Goal scoring patterns over the course of a match: Analysis of Women’s high standard soccer matches

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ABSTRACT

The purpose of this study was to record the time that goals were scored in the course of women’s high standard soccer matches. All matches (n=90) of the three latter women’s World Cups were recorded using video and analyzed with computerized match analysis hardware and video playback system for game performance analysis using Sportscout. Chi-square methods were used for the data analysis and the level of significance was set in p<0.05. The 45-min period analysis revealed that in World Cups 1999 and 2003 most goals were scored in the second half (p<0.05), while in the World Cup of 1995 no significant differences were observed although the second half presented a greater percentage of goals (53.5%). The 15-min period analysis presented that in World Cup of 1995 most goals were scored in the last period (76-90 min, p<0.05). Also in World Cups 1998 and 2002 there was presented a trend towards more goals scored as time progressed. The results revealed that goal scoring in women’s soccer matches might be dependant on time and specifically that more goals are scored as time progresses. The above could be explained by the deterioration in physical conditioning, the tactical play, fluid balance and lapses in concentration.

Key words: women, soccer, goal, frequency, video-analysis.
Introduction

Women's soccer is a rather new sport that presents an upheaval blossoming over the last decade (Konstadinidou & Tsigilis, 2005). Its international recognition was not achieved until 1991, when the first women’s World Cup was held in China. Moreover, in 1996 it was introduced into Olympics’ games program.

Low frequency of scoring is one of soccer’s characteristics; thus, an objective evaluation of the specific characteristics of scoring, that directly determines the factors that ultimately lead to successful attempts and goals, is imperative (Yiannakos & Armatas, 2006). Analyses that studied the relationship between time and goal scoring patterns in men’s soccer presented ambiguous results, some support that the frequency of goals scored during a match is time dependent, (Saltas & Ladis, 1992; Ridder, Cramer & Hopstaken, 1994; Reilly, 1996; Abt, Dickson & Mummery, 2002; Bekris, Louvaris, Souglis, Hountis & Siokou, 2005; Sotiropoulos, Mitrotasios & Travlos, 2005; Yiannakos & Armatas, 2006) while others purport that there is no immediate correlation between them (Jinshan, 1986; Michailidis et al., 2004). There are few studies, to our knowledge, that have studied performance analysis in women's soccer. Miyamura, Susuma and Hisauki (1997) compared women’s soccer matches, from various tournaments (World Cup 1991, PanAsia Cup, 2 final matches from University championship), to men’s matches recording the time that the ball was ‘in game’. Results revealed that men had the ball ‘in game’ for a longer time. Also, there were differences found between women’s tournaments and specifically in the World Cup where it was reported that players kept the ball ‘in game’ longer when compared to the other two women’s tournaments. The above underlined the qualitative differences that exist between teams. Other research from Olsen and Larsen (1997) who studied Norway’s national team’s offensive tactics concluded that long passes and the usage of the defensive region for the beginning of offence are both characteristics of Norway’s soccer. In a more recent study Konstadinidou and Tsigilis (2005) studied the offensive tactics of four top (quarter finalists) teams of the 3rd Women's World Cup.

Because women's soccer is a rather new sport there is a lack in studies, unlike men’s soccer, that observed the characteristics of women’s soccer and more specifically, there was no study found that examined the relationship between time and goal scoring patterns. Thus, the purpose of this study was to record the time that goals were scored in high standard women’s soccer matches, in order to determine the coefficient of dependence.

Methods

Subjects:

Ninety (90) soccer games from the three latter women’s World Cups (World Cup 1995 – Sweden 26 matches, World Cup 1999 – USA 32 matches and World Cup 2003 - USA 32 matches) were studied. The reason for the selection of this tournament was the participation of top international women’s teams.

Study Design - Instrumentation

The soccer games were videotaped and digitized with the help of a Sony video SLV-SE 210D, a PC AMD-XP professional 1333 GHz and a television capture board for PC (PCTV, Pinnacle Systems GmbH, Braunschweig, Germany). The study was based on the researcher’s personal observation who recorded the time that goals scored. The Sportscout video-analysis program for PC was used for the data recording. The analysis’ variables were: 1) the frequency of goal scoring per 45 minutes (two periods: 1-45+ min, 46-90+ min), 2) the frequency of goal scoring per 15 minutes (six periods: 1-15min, 16-30min, 31-45+ min, 46-60min, 61-75min, 76-90+ min). The observation of the chosen soccer games was conducted in the department of Technical and Tactical Analysis in the Laboratory of Sports Performance and Coaching.
Data Analysis

All data were analyzed using the statistical package for PC SPSS 12.0. Chi-square analysis was used to determine the statistically significant differences and the level of significance was set at p<0.05.

Results

Figure one exhibits the frequency of goal scoring in World Cup 1995 as this is examined in time-basis of 45 minutes. Although more goals were scored in the second half, no statistically significant difference presented in goals scored between the first and second half (53.5 vs. 46.5, p>0.05).

![Figure 1: Frequency of goal scoring / 45 min.](image1)

In the World Cup of 1999 the percentage of goal scoring frequency was 42.3% for the 1st half and 57.7% for the 2nd half (figure 2). The statistical analysis showed a significant difference between 2nd and 1st half (57.7 vs. 42.3, x²=4.63, p<0.05).

![Figure 2 Frequency of goal scoring / 45 min.](image2)

In Figure 3 is presented the frequency of goal scoring in the latter World Cup that took place in the USA. The statistical analysis showed significant difference between the two halves (58 vs. 42, x²=5.12, p<0.05)
The 15-min analysis of goals in World Cup 1995 (figure 4) showed that the majority of the goals were scored in the last 15-min period (75-90+). Also there was a trend observed of more goals being scored in the last periods of the two halves (31-45 min and 76-70 min).

In the World Cup of 1999 the results of the goal scoring frequency showed that the majority of the goals were scored in the three last 15-min periods of the match. Although there was a trend for more goals scored as time progressed, there was not any statistically significant differences between the six periods of time.
Finally, in the latter women’s World Cup it was also observed that more goals are scored as time progresses. Moreover, more goals are scored in the last three periods of time. The last period presented a significant difference towards the first (24.3 vs. 10.3, x²=6.84, p<0.05).

**Figure 6: Frequency of goal scoring / 15 min.**

**Discussion**

The purpose of this study was to record the time that the goals were scored in high standard women’s soccer matches, in order to conclude the coefficient of dependence. There were no studies found to examine the relationship between time and goal scoring in women’s soccer. The review of relevant studies that concentrated on the relationship between time (per half time or per 15-min) and goal scoring patterns in men’s soccer matches revealed ambiguous results.

Physiological data for female soccer players show similar differences from the general population to those observed in their male counterparts (Shephard, 1999). Aerobic power has been reported to be 47-49 ml · kg⁻¹ · min⁻¹ in collegiate players (Rhodes & Mosher, 1992), 52 ml · kg⁻¹ · min⁻¹ in English players who underwent a period of concentrated training (Davis et al., 1992) and 54.7 ml · kg⁻¹ · min⁻¹ in the Japanese national team (Kohno et al., 1991). The mean distance covered during a game was reported to be 8500 m, blood lactate concentrations were 5.1 and 4.6 mmol · l⁻¹ at half time and at the end of a game respectively, and mean heart rates were in the range 173-177 beats · min⁻¹ (Davis & Brewer, 1993).

The lean body mass of female soccer players is ~ 44 kg (Colquhoun & Chad, 1986) and body fat can account for as much as 21± 22% of body mass (Davis & Brewer, 1993), although Canadian intercollegiate players have values around 16% (McKay & Shephard, 1988). Knee extension and flexion forces are substantially less than in male players (Kohno et al., 1991), but flexibility is greater in women (Nyland et al., 1997). An inadequate intake of energy is less common in soccer players than in some other female athletes (Borgen & Corbin, 1987). Nevertheless, one study indicated that eight of nine female players were trying to lose weight during the playing season, with calcium and iron intake 30% below recommended values (Nutter, 1991). A possible influence of premenstrual syndrome on performance was suggested by an increased risk of traumatic injury during the premenstrual and menstrual phases of the ovulatory cycle; injuries were less frequent in those taking oral contraceptives (Moller-Nielsen & Hammar, 1989).

The huge differences observed in aerobic power within women subjects may have a connection with the level of women’s soccer in general. Differences in physical resources, determined as strength and endurance parameters, between male and female elite soccer teams, are similar to their sedentary
counterparts (Stolen, Chamari, Castagna & Wisloff, 2005). This means that compared with sedentary counterparts within the same sex, the female elite soccer players have improved as much as the male elite soccer players. Therefore, there is no reason to claim that female soccer has shortcomings compared with elite male soccer in terms of strength and endurance (Helgerud, Hoff & Wisloff, 2002).

From the above it is clear that although there were no similar studies found which examined the relationship between time and goal scoring patterns in women’s soccer, the causes for more goals scored as time progresses could be similar to those for men.

From a purely physiological perspective there is a strong body of knowledge supporting a reduction in physical condition over the course of a match leading to a state of fatigue and reduced physical performance (Saltin, 1973; Bangsbo, 1994). However, it appears that physical condition may not influence goal-scoring ability (Abt et al., 2002). Studies by Zeederberg et al. (1996) and Abt et al. (1998) have shown that neither carbohydrate depletion nor supplementation appears to influence the performance of game related skills such as shooting. As such, maintenance of shooting ability as a match progresses would further aid attackers in gaining an advantage over defenders.

The appearance of fatigue that was mentioned above can be presented easily from diverse factors. Several studies that worked on time-motion analysis of men’s soccer matches have provided evidence that players’ ability to perform high intensity exercise is reduced towards the end of games in both elite and sub-elite soccer (Krustrup et al., 2006; Mohr et al., 2004a; Mohr, Krustrup & Bangsbo, 2005; Drust, Reilly & Rienzi, 1998; Van Gool, Van Gerven & Boutmans, 1988). Thus, it has been demonstrated that the amount of sprinting, high-intensity running, and distance covered are lower in the second half than in the first half of a game (Bangsbo, Nyrrregaard & Thorsøe, 1991; Bangsbo, 1994; Mohr, Krustrup & Bangsbo, 2003; Reilly & Thomas, 1979). Furthermore, it has been observed that the amount of high-intensity running is reduced in the final 15 min of a top-class soccer game (Mohr et al., 2003) and that jumping, sprinting and intermittent exercise performance is lowered after versus before a soccer game (Mohr, Krustrup, Nybo, Nielsen & Bangsbo, 2004b; Mohr, Krustrup, & Bangsbo, 2005; Rebelo, 1999). In a review of the prolonged run-up, which the Korean team adopted in preparing for the 2002 World Cup Finals, Verheijen (2003) described how initially the team could not keep up the desired pace of the game for the full 90 min. Players made high intensity runs less frequently and fewer explosive actions as the second half progressed. This reduction may indicate the development of fatigue in the second half, although total distance covered appears not to be a perfect indicator of physical performance in a match (Bangsbo, 1994). From the above it is clearly seen that in second half, and more specifically towards the end of the match, fatigue that players face leads them to make mistakes and as a result, more goals are scored. The physiological mechanisms responsible for fatigue appear to change during different periods of a match. Temporary fatigue may be related to disturbed muscle ion homeostasis. Impaired exercise ability in the first few minutes after half-time could be explained by a markedly lowered muscle temperature at the start of the second half. The decrement in the last stage of a game may be caused by a depletion of muscle glycogen in individual fibres, and under thermal stress conditions also dehydration and the concomitant hyperthermia (Mohr et al., 2005).

Another possible factor of higher scoring frequency towards the end of a match is the tactics. In the study by Mohr et al. (2003), within each playing position there was a significant variation in the physical demands depending on the tactical role and the physical capacity of the players. As far as the tactical factor is concerned, Reilly (1996) reports that play may become urgent towards the end of play as teams chase a result. Although, an “urgent” game is difficult to quantify, it would appear that the players are more willing to take greater risks towards the end of a match in order to affect an outcome (Abt et al., 2002). It is also possible that the losing team pushes players forward in order to create scoring opportunities, thereby scoring themselves or conceding further goals (Reilly, 1997). Mohr et al. (2003) supported that the reduced amount of high-intensity work at the end of the game was related to the fact that the outcome of the match had been decided.

Factors such as dehydration and hyperthermia may also contribute to the development of fatigue in the
later stages of a soccer game (Magal et al., 2003; Reilly, 1997) and influence goal scoring patterns. Soccer players have been reported to lose up to 3 litres of fluid during games in temperate thermal environments and as much as 4 – 5 litres in a hot and humid environment (Bangsbo, 1994; Reilly, 1997), and it has been observed that 5 and 10m sprint times are slowed by hypohydration amounting to 2.7% of body mass (Magal et al., 2003). Moreover, cognitive function is diminished in the hypohydrated state (Reilly & Lewis, 1985), possibly leading to a reduction in decision making ability and/or skill performance. However, in the study by Krustrup et al. (2006) a significant reduction in sprint performance was observed, although the fluid loss of the players was only about 1% of body mass, and no effect on core or muscle temperature was observed in a study with a similar loss of fluid (Mohr et al., 2004b). Also, Hoffman, Stavsky and Falk (1995) reported no decrease in shooting ability during a simulated basketball game, despite fluid losses approaching 2% of body mass. Thus, it would appear that fluid loss is not always an important component in the impaired performance seen towards the end of a game. Finally, icy or waterlogged surfaces are likely to impair all movements, whereas high altitudes or very hot conditions predispose to fatigue in the second half of a match (Reilly, 1994).

The last factor of goal scoring patterns is lapses in concentration of the players. Abt et al. (2002) concluded that higher percentage of scoring before half time and in the final 5 min of the game, are derived from lapses in concentration.

The results of the present study indicated that women’s soccer is similar to men’s soccer as far as the relationship between time and goal scoring patterns are concerned. Previous studies in men’s soccer, as presented before, concluded that goal scoring patterns are time depended. Specifically, it was shown that more goals were scored in the second half and that as time progresses in soccer matches more goals were scored. In conclusion, women’s soccer seems to accord with men’s soccer’s trend for more goals scored as time progresses and it could be explained by the deterioration in physical conditioning, the tactical play, fluid balance and lapses in concentration.

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