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## Match analysis in football: a systematic review

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### Abstract

The main focus of this paper was to review the available literature on match analysis in adult male football. The most common research topics were identified, their methodologies described and the evolutionary tendencies of this research area systematised. A systematic review of Institute for Scientific Information (ISI) *Web of Knowledge* database was performed according to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guidelines. The following keywords were used: *football* and *soccer*, each one associated with the terms: *match analysis*, *performance analysis*, *notational analysis*, *game analysis*, *tactical analysis* and *patterns of play*. Of 2732 studies initially identified, only 53 were fully reviewed, and their outcome measures abstracted and analysed. Studies that fit all inclusion criteria were organised according to their research design as descriptive, comparative or predictive. Results showed that 10 studies focused predominantly on a description of technical, tactical and physical performance variables. From all comparative studies, the dependent variables more frequently used were “playing position” and “competitive level”. Even though the literature stresses the importance of developing predictive models of sports performance, only few studies ( $n = 8$ ) have focused on modelling football performance. Situational variables like game location, quality of opposing teams, match status and match half have been progressively included as object of research, since they seem to work as effective covariables of football performance. Taking into account the limitations of the reviewed studies, future research should provide comprehensive operational definitions for the studied variables, use standardised categories and description of activities and participants, and consider integrating the situational and interactional contexts into the analysis of football performance.

**Keywords:** *game analysis, soccer, performance, review*

### Introduction

To better understand the constraints that promote sporting success, match analysis has assumed a very important role in sports games (Carling, 2009). In football, match performance can be defined as the interaction of different technical, tactical, mental (Carling, 2009) and physiological factors (Drust, Atkinson, & Reilly, 2007).

Although one of the first works in this area of research was published in 1910 by Hugh Fullerton, the scientific research carried out was minimal during the following decades. This limited research production was among other reasons behind the lack of scien-

tific journals on the subject (Hughes & Franks, 2004a). Since the 1990s, however, and through the creation of international scientific societies (e.g., International Society of Performance Analysis of Sport), the edition of specialised scientific journals (e.g., *International Journal of Performance Analysis in Sport*; *Journal of Quantitative Analysis in Sports*) and the introduction of world conferences on notational analysis (currently named, “World Congress of Performance Analysis in Sport”), match analysis has gained a more prominent place in the scientific literature.

More recently, there have been specific edited books (Carling, 2009, 2005; Hughes, 1997, 2008;

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Hughes & Franks, 2004b; Reilly, 1977), and a significant amount of original research papers in scientific journals. However, despite an increase in the amount of research, there are still only a few systematic reviews available on match analysis, specifically in football.

The purpose of this study was therefore to systematically review and organise the literature on match analysis in adult male football as an attempt to identify the most common research topics, to characterise their methodologies and to systematise the evolutionary tendencies on this topic.

## Methods

A systematic review of the available literature on match analysis in adult male football was conducted according to PRISMA (Preferred Reporting Items for Systematic reviews and Meta-analyses) guidelines. Three independent reviewers separately conducted the analysis (HS, RM, JL) performed on 4 November 2011.

In order to ensure the quality of articles, the electronic database Institute for Scientific Information (ISI) *Web of Knowledge* was researched for relevant publications prior to 4 November 2011, using the keywords *football* and *soccer*, each one associated with the terms: *match analysis*, *performance analysis*, *notational analysis*, *game analysis*, *tactical analysis* and *patterns of play*.

The inclusion criteria for these articles were: (1) relevant data concerning technical and tactical evaluation or statistical compilation, and time-motion analysis; (2) performed by amateur and/or professional adult male footballers and (3) written in English language. Studies were excluded if they: (1) included children or adolescents (under 18 years); (2) included females; (3) did not include any relevant data and (4) were conference abstracts. If there

was disagreement amongst authors regarding the inclusion of certain articles, the final decision was left to the senior author (JL) due to greater experience on these matters.

To organise the results, the studies were grouped according to the major research topics of match analysis that emerged from the detailed analysis, and to the methodological strategies used.

## Results

The initial search identified 2732 titles in the described database. After importing all references found using a reference manager software (EndNote X4, Thomson Reuters, Philadelphia, PA, USA), duplicates were removed (792 references) and papers from non-sports science-specific journals (1550 references) were eliminated either automatically or manually. The remaining 390 articles were then screened for relevance based on their title and abstract, resulting in another 279 studies being eliminated from the database. The full text of the remaining 111 articles was then read and another 58 were rejected due to a lack of relevance to the purpose of this study. At the end of the screening procedure, only 53 articles remained for the systematic review (Figure 1).

The chronological analysis of the articles published not later than year 2011 that comprise this review work evidenced the recent development in this area of research, highlighting that almost half (45%) of the studies were published in the last two years (i.e., years 2010 and 2011).

After in-depth analysis, it was decided that the most appropriate way to present the results would be to categorise them as suggested by Marcelino, Mesquita, and Sampaio (2011). Based on this categorisation system, a new system was created resulting in the categorisation of material as a

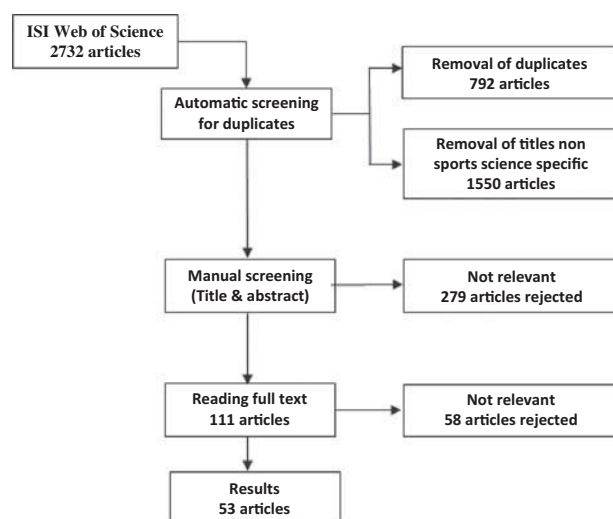


Figure 1. Flow chart of methodology used for the article search.

function of two levels of analysis: a first-order level, depending on the type of analysis performed (descriptive analysis, comparative analysis and predictive analysis); and a second-order level, depending on the type of variables analysed (Figure 2).

## Discussion

### *Descriptive analysis*

The common aim of many of these reviewed papers is to describe the activity patterns of players (Table I). However, there are some exceptions. Carey et al. (2001) analysed the footedness of 236 players in the 16 teams of the 1998 World Cup finals in France. These researchers found no evidence that these players differed in any way from the rest of the population regarding their degree of right-footedness as measured by their choices on the pitch. De Baranda, Ortega, and Palao (2008) analysed the characteristics of goalkeepers' defensive interventions together with the type of opponent attack. Their results showed that the opposing teams used positional attacks more frequently and had the final pass coming from the far zones of the field. Goal saving and control with the feet were the most frequently used actions by goalkeepers, together with displacement before performing technical movements/skills.

Regarding time-motion analysis, studies were grouped by movement categories according to their intensity, ranging from five to seven categories from

"standing" to "sprinting", trying to characterise the physical requirements in football. In general, these studies have shown that elite players normally covered distances between 9 and 14 km, and performed approximately 1330 activities during a match, including 220 displacements at high speed (Barros et al., 2007; Di Salvo et al., 2007; Lago, Casais, Dominguez, & Sampaio, 2010; Rampinini et al., 2007).

Given the specificity of the goalkeepers' activity, these players were also targeted for a similar analysis (De Baranda et al., 2008). It was found that goalkeepers ( $n = 62$ ) covered a total distance of  $5611 \pm 613$  m per match, of which  $4025 \pm 440$  m were covered walking,  $1223 \pm 256$  m jogging,  $221 \pm 90$  m running,  $56 \pm 34$  m at high intensity while the distance covered in sprinting was  $11 \pm 12$  m.

### *Comparative analysis*

*Different playing position.* The relationship between the player's positional role and performance was frequently studied (Table II). In these investigations, the authors attempted to group players according to different criteria, which made it difficult to compare accurately the results. Therefore, it seemed consensual to group players according to three major groups: defenders, midfielders and forwards. Based on these functional positions, researchers seek to find relationships that are established with physical-

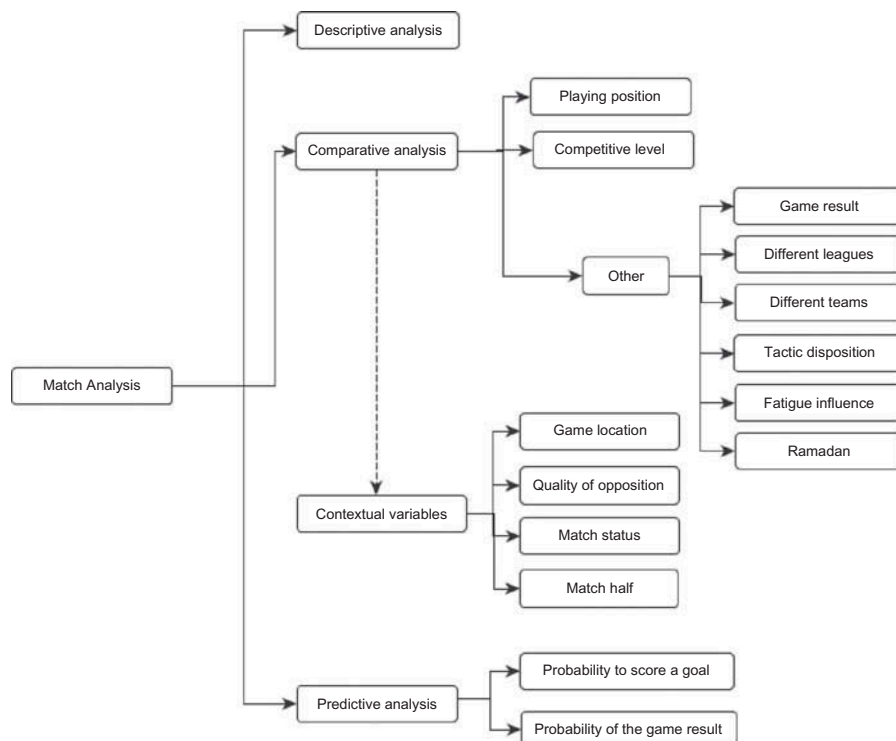


Figure 2. Scopes of match analysis.

Table I. Empirical studies with predominantly descriptive analysis.

Study	Sample	Movement categories	Procedures
Barros et al. (2007)	55 players of First Brazilian Division	Standing/walking/jogging, low-speed running, moderate-speed running, high-speed running, sprinting.	Video analysis of the activity of players.
Di Salvo et al. (2007)	300 players of Spanish Premier League	Standing/walking/jogging, low-speed running, moderate-speed running, high-speed running, sprinting.	Computerised match analysis system (AMISCO)
Rampinini, Coutts, Castagna, Sassi, and Impellizzeri (2007)	20 players of a successful team that participated in a major European National League	Standing, walking, jogging, running, high-speed running, sprinting.	Computerised match analysis system (ProZone)
Di Salvo, Benito, Calderon, Di Salvo, and Pigozzi (2008)	62 goalkeepers of English Premier League	Walking, jogging, running, high-speed run, sprinting and total distance.	Computerised match analysis system (ProZone)
Bradley, Di Mascio, Peart, Olsen, and Sheldon (2010)	110 players of European successful teams	Standing, walking, jogging, running, high-speed running, sprinting.	Computerised match analysis system (ProZone)
Gregson, Drust, Atkinson, and Di Salvo (2010)	485 players of the English Premier League	Total high-speed running (expressed as both high-speed running distance completed with the respective players team in possession and without possession), high-speed running distance, total sprint distance.	Computerised match analysis system (ProZone)
Vigne, Gaudino, Rogowski, Alloatti, and Hautier (2010)	388 players of the Italian Series A	Walking, jogging, speed below the anaerobic threshold, speed above the anaerobic threshold, sprint.	Computerised match analysis system (SICS)
Carling (2011)	21 players of French League 1 division	Total distance covered in: low-to-moderate intensity; high intensity; very high intensity.	Computerised match analysis system (AMISCO)
Castellano, Blanco-Villaseñor, and Álvarez (2011)	434 players of Spanish Premier League	Standing/walking/jogging, low-speed running, moderate-speed running, high-speed running, very high-speed running, sprinting.	Computerised match analysis system (AMISCO)
Robinson, O'Donoghue, and Wooster (2011)	180 players of the English Premier League	Path changes of: 45° to 135° to the left; 45° to 135° to the right; more than 135° to the left or the right.	Computerised match analysis system (ProZone)

activity patterns (Barros et al., 2007; Bloomfield, Polman, & O'Donoghue, 2005, 2007; Bradley et al., 2010; Dellal et al., 2011; Dellal, Wong, Moalla, & Chamari, 2010; Di Salvo et al., 2010, 2007; Di Salvo, Gregson, Atkinson, Tordoff, & Drust, 2009; Gregson et al., 2010; Kaplan, Erkmen, & Taskin, 2009; Lago-Peñas, Rey, Lago-Ballesteros, Casáis, & Domínguez, 2011; Rampinini et al., 2007; Vigne et al., 2010), frequency of game actions (Bloomfield et al., 2007; Dellal et al., 2010, 2011; Di Salvo et al., 2010, 2009; Rampinini et al., 2007; Vigne et al., 2010) and efficacy of game actions (Dellal et al., 2010, 2011).

The results showed that the demands on the physical and technical realms are different depending on the specific position the player takes in the field, which may enable the development of more insightful and specific training programmes for football players.

*Different competitive levels.* Match analysis also focused on the performance comparison between different competitive levels. However, due to the different strategies used by different research teams, to structure the competitive levels, it becomes difficult to extrapolate (Table III). More specifically, researchers not only compared competitive levels between different teams in the same competitions according to their final ranking (Hughes & Franks, 2005; Lago-Ballesteros & Lago-Peñas, 2010; Rampinini, Impellizzeri, Castagna, Coutts, & Wisløff, 2009), but also compared players relative to their level of professionalism (defined in accordance with the players' competitive level, who were classified as professional, semi-professional and amateur) (Kaplan et al., 2009; O'Donoghue, Boyd, Lawlor, & Bleakley, 2001), or as a function of the quality of teams in which they played (Bradley et al., 2010).



Table II. Comparative studies with predominantly comparative analysis according to the different functional positions of the players.

Study	Sample	Categories of player positions	Analysed variables	Main results
Barros et al. (2007)	55 players of First Brazilian Division.	Central defenders, external defenders, central midfield, external midfield, forwards.	Distances covered at different intensities.	The distances covered by external defenders, central midfielders and external midfielders were greater than forwards. The forwards covered greater distances than central defenders.
Bloomfield et al. (2007)	55 of the English Premier League.	Defenders, miedfielders and forwards.	Purposeful movements (PM).	The specific position on the field had a significant influence on %PM time spent sprinting, running, shuffling, skipping and standing still. The position had no significant influence on the %PM time spent performing movement at low, medium, high or very high intensities.
Di Salvo et al. (2007)	300 of Spanish Premier League.	Central defenders, external defenders, central midfield, external midfield, forwards.	Distances covered at different intensities.	Midfield players covered a significantly greater total distance than the groups of defenders and forwards. The shortest distance was covered by central defenders.
Rampinini et al. (2007)	20 players of a successful team that participated in a major European National League.	Centre-back, fullback, midfield, forward.	Match activities, match distances, other match-analysis measures.	Difference of all variables between player positions
Di Salvo et al. (2009)	563 of the English Premier League.	Central defenders, external defenders, central midfield, external midfield, forwards.	High-intensity running activity.	The total high-intensity running was dependent upon playing position with the external midfielders completing the highest and lowest distance, respectively.
Dellal et al. (2010)	3540 players of French League 1 division.	Central defenders, full-backs, central defensive midfielders, wide midfielders, central attacking midfielders, forwards.	Physical parameters (distances covered in high intensity and sprinting, of ground duels or heading duels won. Technical parameters (successful passes, total duration of individual ball possession, number of touches per individual possession).	In the offensive phase, the forwards covered about 4 times more the total distances in sprinting than central defenders and full backs.  Midfielders performed successful passes ranging from 75% to 78%, whereas lower values were found for the forwards (71%) and central defenders (63%), respectively.
Di Salvo et al. (2010)	717 players of Champions League teams.	Central defenders, external defenders, central midfield, external midfield, forwards.	Total number of sprints and total sprint distance covered.	Differences were found in most of the analysed variables depending on the specific position on the field. Wide midfielders performed a higher number of sprints in all five distance categories than all other positions.
Vigne et al. (2010)	388 players of the Italian Series A.	Defenders, miedfielders and forwards.	Distances covered at different intensities.	The midfielders covered significantly more distance than players in other positions. For midfielders, the number of displacements of 2–40 m and the number of sprints covering between 2 and 9 m and between 30 and 40 m are considerably greater than for other positions.
Dellal et al. (2011)	5938 of the English Premier League and of Spanish Premier League.	Central defenders, full-backs, central defensive midfielders, wide midfielders, central attacking midfielders, forwards.	Distances covered at different intensities. Technical parameters.	English Premier League and Spanish Premier League teams present differences in various physical and technical aspects of match play, suggesting that cultural differences may exist across professional soccer leagues and playing positions.

Table III. Empirical studies with predominantly comparative analysis based on the different competitive levels.

Study	Sample	Number of considered levels	Strategies used to established the levels	Results
O'Donoghue et al. (2001)	72 players of the English Championships	Three	Elite, amateurs and semi-professional players	Semi-professional players performed more discrete movements than the other players. Amateur players performed a significantly lower number of periods of high-intensity activity than elite and amateur players. However, the duration of the periods of high-intensity activity performed by amateur players was significantly longer than those performed by the other groups of players.
Hughes and Franks (2005)	116 matches of the 1990 (Italy) and 1994 (USA) World Cup	Two	Successful teams (quarter-finalists) and unsuccessful teams (first round losers)	For successful teams, longer passing sequences produced more goals per possession than shorter passing sequences. For unsuccessful teams, neither tactic had a clear advantage.
Rampinini et al. (2009)	186 players of the Italian Series A	Two	Successful teams (ranked in the first five positions) vs. less successful teams (ranked in the last five positions)	The players from the more successful teams covered greater total distance with the ball and very high-intensity running distance and also had more involvements with the ball, completed more short passes, successful short passes, tackles, dribbling, shots, and shots on target compared to the less successful teams.
Bradley et al. (2010)	110 players of European successful teams	Two	Elite domestic players (that played in teams that compete in one of the strongest Leagues in the world) vs. Elite international players (that played in teams ranked in the Top 10 of the FIFA)	No statistical significant differences were found between the groups for high-intensity running distance, mean recovery time or maximal running speed.
Lago-Ballesteros and Lago-Peñas (2010)	380 matches of the Spanish Premier League	Three	According to the final ranking	Top teams had a higher average of goals for total shots and shots on goal than middle and bottom teams. Bottom teams needed a higher number of shots for scoring a goal than the other groups of teams. Middle teams showed a lower value in assists and ball possession than top teams.

Similarly, the researchers characterised the relationships established with the patterns of physical activity (Bradley et al., 2010; Kaplan et al., 2009; O'Donoghue et al., 2001; Rampinini et al., 2009), frequency (Lago-Ballesteros & Lago-Peñas, 2010; Rampinini et al., 2009) and efficacy (Hughes & Franks, 2005; Rampinini et al., 2009) of game actions (e.g., involvements with the ball, successful passes, dribbling, shots and shots on target). With the exception of the research conducted by Bradley et al. (2010), in which the authors determine the high-intensity activity patterns in elite domestic and elite international players, these types of studies revealed the existence of several differences related to competitive level. These researches concluded that, overall, the players of more successful teams covered greater total distances with the ball, and at very high-intensity running, had a high average of

goals for total shots on target, performed more involvements with the ball, higher number of passes, tackles, dribbling and shots on target when compared with less successful teams (see Table III).

Under this context, a different methodology was reported by Hughes and Franks (2005), which demonstrated the effect of data normalisation on the interpretation of the efficacy of the passing sequences between successful and unsuccessful teams. Data normalisation for the purpose of comparisons is crucial because it enables the analysis of the relative importance of the conversion rates from the different lengths of passing sequences per possession into goals. It is therefore necessary to assess the relative contribution of each possession length from equal frequencies occurrences.

These differences resulting from the different competitive levels of studies may provide useful



information for coaches who want their players to reach greater levels of performance (O'Donoghue et al., 2001).

*Other comparisons.* In addition to the nature of comparative studies which focused its analysis on the basis of the functional position of players and competitive level, there were a number of studies that focused their analysis on other aspects, although these were fewer in number.

We found two studies that built the comparative analysis on the basis of the game's end result (Lago-Penas, Lago-Ballesteros, Dellal, & Gomez, 2010; Lago-Peñas, Lago-Ballesteros, & Rey, 2011). These authors showed that there are game-related statistics like total number of shots, shots on goal, crosses, crosses against and ball possession, venue and quality of opposition that allow to discriminate between winning, drawing and losing teams.

Most of the comparative studies previously presented (see Table III) focused on the quantification of physical-activity profiles of players in a particular league, in contrast with the fewer studies that compared performances between different leagues (Dellal et al., 2011), or in different teams (Papadimitriou, Aggeloussis, Dersi, Michalopoulou, & Papas, 2001; Papadimitriou, Taxildaris, Alexopoulos, Mavromatis, & Papas, 2001). There were also other studies that aimed at producing other comparisons. These include the influence of fatigue (Carling & Dupont, 2011; Lyons, Al-Nakeeb, & Nevill, 2006; Rey, Lago-Peñas, Lago-Ballesteros, Casais, & Dellal, 2010), of an overfilled calendar (Lago-Peñas, Rey, et al., 2011; Rey et al., 2010), of the Ramadan (Zerguini, Kirkendall, Junge, & Dvorak, 2007), of substitutes and replaced players (Carling, Espié, Le Gall, Bloomfield, & Jullien, 2010) and the influence of own or opposing team's formation (Bradley et al., 2011; Carling, 2011).

The main finding of these studies suggests that the performance of soccer players was not influenced by short recovery between matches (Carling & Dupont, 2011), whereas playing formation had effect on some performances. In the study by Bradley et al. (2011), the results suggest that playing formation does not influence the overall activity profiles of players, except for attackers. In line with the latter results, the work by Carling and Dupont (2011) has shown that, overall, physical performance in the reference team was not greatly affected by opposing team's formation. In contrast, skill-related demands varied substantially according to the opponent's formation and may have consequences for tactical and technical aspects and team-selection policies. Further, performance declined significantly for speed, agility, dribbling speed and endurance, remaining low even after the Ramadan (Zerguini et al., 2007).

### *Predictive Analysis*

Although seldom, these studies with the predictive power were published with some frequency in the last two years (Lago-Penas & Lago-Ballesteros, 2011; Lago-Penas et al., 2010; Lago-Peñas, Rey, et al., 2011; Tenga, Holme, Ronglan, & Bahr, 2010a, 2010b; Tenga, Ronglan, & Bahr, 2010). There were only two studies that were published previously (Hughes & Franks, 2005; Pollard & Reep, 1997). The common purpose of this type of studies is to determine the most effective ways of playing. Through the use of multidimensional qualitative data instead of unidimensional frequency data, the ability to describe soccer match play is improved (Tenga et al., 2010a).

From the chronological analysis it came out that the first study in this area was the one by Pollard and Reep (1997). This research team investigated the effectiveness of ball possession, and developed a quantitative variable that represented the probability of a goal being scored, minus the probability of a goal being conceded. More recently, Hughes and Franks (2005), taking as reference the research from Reep and Benjamin (1968), used data normalisation and regression analysis to further explore the results.

Through discriminant analysis, some authors have attempted to identify which game-related statistics allow to discriminate winning, drawing and losing. In a study conducted with 380 games of the Spanish First league, Lago-Penas et al. (2010) inferred that the discriminant functions classified correctly 55.1% of these teams. The higher discriminatory power variables were the total shots, shots on goal, crosses, crosses against and ball possession. Similarly, through the analysis of 288 of the UEFA Champions League matches, Lago-Peñas et al. (2011) concluded that the discriminant functions correctly classified 79.7% of winning, drawing and losing teams. The variables that had a higher discriminatory power were shots on goal, crosses, ball possession, venue (home/away) and quality of opposition.

The above-mentioned studies present reference values of game statistics and demonstrate in which aspects of the game there are differences between winning, losing and drawing. This profile can be of help to the coach when preparing training sessions and matches. As stated by Lago-Peñas et al. (2011), scouting for the upcoming opposing team, together with the assessment of post-match performance can be done in a more objective way by establishing the impact of particular variables on team performance.

Additionally, three studies (Tenga et al., 2010a, 2010b, 2010) used logistic regression techniques to run the analysis, with two of them (Tenga et al.,

2010a, 2010b) assessing the interaction context with the opponents. The analysis of this variable (interaction context with the opponents) seems extremely important in the context of match analysis, but surprisingly was not studied in any of the other reviewed studies. Tenga et al. (2010b) investigated the effect of tactics on scored goals in 163 matches of Norwegian professional football league, and concluded that for the main variable “team possession type”, counter-attacks were more effective than elaborate attacks when playing against an imbalanced defence. Using the same sample, the authors (Tenga et al., 2010a) examined the effect of playing tactics on score box possession; the latter term is defined as entry into score box (main scoring area in front of the opponent’s goal defined as an imaginary extension of the penalty area from 16 to 30 m of estimated distance to the opponent’s goal line) with high degree of control over the ball or when a set play is given to the attacking team as a result of entry into score box. High degree of control over the ball means enough space and time to make it easier to perform the intended action on the ball, and concluded that for the main variable “team possession type” (defined as degree of offensive directness by levels of utilisation or creation of imbalance in the opponent’s defence to achieve penetration), counter-attacks were more effective than elaborate attacks when playing against an imbalanced defence but not against a balanced one. Lastly, Tenga et al. (2010) examined the relationship between broader measures (scoring opportunities and score box possessions) and the ultimate measure (goals scored) of offensive effectiveness. They concluded that regardless of the outcome measure for offensive effectiveness used, the results stayed similar. The authors highlight that the scoring opportunities and score box possessions can be researched as a proxy for goals scored when comparing the efficiency of different playing tactics in soccer.

They concluded that the results were very similar regardless of which outcome measure for offensive effectiveness was used.

From the above results, although the literature highlights the importance and relevance of this type of research (Gréhaigne & Mahut, 2001), and despite the constant use of sophisticated analytical techniques in match analysis, there are still few available studies that have worked on developing predictive models of sports performance (Marcelino et al., 2011).

#### *Contextual variables*

Despite strong evidence of the role context plays in other sports-science domains, like motor-skills learning (Magill & Hall, 1990) or sport psychology

(Strachan, Côté, & Deakin, 2009), there is little work done on match analysis. This review confirmed the existence of a group of studies that focused their analysis on the comparison of variables related to physical (Carling, 2010, 2011; Carling & Bloomfield, 2010; Carling & Dupont, 2011; Castellano et al., 2011; Di Salvo et al., 2007, 2009; Jacklin, 2005; Lago, 2009; Lago et al., 2010; Lago & Martín, 2007; Lago-Peñas & Dellal, 2010; Lago-Peñas & Lago-Ballesteros, 2011, 2011; O’Donoghue et al., 2001; Pollard, 2006; Poulter, 2009; Rampinini et al., 2007, 2009; Sánchez, García-calvo, Leo, Pollard, & Gómez, 2009; Taylor, Mellalieu, James, & Shearer, 2008; Thomas, Reeves, & Smith, 2006; Vigne et al., 2010) and technical performance (Carling & Dupont, 2011; Rampinini et al., 2009) in relation to the match half. The genesis of this phenomenon as an object of study is sustained through the principle that fatigue influences the physical and technical performance of the players.

Our results confirmed that a decrement in players’ performance in the Italian (Vigne et al., 2010), English (O’Donoghue et al., 2001), French (Carling, 2011; Carling & Bloomfield, 2010; Carling & Dupont, 2011) and Spanish leagues (Di Salvo et al., 2007) tends to be observed in the second half of the match. However, this decrement (total distance covered and distances covered at high and very high intensity) is not a phenomenon that occurs systematically; it has instead been associated with the distance covered by players during the first half. The results demonstrated that when players are required to carry out a more intense first half, total distance covered is decreased in the second half. In case of a less intense first half, total distance and high-intensity running distance did not change, and very high-intensity running even increased on the second half. Regarding the technical aspects, Rampinini et al. (2009) observed a decline between the first and second half of the Italian league since players were less involved with the ball, had less short passes and less successful short passes. These data are in contrast with the study by Carling and Dupont (2011) who concluded that there were no significant differences in performance shown by French league midfield players.

When investigating the effects of game location commonly referred to as “home advantage”, several studies (Jacklin, 2005; Lago & Martín, 2007; Lago-Peñas & Lago-Ballesteros, 2011; Lago-Peñas, Lago-Ballesteros et al. 2011; Pollard, 2006; Sánchez et al., 2009; Thomas et al., 2006) have confirmed indicators pointing to a more favourable outcome when teams play at home. There is a tendency for teams that play at home to score more goals (Poulter, 2009), perform more shots on goal (Lago-Peñas &

Lago-Ballesteros, 2011; Poulter, 2009; Taylor et al., 2008), more crossings (Lago-Peñas & Lago-Ballesteros, 2011; Taylor et al., 2008), more passes, more successful passes, more dribbles with success and to take more corners (Lago & Martín, 2007; Lago-Peñas & Dellal, 2010; Lago-Peñas & Lago-Ballesteros, 2011; Poulter, 2009) compared with teams playing away. In regard to disciplinary behaviour, teams playing at home commit fewer fouls (Poulter, 2009) and receive less yellow cards (Lago-Peñas & Lago-Ballesteros, 2011; Poulter, 2009; Thomas et al., 2006). In general, the results of the reviewed studies showed that a home advantage effect exists for most performance and discipline measures at a team level. These findings indicate that strategies in soccer are influenced by match location and teams may alter their playing style accordingly.

Apart from the aspects related to home advantage and match half, researchers have attempted to study the influence of other contextual aspects, particularly those related to quality of opposition and match status. An increasing tendency (Table IV) for studies to jointly analyse the influence of the mentioned contexts on different variables was observed (Castellano et al., 2011; Lago, 2009; Lago et al., 2010; Lago & Martín, 2007; Lago-Peñas & Dellal, 2010; Lago-Peñas, Rey, et al., 2011; Taylor et al., 2008). The results of the later studies showed that there are significant differences based on the quality of the opposition and the ongoing result of the game.

In all the reviewed studies, researchers used categories of match status defined based on the intervals: losing  $]-\infty; -1]$ , drawing  $[0]$  and winning  $[1; +\infty[$ , which are considered appropriate for games like football that end with a low score (Marcelino et al., 2011), and they conclude that when losing the teams had more ball possession (Lago, 2009; Lago & Martín, 2007; Lago-Peñas & Dellal, 2010) and performed more crosses (Taylor et al., 2008) and dribbles (Taylor et al., 2008). On the other hand, when winning the teams performed: (1) more interceptions, clearances and aerial challenges (Taylor et al., 2008); (2) fewer passes and dribbles (Taylor et al., 2008); (3) and less high-intensity exercises (Lago, 2009; Lago-Peñas, Lago-Ballesteros, et al., 2011).

Regarding the quality of opposition, researchers have opted for the construction of categories based on different parameters. For example, Lago and Martín (2007) classified the groups based on a reference team (e.g., Real Madrid), while Taylor et al. (2008) opted for a symmetrical division based on the final ranking, grounding their analysis on the dichotomy “strong opposition” versus “weak opposition”; still Taylor and colleagues considered that this division did not provide the necessary sensitivity to detect all the differences.

There are other studies (Lago, 2009; Lago et al., 2010; Lago-Peñas & Dellal, 2010; Lago-Peñas, Rey, et al., 2011) in which the quality of opposition is also classified into “strong” or “weak”, but with different meaning. This categorisation is based on the difference between the final league’s ranking of the team under study and the final league’s ranking of the opponent team. More recent studies consider three (Castellano et al., 2011) or four groups (Lago-Peñas & Lago-Ballesteros, 2011) according to the final position in the league’s ranking. In this regard, Marcelino et al. (2011) considered that the construction of groups to analyse the effect of opposition quality must overcome traditional reductionism of symmetrical division based on the final ranking. Alternatively, the latter team of researchers suggested the application of statistical techniques where cluster analysis and independent variables are used.

The studies that focused their analysis on the quality of the opposing teams showed that when playing against strong opponents, they perform more passes (Taylor et al., 2008), less dribble (Taylor et al., 2008) and covered greater distances (Castellano et al., 2011; Lago et al., 2010; Lago-Peñas, Lago-Ballesteros, et al., 2011). In addition, playing against strong opponents is associated with a reduction in ball-possession time (Lago & Martín, 2007; Lago-Peñas & Dellal, 2010). These findings may be important for coaches, when developing strategic and tactical aspects in order to improve the performance of their teams in relation to the diversity of situational variables that their teams may encounter.

### Limitations and recommendations for future research

Research on match analysis in adult male football has been mainly focused on the description of physical and/or physiological aspects of football and technical game actions as an attempt to quantify the activity of players. However, in most cases, this was done without considering the situational and interactional contexts in which such performances happen/occur.

The reviewed studies have revealed concerns related to a lack of operational definitions and conflicting classifications of activity or playing positions that make it difficult to compare similar group of studies. The integration of comprehensive operational definitions for the analysis variables, the standardisation of the groups established by player positions and the use of the same movement categories are imperative in order to progress to a more comparable and replicable research in the future.

Table IV. Empirical studies with situational – match status, quality of opposition and match location.

Study	Sample	Categories	Variables	Results
Lago and Martin (2007)	170 games of the Spanish First league	Winning, drawing, losing Home vs. away Reference team	Percentage of team possession	The teams that played at home had more possession than the teams playing away.  When loosing, teams playing at home had more possession than when they were drawing or winning. The worse the opposing team, the higher was the percentage of ball possession.
Taylor et al. (2008)	40 games of a professional English team	Winning, drawing, losing Home vs. away Strong vs. weak	Technical behaviours	At winning: teams performed more interception, clearance and aerial challenge and fewer crosses, passes and dribbles. At losing: teams made more crosses, dribbles and passes and fewer clearances and interceptions. Playing at home, performed more crosses and shots, but fewer interceptions and tackles. When they played against strong opponents, they performed more passes and less dribbling.
Lago (2009)	27 games of the Spanish first League	Winning, drawing, losing Home vs. away Strong vs. weak	Percentage of team possession	Possession was greater when losing than when winning or drawing.  Playing against strong opponent teams has been associated with a decrease in time of possession. The possession was not influenced by the venue of the game.
Lago et al. (2010)	27 players of the First Spanish League	Winning, drawing, losing Home vs. away Strong vs. weak	Work rate	The players performed less high-intensity exercises when they were winning.  The teams playing at home covered greater distances. Players covered greater distances when they played against strong opposition.
Lago-Peñas and Dellal (2010)	380 games of the Spanish First league	Winning, drawing, losing Home vs. away Reference team	Percentage of team possession	The best ranked teams maintained a high percentage of possession and their pattern of play was more stable. Time of possession was greater when teams were losing and when they played at home. Playing against strong opponents is associated with a reduction in time of possession.
Lago-Peñas, Lago-Ballesteros, et al. (2011)	172 players of the Spanish First league	Winning, drawing, losing Home vs. away Strong vs. weak	Work rate	The elite players performed less high intensity when winning than when losing.  The teams playing at home covered greater distances at low intensity than the teams playing away. Players covered a greater distance walking and jogging when playing against stronger teams
Castellano et al. (2011)	434 players of the Spanish First league	Winning, drawing, losing Home vs. away Strong, medium and weak	Work rate	The total distance covered by players at different intensities during the effective time of play was higher when playing at home, when the reference team was losing and when the opponent team was strong.

Taking into account that predictive models assume lesser importance in reviewed studies on football-match analysis, we agree with Gréhaigne and Mahut (2001) who suggest a crucial need to move beyond the description of behaviours and progress towards prediction of performance. One facet of the prediction of sporting behaviour (i.e., performance) involves examining tactical strategies of individuals or teams with an aim to identify common patterns of behaviour and movement (James, Mellalieu, & Hollely, 2002).

Attempting to predict future performance on the basis of previous performances is a challenging task yet important for match analysts. Typically the basis for any prediction model is that performance is repeatable, to some degree. In other words, events that have previously occurred will occur again in some predictable manner. This type of prediction is based on the principle that any performance is a consequence of factors like prior learning, inherent skills and situational variables (James, 2012).



## Conclusion

This work shows how a considerable number of studies on match analysis in adult male football have enabled the general description of technical, tactical and physical variables. Further, there are some studies that have developed their analysis in relation to other categories of comparison like final game score, Ramadan influence, levels of fatigue, different leagues, teams or tactical systems.

A large number of studies have focused their analyses on four main situational variables of performance that seem to assume a greater importance: (1) game location; (2) quality of the opposition; (3) match status and (4) match half. It is noteworthy that the new methodological advances have enabled overcoming some of the typical match-analysis limitations (O'Donoghue, 2010) as well as improving ways of establishing groups regarding quality of opposition (Marcelino et al., 2011).

Further, with the help of advanced statistical procedures, some researchers have attempted to find some association between cause and effect in different interactional contexts. However, such studies on possible interactions between analysis variables have only recently been in the agenda of researchers. This research review showed that match-analysis work has been predominantly done using simple description and associations between variables, thus investigating this phenomenon without considering the dynamic, interactive and complex systems' aspects that can better characterise match performance in football (Balague, Torrents, Hristovski, Davids, & Araújo, 2013; Sampaio & Maças, 2012).

The main limitations of the reviewed studies are related to a lack of operational definitions, conflicting classifications of activity or playing positions, and limited studies that consider interactional context in their analyses. Future research should: (1) provide comprehensive operational definitions for the analysis variables, (2) use standardised categories and classifications of activities and participants and (3) consider integrating in the analysis the situational as well as interactional contexts in which the performances happen.

The football game has evolved over the years, together with the development of computer systems that enable a more in-depth understanding of this performance phenomenon. A current challenge involves creating suitable video sequences that can clearly identify and categorise individuals and behaviours over time and regular playing patterns. To this end, we recommend the adoption of methodologies that include situational (match location, match status, quality of opposition, match half), continuous and sequential aspects of the game, so that the science of match analysis can be more readily

applied in the field, as commented elsewhere (Drust & Green, 2013).

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