsbo et al., 2006; Bradley et al., 2009).

The above might also be associated with ball possession. In this study, ball possession was more in the teams that reached the knockout phase than in the teams that only played the group phase, although the latter had a more significant total distance traveled. However, when discriminating by a specific phase, the tendency is not so clear, so further research is suggested. These results were similar to those described for the 2014 World Cup, where the most successful teams had more significant ball possession, being most evident in the offensive areas of the field (Göral, 2015; Paixão et al., 2015). This might reflect that those teams have better executed the critical tasks during the game (Bangsbo et al., 2006; Bradley et al., 2009). Furthermore, when revising the variables related to the ball in the attack third, dribbling in the attack third, and dribbling in the penalty area, that behavior was confirmed. The unusual was that this pattern was not present in the other analysis, so further research is recommended.

CONCLUSIONS

This study showed the differences between physical variables and technical variables when comparing the successful teams and the less successful teams during the 2018 FIFA World Cup in Russia. Technical variables presented more differences than physical variables.

On the one hand, regarding the physical variables, the most successful teams traveled shorter distances, presenting more significant distances in intensity zones 1 and 5 and possession of the ball. This fact might suggest that the teams have better regulation and distribution of game actions during the tournament. On the other, concerning the technical variables, the most successful teams made a more significant number of passes, with a higher percentage of success. This fact is associated with a higher percentage of successful shots on target, more significant play in the attack zone, and dribbling actions in the penalty area. Those above might explain the more significant number of goals scored by these teams.

The above suggests considering physical, tactical, and technical aspects for a team to score and avoid conceding goals. Therefore, these aspects deserve to be analyzed to define their relationship with success in the game.

Last but not least, in terms of practical application, this information is not only beneficial for decision-making by coaches. However, it can also help professionals identify what kind of physical and technical variables can be controlled, both in training and competition.

GEOLOCATION INFORMATION

All this paper was made in Cali, Valle del Cauca, Colombia.

DECLARATION OF INTEREST STATEMENT

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript. The authors report no involvement by the sponsor in the research that could have influenced the outcome of this work.

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