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## ORIGINAL

### SITUATIONAL VARIABLES AND DISTANCE COVERED DURING THE FIFA WOLD CUP SOUTH AFRICA 2010

### VARIABLES CONTEXTUALES Y DISTANCIA RECORRIDA EN LA COPA MUNDIAL SUDÁFRICA'10

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#### ABSTRACT

The aim of this study was to determine whether there is any influence from different contextual variables on the physical performance of the teams during the South African World Cup 2010. The physical performances of 128 teams were studied, measured by distance travelled in meters per minute ( $m \cdot \text{min}^{-1}$ ), during the 64 matches played in South Africa 2010. The contextual variables were: type of competition, continent, match score, FIFA team ranking, and FIFA opponent ranking.

Significant differences were found only in the continent variable ( $F=3.86, p=0.005$ ) and match score in interaction with type of competition ( $F=3.999, p=0.029$ ). The results of this study provide increasing knowledge concerning the influence of contextual variables on the physical demands on

teams during a competition match and, therefore, will help to manage the importance of these energy requirements in relation to physical performance.

**KEYWORDS:** Soccer, motion analysis, competition, situational variables.

## RESUMEN

El objetivo de este trabajo fue relacionar las variables contextuales y la velocidad media de los desplazamientos realizados por los equipos que participaron durante la Copa del Mundo Sudáfrica 2010. Se estudiaron 128 registros, medidos a través de la velocidad media en metros por minuto ( $m \cdot \text{min}^{-1}$ ), durante los 64 partidos celebrados. Las variables contextuales fueron: *tipo de competición, continente, resultado del partido, ranking FIFA del equipo y ranking FIFA del rival*. Únicamente se han encontrado diferencias significativas en las variables *continente* ( $F=3,861; p=0,005$ ) y *resultado del partido* en interacción con *tipo de competición* ( $F=3,999; p=0,029$ ). Los resultados de este trabajo permiten aumentar el conocimiento referente a la influencia de las diferentes variables contextuales en la intensidad de desplazamiento de los equipos mientras disputan un partido de competición y, en consecuencia, gestionar la importancia de estos requerimientos energéticos con relación a la evaluación del rendimiento físico.

**PALABRAS CLAVE:** fútbol, análisis del movimiento, competición, variables situacionales.

## INTRODUCTION

The study of physical demands during competition games has been a very recurrent goal in the history of research in football (Carling, Bloomfield, Nelsen, and Reilly, 2008). Nowadays, a large amount of information about the leading national championships is available: the English Premier League (Dellal et al., 2011; Di Salvo, Gregson, Atkinson, Tordoff, and Drust, 2009), the Italian Serie A (Vigne, Gaudino, Rogowski, Alloatti, and Hautier, 2010), the Spanish La Liga (Dellal et al., 2011; Zubillaga, Gorospe, Hernández-Mendo, and Blanco-Villaseñor, 2007), the French Ligue 1 (Dellal, Wong, Moalla, and Chamari, 2010), the German Bundesliga (Dellal, 2008). Similarly, there is considerable literature on international competitions such as the UEFA Champions League or Europa League (Di Salvo, Baron, González-Haro, Gormasz, Pigozzi, and Bachl, 2010). However, no information regarding physical demands of the national teams involved in world cup games has been found by the authors in the scientific literature.

The knowledge about the competition physical demands provides relevant information in order to optimize the training process of the sportsmen or women (Castellano, Frenández, Castillo, and Casamichana, 2010). It also offers the possibility of specific training protocols to be developed according to the demands found (Bradley, Mascio, Peart, Olsen, and Sheldon, 2010; Di Salvo,

Baron, Tschan, Calderón Montero, Bachl, and Pigozzi, 2007). Over the last years, detailed knowledge has been gathered concerning the physical demands of players in accordance with their specific positions on the pitch (Di Salvo et al., 2007; Di Salvo et al., 2010; Zubillaga et al., 2007), the differences between the periods of the match (Rampinini, Impellizzeri, Castagna, Coutts, and Wisloff, 2007), differences between different championships (Dellal et al., 2011) and different situational variables such as the level of the opponent, the temporary result of the match or its location, which seems to have an impact on the physical response given by the players during the matches, have been analyzed (Castellano, Blanco-Villaseñor, and Álvarez, 2011; Lago, Casais, Dominguez, and Sampaio, 2010). According to subsequent findings, the teams have to cope with greater physical output than their opponents when playing against higher level squads.

In this sense, the study aims at using the descriptive data to check how certain situational variables can have a significant impact on the average speed of trips made by national teams during an international championship. The importance of this study lies in the fact that it can possibly be established whether variables like the type of competition, the result of the game or the level of the teams can be affected in the average speed of the trips made by teams during a competition game. It might also prove helpful for the development of strategies in the training planning as well as for the implementation of recovery protocols between the same championship successive games.

## **2. MATERIALS AND METHODS**

### **2.1. Participants**

The values ( $n=128$ ) of the total distance covered by the teams in each of the games during the World Cup 2010 were collected from the official website offered by the FIFA (2010a). The four games in which stoppage time was played were eliminated ( $n=8$  registers). This means a total of 120 values of the total distance covered by whole the team, working out the average speed expressed in meters per minute ( $m \cdot \text{min}^{-1}$ ).

### **2.2. Depending variable: average speed of the trips**

The average speed of the trips made by the team ( $m \cdot \text{min}^{-1}$ ) was selected as a global indicator to analyze the meters covered per minute of participation by the team during each played game. This measurement was selected to avoid the influence of games with different real lengths as it has been done in previous studies (Aughey, 2010 and 2011; Brewer, Dawson, Heasman, Stewart, and Cormack, 2010; Harley et al., 2010). The registration technique used by the FIFA to monitor this distance was the ProZone system, a semi-automatic system for the recognition of images obtained through a multi-camera system. This system has independently been validated proving to be a reliable system (Di Salvo, Collins, McNeill, and Cardinale, 2006) with high reliability values (Di Salvo, Gregson, Tordoff, and Drust, 2009).

### 2.3. Independent values

The selected independent variables were the following ones: type of competition, continent, match score, number of played games, team's FIFA ranking and the opponents' FIFA ranking, as it is illustrated in chart 1.

**Table 1.** Levels for each of the classification variables.

| Variable                        | Levels   |
|---------------------------------|--|
| <i>Continent:</i>               | Africa, America, Europe, Asia and Australia                                  |
| <i>Match score:</i>             | Defeat, Draw and Win   |
| <i>Type of competition:</i>     | Group stages and qualifier   |
| <i>No. of played matches:</i>   | 1st, 2nd, 3rd, eighths, quarters, semifinal , 3rd and 4th position and final |
| <i>Team's FIFA Ranking:</i>     | 1-8, 9-19, 20-32 and 33-108  |
| <i>Opponent's FIFA Ranking:</i> | 1-8, 9-19, 20-32 and 33-108  |

The levels of situational variables were the following ones: a) for the variable *type of competition* the differences between the two competition formats existing in the World Cup were analyzed. The first stage with groups of four teams that play against each other (96 registers), with only the two national sides with the highest number of points making their way through, and the second stage during which the games are played in qualifying rounds (32 registers), in which the winning national team goes through to the next stage and the loser is sent out of the competition; b) for the variable *continent* the teams are qualified according to the continent to which they belong so that the world championship includes a total of 6 teams from Africa, 8 teams from America, 13 teams from Europe, 3 teams from Asia and 2 teams from Australia; c) The *match score* was divided in three levels, win, defeat and draw. Additionally, a difference between the type of competition and the type of played game was established (group stages or qualifier); d) the variable number of played games was considered to determine whether there was a variation in the distance covered by teams as they progressively played games throughout the World Cup. The number of analyzed games corresponds to: 96 registers of the group stages (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> game), 16 registers of the fourth game (round of 16), 8 registers of the fifth game (quarter-final), and finally only 4 registers for the sixth game (semifinal) and the seventh game (final and third and fourth position), which made a total of 128 registers; e) Lastly, the teams' *FIFA ranking* was also introduced to establish the extent to which different levels of game of the national teams influenced the energetic demands in the games. The FIFA ranking is produced according to the points of each national team. After each played game, the participating teams receive a series of points according to the result of the game (M), its importance (I), the level of the opponents (T) and the average value of each team's confederations (C); with the formula being as follow,  $Points = M * I * T * C * 100$  (FIFA, 2010b).

## 2.4. Procedure

The values of the distances covered per minute by the teams were taken from the FIFA website (2010a). The accumulated distance covered by all the team players who have taken part in the game was recorded and the average value of each minute was worked out, that is to say, the average speed of the trips ( $\text{m}\cdot\text{min}^{-1}$ ), in order to have a global indicator of the distance covered per minute of playing time of the team during the game.

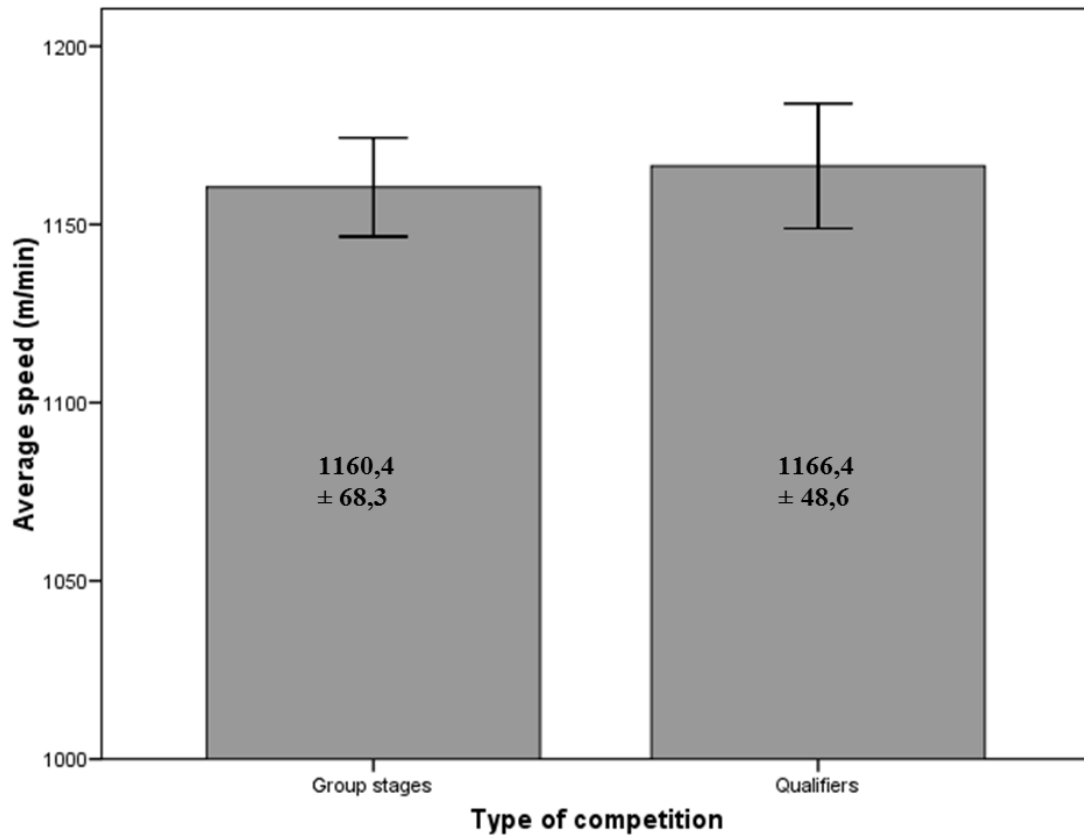
## 2.5. Statistical analysis

The figures are presented as averages and standard deviation ( $\pm\text{DS}$ ). Levene's statistical analysis for the test for homogeneity of the variances was used. Student's t-test was carried out to estimate the presence of significant differences in the average speed ( $\text{m}\cdot\text{min}^{-1}$ ) of the teams in relation with the variable *type of competition*. The analysis of variance (ANOVA) was used for the rest (game result, number of played games, continent, team's FIFA ranking and the opponent's FIFA ranking). Bonferroni's post-hoc test was used when significant differences between them were estimated. All the statistical analyses were carried out using the statistical package *SPSS 16.0 for Windows* and the admitted significance level was  $p<0.05$ .

## 2. RESULTS

### *Type of competition*

The Figure 1 shows the average speed per team in each of the two stages of the competition. No significant differences have been found ( $t = -0.457$ ;  $gl=126$ ;  $p= 0.649$ ) although the teams' average speed is at its highest level during games played in the qualifying form.

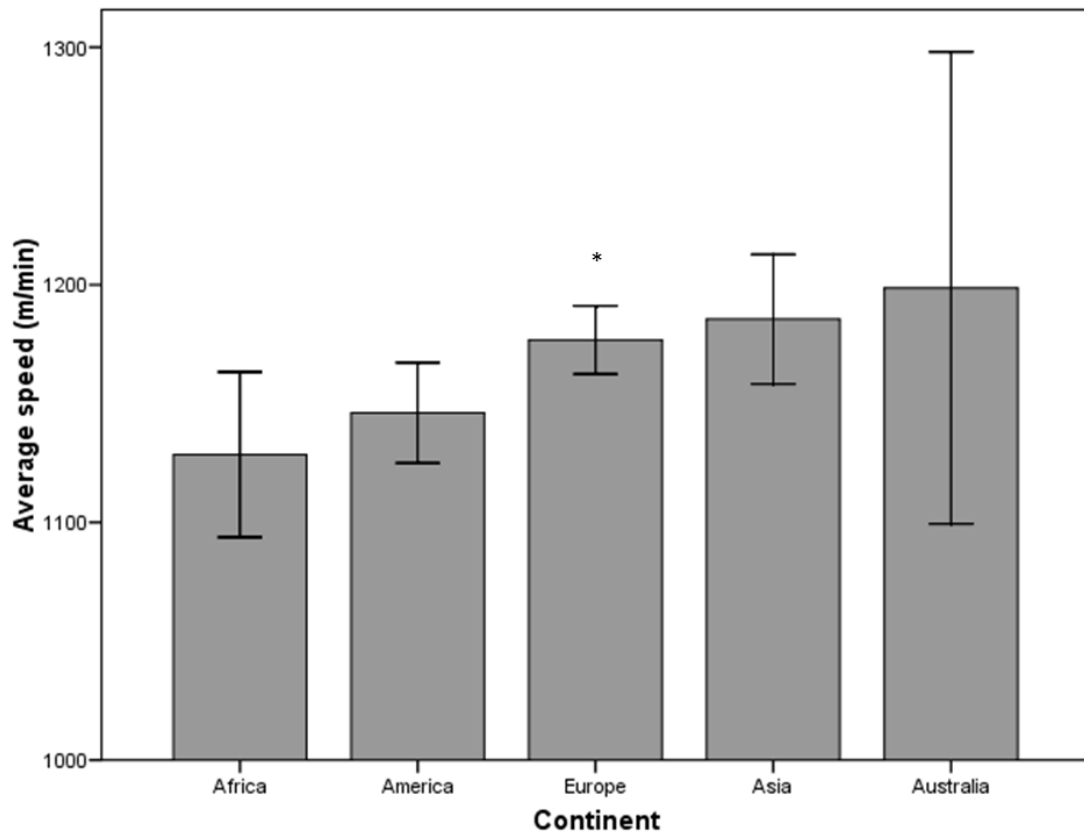


**Figure 1.** Teams' average speed during the different types of competition within the World Cup South Africa 2010.

### *Continent*

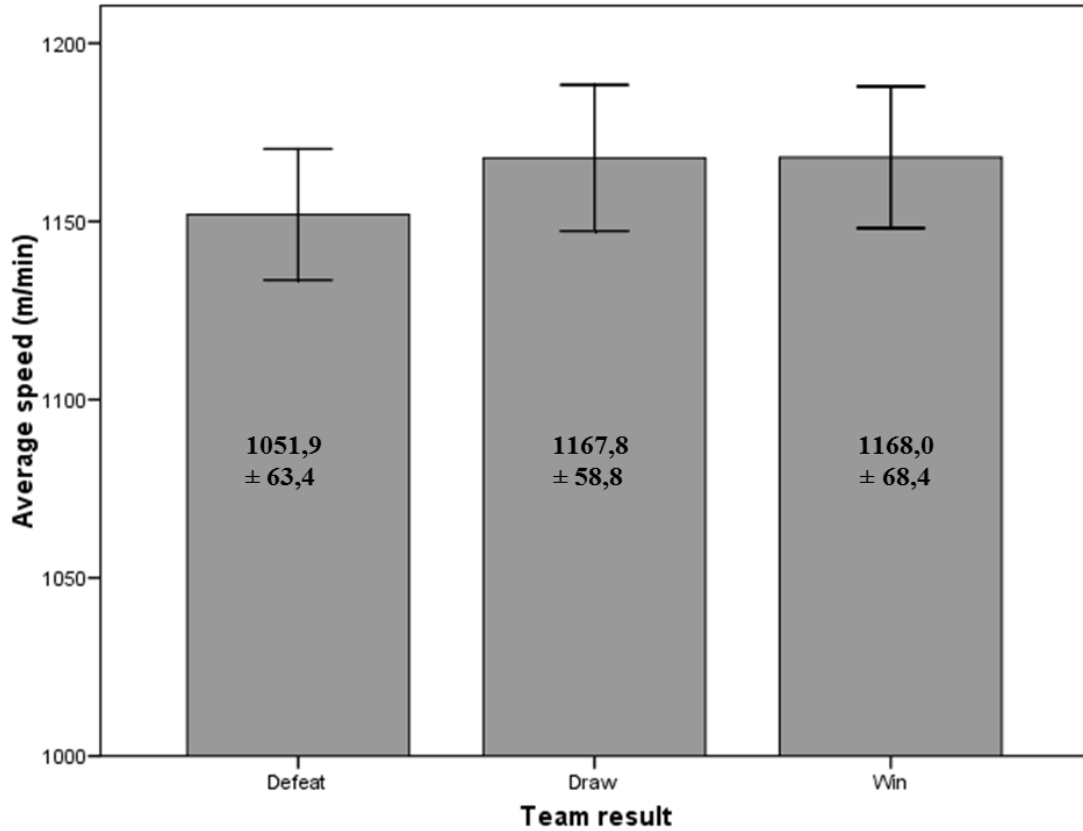
The figure 2 shows the average speed of the national teams grouped by continents, with the findings revealing that the European national teams travel at significantly higher speeds with respect to the ones from Africa ( $F=3.861; p=0.005$ ).

**Figure 2.** Average speed of the trips made by the teams from the different continents within the World Cup South Africa 2010. \* is > Africa.



*Final result*

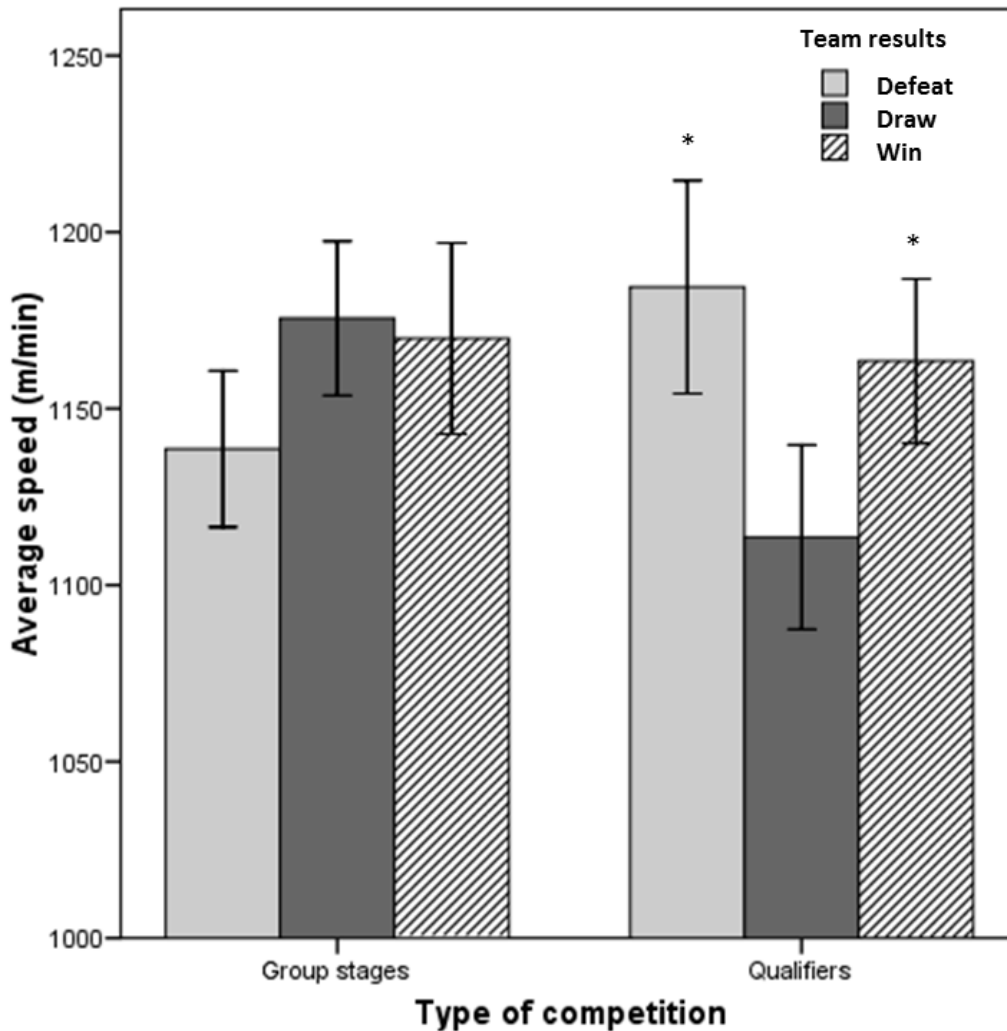
Figure 3 shows the average speed of the trips made by the defeated, drawing and the winning teams, with no significant differences found between them ( $F=0.941;p=0.393$ ).



**Figure 3.** Average speed of the trips made by the winning, drawing and defeated teams within the World Cup South Africa 2010.

However, significant differences were estimated according to the stage of the competition (group stages or qualifier, Figure 4), with the drawing teams travelling at a lower average speed ( $1113.6 \pm 16.4$ ) with respect to the defeated ( $1184.4 \pm 52.2$ ) and the winning ones ( $1163.5 \pm 40.3$ ) ( $F=3.999$ ;  $p=0.029$ ), no differences were found ( $F=2.866$ ;  $p=0.062$ ) in the games played during the group stages (defeat =  $1138.6 \pm 63.4$ ; draw =  $1175.5 \pm 56.4$ ; win =  $1160.4 \pm 68.3$ ).

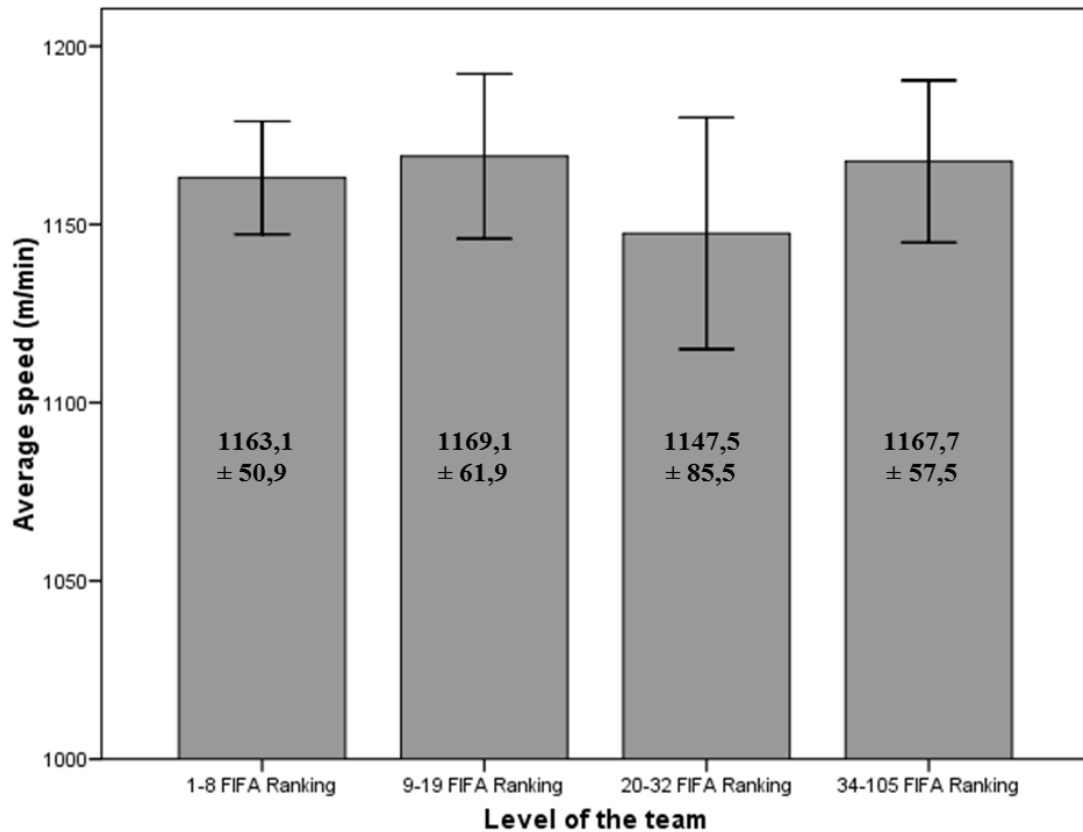




**Figure 4.** Average speed of the trips made by the winning, drawing and defeated teams according to the different stage of the competition within the World Cup South Africa 2010. \* is > draw.

#### *Team's FIFA ranking*

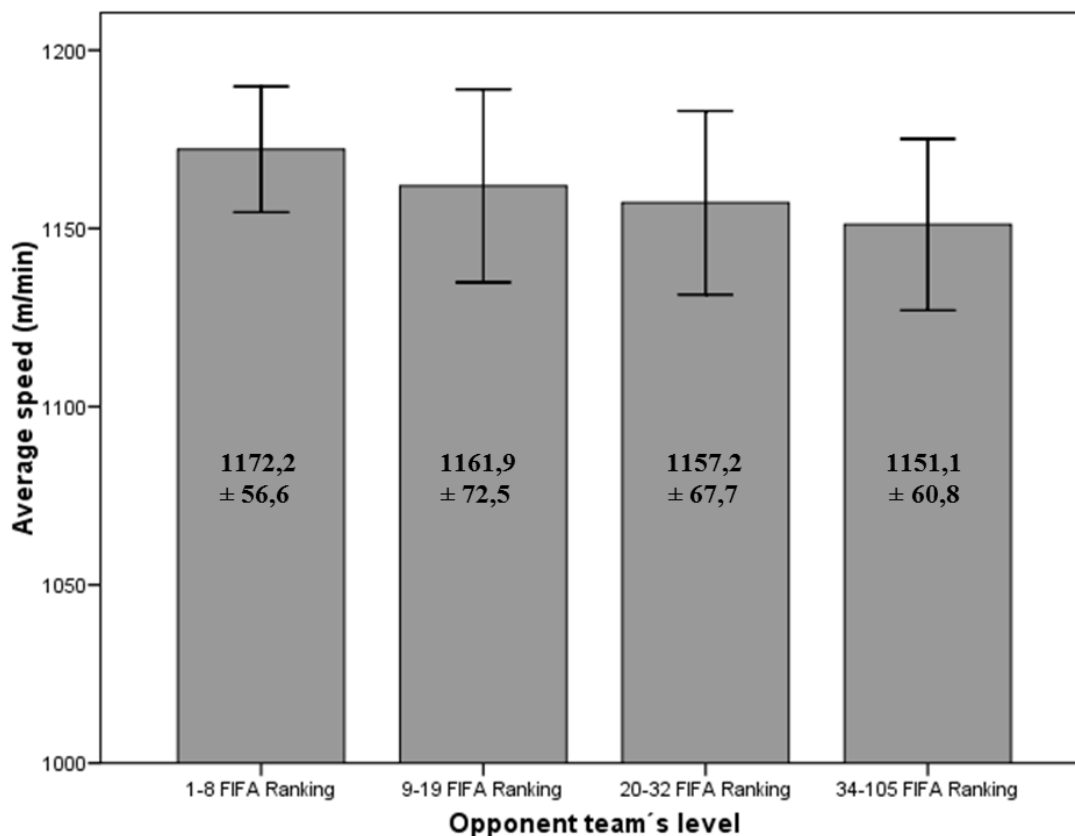
Figure 5 shows the average speed of the trips made by each of the four teams of the established level in accordance with FIFA ranking before the competition goes under way. It is noted that there were no significant differences between the groups ( $F=0.693$ ;  $p=0.557$ ), with the 3<sup>rd</sup> level group (20-32 FIFA Ranking) travelling at a lower average speed.



**Figure 5.** Average speed of the trips made by the four level groups within the World Cup South Africa 2010.

#### *Oponent's FIFA Ranking*

Figure 6 shows the average speed of the trips made by each of the four level groups established according to the *FIFA Ranking* before the start of the competition. In this case, the average speed of the trips made by the opponent team is revealed. It is noted that, although there are no significant differences between the groups ( $F=0.669; p=0.573$ ), the higher level the opponent team shows, the higher the speed at which the team travels is, with the average speed decreasing as the opponent team level diminishes.



**Figure 6.** Average speed of the trips made by the opponent teams from the four level groups within the World Cup South Africa 2010.

#### 4. DISCUSSION

This study was aimed at analyzing the average speed of the trips made by each of the national teams taking part in the World Cup South Africa 2010 according to different situational variables: competition type, continent, game result, number of played games, own team and opponent team's FIFA Ranking. It is, as far as the authors know, the first study to implement statistical inferences from average speed variable of all the same team players who played every game ( $\text{m}\cdot\text{min}^{-1}$ ).

The first analyzed situational variable was the *competition type*, that is to say, the type of games (league or qualifier). No research in the impact of physical performance of the national teams according to that variable has been found, although studies in relation to different national leagues are available: the English Premiere League, the Dutch Eredivisie, the German Bundesliga, the Belgium Jupiler League, the Italian Serie A and the Danish SAS Ligaen (Bangsbo, Nørregaard and Thorsoe, 1991; Dellal et al., 2011; Mohr, Krusturp and Bangsbo, 2003; Pirnay, Geurde, and Marechal, 1993; Verheijen, 1998). Additionally, we believe it is a variable that could influence the teams' patterns of play, knowing that the competition characteristics allow for any previously made error to be corrected (league type), whereas an error in the other competition type (qualifier) would lead to an elimination. However, given the

obtained results, it is concluded that it did not influence the average speed of the trips made by the teams when this variable was analyzed alone. Nevertheless, it presented relevant information when it was combined with the result obtained by the teams during the games (Figure 4). During the qualifying rounds, the drawing teams made trips at a lower average speed than the winning and defeated teams, which differences were not obtained when the average speed of the games in the group stages was analyzed. These results could be justified since the teams playing a tied game maintained a system order during qualifying round games for fear of being eliminated, taking very few risks and without total physical exhaustion. Moreover, when the match result was uneven, the disadvantaged team was obliged to work harder physically in order to reverse the disadvantageous situation in which they were as soon as possible (Castellano et al., 2011; Lago et al., 2010).

As regards the average speed of the trips according to the team's level, it was noted that there were no differences between the 4 level groups. This result seems not to be consistent throughout the literature, with Di Salvo et al. (2009) finding that the best classified teams travel a shorter distance with high intensity and shorter distance with sprint than the teams classified in the middle positions and the lower positions on the table.

Even though there are not significant differences, it was also estimated that the average speed of the trips lowered as the opponent's level decreased, travelling at a higher average speed when the matches were played against teams with a high FIFA Rankin. These results are consistent with the ones found by Lago et al. (2010) and Castellano et al. (2011) who found larger distances covered by first league players when they played against a team with a better classification in the league than when they took on a lower classified squad.

We understand that the biggest limitation of the study refers to the fact that it was decided that the teams' physical demand would be resumed in a single performance indicator, knowing that the players' positioning has specific requirements in the competition (Dellal et al., 2011; Di Salvo et al., 2010; Zubillaga et al., 2007) and that it would be interesting to know them and relate them with other situational variables that can influence these player's demands. In addition, intensity ranks would provide the study with more information, especially the distance covered at high speed since it can prove a key to determining the team or competition's physical profile (Di Salvo et al., 2009; Di Salvo et al., 2010). However, despite the bias in the data collection, this study can provide relevant information from which new research issues can be suggested.

## 5. CONCLUSIONS

The main conclusions obtained in this study can be summarized in the following points:

- The situational variable referring to the *competition type* (group stages or qualifiers) appears not to affect the teams' physical demands when the

study is conducted only taking this variable at maximum competitive level into account. However, if it is related to the obtained result, winners as well as losers travel at a higher average speed than the drawing teams during qualifying games.

- The European teams travel at a significantly higher average speed than the ones from Africa, although no significant differences were found between the rests of the continent.

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