

Research article

Beach soccer: analysis of the goals scored and its relation to the game physiology

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Abstract

The beach soccer is characterized as a modality of intermittent character of high intensity, requiring high demand of energy and of the anaerobic system with intensities above 90% of maximum heart rate. The objective of this study is: (i) to analyze the incidence of goals in beach soccer matches, checking in which periods of matches the goals happen; (ii) to identify the team that scored the first goal and check the final result obtained by this team: win, draw or defeat; (iii) to relate the results to the physical performance, technical, tactical and psychological. We analyzed all the goals ($n = 2.020$) in 8 Beach Soccer FIFA World Cup. According to the data, it was found that most of the goals (35.89%) are scored in the last period of matches; the team that scores the first goal of the match features average probability of winning of 62.03%. Thus, it is suggested that the higher incidence of goals in the 3rd period of the matches is associated mainly to the interaction of physical and psychological factors. Regarding the influence of the first goal for the final result, it is believed that the psychological aspect appears to interfere with greater relevance.

Keywords: Psychological Goal, FIFA World Cups, goal timing, collective sports.

Introduction

The beach soccer is a relatively new sport, having its beginning in the 90s. In 2005, the beach soccer was managed and organized by the *Fédération Internationale de Football Association* - FIFA, which has already spread it to at least 170 of the 207 national associations that constitute the FIFA federation, becoming

so, a sport of high performance (Escobar & Lacerda, 2010). For Escobar et al. (2011), although less popular than other sports, beach soccer has been gaining attention in the sports scene, being currently one of the fastest developing sports in the world (FIFA).

This sport has very specific characteristics (compared to soccer and futsal), as the dimensions of the field; the type of field in which it is practiced; the number of athletes, which has five players on each team, when one of those must be the goalkeeper; the playing time is divided into three periods of 12 minutes with 3-minute intervals between the periods; substitutions are unlimited, allowing the game to be maintained at a high rate.

The beach soccer is a team sport that requires from its players varied physical valences due to the demands of its own sports modality and the kind of field in which it is practiced (Barbosa, 1998; Pereira et al., 2007; Silva et al., 2005 as cited in Escobar et al., 2011). In this sense, it is characterized as a modality of intermittent character of high intensity that requires high demand of energy and of the anaerobic system with intensities above 90% of maximum heart rate.

In beach soccer, sand floor privileges air moves, which also requires great skill of the players (Fazolo et al., 2005), making it very exciting due to its beautiful acrobatic moves which make it a high-impact, attractive, and of course popular sport (Mina et al., 2012). The beach soccer is a synonymous of spectacle, excitement and goals. According to statistics of FIFA, the world championships held until now recorded an average of over eight goals per game (Conceição, 2012). The goal is the aim and, consequently, the most important aspect of the game (Fukuda & Santana, 2012), it determines the procedures that lead to the goal, and therefore the imbalance on the scoreboard supposed to find some of the keys of the game, as it allows to identify the most effective forms of attack, and, conversely, provide insight to better defensive organization (Mombaerts, 2000).

The aim of this study was: i) to analyze and quantify, in absolute and percentage terms, the incidence of goals in matches of Beach Soccer FIFA World Cups; verifying in which periods of the matches goals happen, over total time of the game; ii) to identify the team that scored the first goal of the match and to verify the final result obtained by this team: win, draw or defeat; thus, identifying what is the probability of a team that scores the first goal of the match to be victorious; iii) to relate the obtained results to physical, technical, tactical and psychological performance.

Despite the increasing worldwide popularity of Beach Soccer, played either at amateur and professional level, few scientific studies focused on this sport, leaving open several questions about its performance profile (Mina et al., 2012; Scarfone et al., 2009; Sannicandro et al., 2007). Escobar et al. (2011) states that it has been noticed the lack of specific literature, especially in relation to data on training prescription and physical, technical, tactical and psychological aspects due to the environment where the beach soccer is played. The basis of the characteristics involved in the sport as the predominant pathways, the anthropometric profile, the biomechanical among others are essential for the structuring of training aiming high levels of athletic preparation.

Thus, this research is justified due to allow the expansion of expertise and contribute to the development of this sport, allowing also to know the way of goals, competition characteristics and provide references for training and competition in beach soccer (Zhao, 2007).

Material and methods

Sample

We analyzed all the matches in 8 Beach Soccer FIFA Worlds Cups organized by *Fédération Internationale de Football Association* – FIFA, between 2005 and 2015; totalizing 2.020 goals and 244 matches.

The data were obtained from the database of the website of the FIFA (www.fifa.com) through official overviews of the matches. We collected quantitative data, which are related to the times the goals were scored in the course of the matches. Castellano et al. (2012) established the reliability of the FIFA match statistics by randomly coding five matches and compared with the FIFA website data. The resulting values using Cohen's Kappa (K) were between ($0.93 \leq K \leq 0.97$). This establishes a high reliability index for the FIFA website data.

Variables

For the study, we used the following variable:

- Average goals per game and obtained by competition;
- Division of match in periods of time: 1st-12th min.; 13th-24th min.; 25th-36th min.; and extra time (37th-40th min.);
- The relationship between scoring the first goal of the match and the final result obtained by the same team, using the variables: Victory, Draw and Defeat. For this variable we analyzed as it is described in studies developed by Leite and Barreira (2014), Barreira et al. (2014) and Machado et al. (2014), only the goals scored during regular time of the match were considered, 3 periods of 12 minutes.

Data analysis

All data were analyzed using the statistical package for PC SPSS 20.0. (Lead Technologies Inc, USA). Non parametric chi-square (χ^2) analysis was used to determine the statistically significant differences and the level of significance was set at $p < 0.05$.

Results

Figure 1 shows that the beach soccer in the ten years period considered, there is a reduction in the average number of goals per match since the World Cup FIFA Brazil 2005 were scored 8.2 goals per match while in Portugal in 2015 were scored 7.9 goals per match, i.e. less of 0.3 goals per match. However, the overall average of competitions, beach soccer still has an average of over eight goals per match.

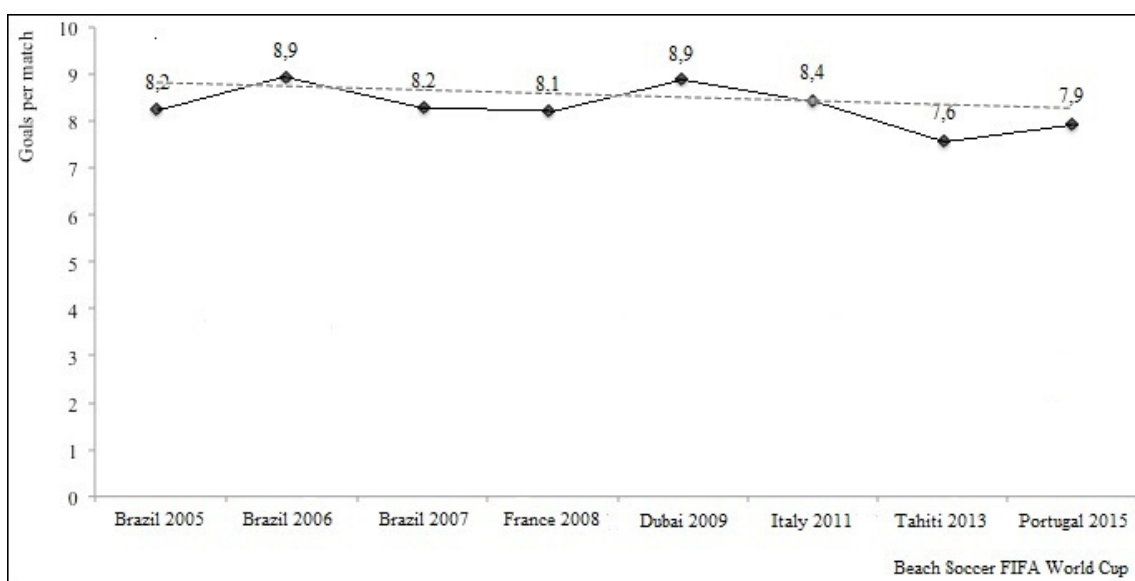


Figure 1. Average goals per match in the Beach Soccer FIFA World Cups between 2005 and 2015.

The table 1 shows the time distribution of goals scored in Beach Soccer FIFA World Cups, divided by periods of game. A total of 2.020 goals were scored in the analyzed tournaments. Of this total, 604 goals were scored (29.9%) in the 1st period; 664 goals (32.87%) in the 2nd period; 725 goals (35.89%) in the 3rd period; and 27 goals (1.34%) in the extra time of the games.

Period	World Cup 2005	World Cup 2006	World Cup 2007	World Cup 2008	World Cup 2009	World Cup 2011	World Cup 2013	World Cup 2015	Total	Total (%)
1 st period	49	73	79	70	96	74	69	93	604	29.9
2 nd period	51	94	89	90	80	104	76	80	664	32.87
3 rd period	64	119	90	93	104	88	89	79	725	35.89*
Extra time	-	-	3	6	4	3	9	2	27	1.34
Total	164	286	261	259	284	269	243	254	2.020	100

Table 1. Distribution of goals scored in Beach Soccer FIFA World Cups, divided by periods of game.
 * Statistically significant difference between 1st and 2nd periods (p<0.05).

The data on the table 3 show the results obtained in the Beach Soccer World Cups matches and the relationship between the first goal scored and the final result of the match. In 62.03% of matches (151 matches), the team that scored the first goal won the match; the match ended in a draw 15.33% of matches (38 matches); and the team that scored the first goal was defeated in 22.64% of matches (55 matches).

Aspect (excluding 0x0 draws)	World Cup 2005	World Cup 2006	World Cup 2007	World Cup 2008	World Cup 2009	World Cup 2011	World Cup 2013	World Cup 2015	Average (%)
Win	65	71.88	56.26	71.88	59.38	43.75	59.38	68.75	62.03*
Draw	10	12.5	21.87	16.62	12.5	25	18.75	6.25	15.33
Defeat	25	15.62	21.87	12.5	28.12	31.25	21.87	25	22.64

Table 2. Relationship between first goal scored and the final result of the match.
 * Statistically significant difference between draw and defeat (p<0.05).

Discussion

Temporal analysis of goals scored

Analyzing the data in Table 1, most goals in FIFA World Cup Beach Soccer matches were scored in the 3rd period (36.4%). However, in this mode we did not find similar studies in the literature for comparison of results.

As well as other modalities of team sports invasion (such as futsal, basketball, handball, etc.), beach soccer has unlimited substitutions. An unlimited number of players replacements enables technicians to the constant rotation of these and, by extension, the possibility of keeping the intensity and high level of drives throughout the match (Álvarez-Medina et al., 2002; Castellano & Casamichana, 2010; Dias & Santana, 2006; Escobar et al., 2012). Due to this specific feature of unlimited substitutions, we believe that the temporal occurrence of goals throughout the game should have a more linear distribution.

Thus, a possible explanation for these results may be an interaction between the physical, technical, tactical and psychological, highlighting mainly the physical factor and also the psychological.

In the study by Escobar et al. (2012), one of the variables studied was the anaerobic power. According to the results it ratified a predominantly anaerobic nature of the sport. Castellano and Casamichana (2010) measured the heart rate (HR) amateur Spanish players of beach soccer and found that most of the time (59.3%) players are at a frequency >90% HR_{max}.

In his study, Scarfone et al. (2009) measured the heart rate (HR), the lactate concentration (LC) and the power performance (countermovement jump, CMJ). According to the results, match intensity showed differences for HR categories (p=0.001) and their interaction with match periods (F(8, 64)= 4.18; p=0.0005), and La values (p=0.03). A progressive decrease of occurrence toward the end of the match emerged for HR >85% (periods: first = 75%, second = 61%, third = 31%). A similar trend emerged for La values (periods: first = 8.7±4.0mmol.L-1; second = 6.7±3.8mmol.L-1; third=5.3±2.7mmol.L-1). With respect to pre-match condition

(36.6±5.3cm), higher ($p < 0.004$) CMJ performances were found at the end of the match periods (first = 39.5±6.5cm; second = 40.9±6.4cm; third = 39.2±6.0cm).

It is important to mention the disadvantage imposed by the playing surface in beach soccer (Castellano & Casamichana, 2010). The sand reduces the maximum force and the maximum applied power, increasing the impact time and pulse (Barrett et al., 1997; Giatsis et al., 2004). This type of surface absorbs part of the applied energy, thus reducing the reaction force (Bishop, 2003), and this can lead to a lower maximum speed of motion due to the instability of sand (Giatsis et al., 2004).

Lejeune et al. (1998) mentions that the act of running in the sand requires 1.6 times more energy expenditure compared to the race held on the track, supposedly a greater role request of the mechanical work of the muscles and tendons. According to Pinnington et al. (2001), the average energy expenditure among amateur runners was significantly lower in hard ground when compared to the amount earned in the sand (8.94 x 13.20 METs, $p < 0.01$), which could represent, respectively, an expense energy of approximately 10.4 calories and 15.4 calories per minute, considering the mean body mass of a 70 kg adult.

On average, a beach soccer athlete travels a distance of approximately 100 meters every minute of the game, being necessary, therefore, high speed and short recovery intervals with work ratio 1.4:1 (for every minute rest, there is 1.4 minutes of work) (Scarfone et al., 2009; Castellano & Casamichana, 2010).

Based on the precepts of Bompa (2002) and McArdle, Katch, and Katch (2008), the anaerobic training, adopted short recovery intervals, has as a result of larger accumulation and resynthesis of ATP, amount of creatine phosphate (CP) and muscle glycogen, which can lead to an increase in resistance to fatigue. According to Escobar et al. (2012), the body tends to reach steady-state, that is the balance between cost and consumption and oxygen during the physical effort. In predominantly aerobic exercises, the lactate can be used as energy source, the levels being held in equilibrium between its use and demand or even lower when reaching the steady state. However, when it comes to the predominantly anaerobic exercise training, with increasing exercise intensity, the lactate concentration tends to increase in an amount greater than the capacity of its removal performed by respiratory activity, leading to its accumulation in the bloodstream and in muscle cells (Gomes & Souza, 2008 as cited in Escobar et al., 2012).

Although the marked decrease in intensity of playing might indicate that players undergo fatigue (Mohr et al., 2003), it might be hypothesized that players tend to adopt tactical strategies to spare their energies throughout the match (Scarfone et al., 2009).

Regarding the appearance and psychological impact goals, according to Escobar et al. (2012), via unlimited substitutions the high level can maintained during the three periods of play. Thus, the interpretation of results using only the physical performance of players seems to be the main explanation for this phenomenon. Considering that, with the unlimited substitutions, the level of performance can be assured with the exchange of players at each point of the game. So we can also suggest that the psychological aspect has importance in the results.

As the play draws to its end, the final minutes of the match appear to be a critical period of the match, in which the errors on the part of the players are more frequent, inducing greater number of goals (Dias & Santana, 2006). According to Fukuda and Santana (2012), the final minutes is the time setting of the game, insofar as, according to the momentary result of the game, the attack scenarios may become sharpened and consequently can facilitate situations of counterattack. According to Reilly (1997), it is possible that the losing team tends to guide its players to more advanced areas of the pitch in order to create more completion situations, giving higher probability of scoring and conceding goals.

Thus, it appears that the physical and mental state of the players due to the high intensity of the match in its final moments, seems to exert significant influence on the implementation of technical-tactical actions, thus, regardless of the momentary outcome of the match, the player's action includes a closer higher risk, as closer as it is from the end of the match (Leite & Barreira, 2014).

Relationship between scoring the first goal and the final result of the match

According to the data of table 2, the team that scores the first goal in matches of Beach Soccer FIFA World Cups presents a high probability of achieving victory (average of 62%).

According to Castillo-Rodríguez et al. (2007) football is evolving in order to outline the matches tactically, observing little variations in matches and few goals, which makes us see the importance of being the team to score the first goal, since in a high probability will be the team winning. The tactic football evolution has been such that it is observed as the team goes ahead on the scoreboard in a few occasions draw and even less is defeated by the opposing team. As states Bloomfield et al. (2005) the start goal is influential in determining the match result.

The goal also appears to be an inducer factor of high psychological burden on the players (Álvarez-Medina et al., 2002), being a strong predictor of final result (Sampedro & Pietro, 2012). Roffé et al. (2007) states that in every analysis that has been done on the "psychological goal" (also called psychological moment) has been able to find relevant relationships with psychological variables both individual as of team. Gayton et al. (1993) defines the psychological moment as the benefit obtained when you have an initial success in a sporting context, which produces a psychological moment in the sportsman that will lead to future success and that explains the yield variations in the teams and in their players.

Theis (1992) supported that when a team scored first goal, presents improvement in performance and increased self-confidence. Football coach should have his players prepared tactically and psychologically, in order to be ready to face getting back in score. Thus, training should include training matches with different number of players and time limit.

The mental aspect just seems to be the main factor associated with the influence of the first goal for the final result of the game, however, there are other factors (e.g. substitutions, expulsions, interval) that seem to influence the performance of the teams but with less relevance (Roffé et al., 2007). I.e., the team that can score the first goal of the match tends to improve its psychological aspect, maintaining or improving their performance, while the team that suffers the first goal suffers a decrease in psychological aspect, tending to reduce its performance in competition (Leite & Barreira, 2014). According to Roffé et al. (2007), the player can enter a "psychological crisis", during which their ability to meet the demands and needs of the competition can be substantially altered.

Thus, there is a high probability that the team who scores the first goal of the match to get the victory in the final result of the same. Regarding the characteristics that may explain the influence of the first goal for the final outcome of the match, all the aspects of the team sport must be present: physical, technical, tactical and the psychological. However, the psychological aspect seems to be the main aspect responsible for the victory of the team that scored the first goal (Leite, 2013).

In many team sports, such as beach soccer, competitions include the realization of consecutive days in games. Moreover, due to the current sporting situation increasingly focused on victories, glory, quest for resilience and the gestures perfect engines are assumed to consider the psychological aspect in the process of training and athlete preparation for competitions to be as relevant as the physical, technical and tactical preparation (Escobar & Lacerda, 2010)

Conclusion

The beach soccer is an intermittent sport of very high intensity, whose physiological profile shows that more than half the time is spent at intensities $>90\%$ of HR_{max} , thus requiring large amounts of energy through anaerobic system.

In collective sports games, the yield is associated with a union of physical, tactical, technical and psychological aspects. According to the results of this study it may suggest that the prevalence of goals in the 3rd period of the games is associated mainly to the combination of physical and psychological factors. Regarding the influence of the first goal for the game results, it is believed that psychological aspect seems to interfere with highest importance.

However, experts say it is important that they be carried out specific research aimed at beach soccer. Fazolo et al. (2005) mentions that the transfer of technical, physical and tactical elements of similar sports may not be relevant to the Beach Soccer. The measurement of the physical qualities of the athlete, the evaluative principles of performance should meet the sensitivity and specificity of sport. Thus, it is assumed that the use of specific protocols for evaluation in sandy soil is required to obtain the greater reliability of the results, providing the basis for the optimal prescription of training Beach Soccer athletes.

This more specific focus would increase our knowledge of beach soccer and help to improve training programs by developing their degree of specificity. Only thus will it be possible to apply knowledge of the sport's physical and physiological demands in a more detailed way (Castellano & Casamichana, 2010).

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