25. FEMALES AND FOOTBALL

O-143 Analysis of morphological features and played team positions in elite female soccer players

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OBJECTIVE Female soccer is very popular in Nordic countries. In 1997 a total of 200 000 players were registered in Sweden, and 40 000 (20%) of them were women, making female soccer the second largest sport in Sweden. The popularity of soccer continues to increase worldwide. In the last 10 years, the number of females participating in soccer has also risen within collegiate institutions in the United States. The purpose of this study was to determine the morphological differences in elite female soccer players based on team positions.

METHODS The sample was comprised of elite female soccer players, members of first league clubs in the Croatian League (n=24). Anthropometrical variables were measured according to the International Biological Program. The differences between team positions (goalkeepers, defenders, forward and midfielders) were analyzed by Manova. Statistical significant was set at $p<0.05$.

RESULTS The investigation showed that the goalkeepers were the oldest and possessed the longest playing experience, while the forwards were the youngest. The goalkeepers were the tallest and the heaviest players in the team, with the longest legs, arms and greatest thigh girth. Multivariate analysis of variance showed no significant differences in any of the selected morphological variables and playing position in female soccer players (Table 1.).

Table 1. Results of multivariate variance analysis of variance.

	F	P
Body mass (kg)	2.0426	0.1402
Body height	0.8746	0.4707
Fat tissue (%)	0.8347	0.4906
Lean body mass (kg)	0.5908	0.6282
Length of the leg (cm)	1.1341	0.3592
Length of the arm (cm)	2.1255	0.1290
Biacromial diameter (cm)	2.8444	0.0636
Bicristal diameter (cm)	2.6371	0.0857
Elbow diameter (cm)	2.7543	0.0976
Knee diameter (cm)	2.5371	0.0957
Upper arm girth (cm)	2.9427	0.0579
Forearm girth (cm)	2.9702	0.0564
Thigh girth (cm)	2.3799	0.1000
Calf girth (cm)	2.9231	0.0590

Wilks' Ratio=0.0388 R=1.2506, p=0.2488

DISCUSSION This study suggested that the morphological characteristics of female soccer players did not differ significantly according to their team positions. Also, the average height and body mass values of the female soccer players were within the normal range just like other elite European female soccer players.

KEY WORDS Morphological differences, female soccer players, team positions.

O-144 Match analyses of Australian international women soccer players using an athlete tracking device

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OBJECTIVE The physiological characteristics of women soccer players have been reported previously (Tumilty., 1993; Davies et al., 1993). The physical requirements of male soccer players have been reported by a number of researchers (Withers et al., 1982; Mohr et al., 2003). Krustrup et al. (2005) also examined the physical demands of women's games in Division One of the Danish League. They reported that the average total distance covered in a game was 10300 m (range: 9700- 11300 m). The preceding studies used video time-motion analysis but advances in technology have generated new methods of match analysis (Larsson, 2003). This study used a global positioning system (GPS), which is an emerging technology, to measure the activity profiles and physical demands of Australian international women soccer players.

METHODS Six players were monitored in four separate international women's soccer games. Each player was fitted with an athlete tracking device which incorporated GPS, triaxial accelerometry, gyroscopes and magnetometers. Players were categorised according to position: defenders (def, n=7), midfielders (mid, n=9) and attackers (att, n=6).

RESULTS Locomotor activity patterns are presented in Table 1. The total distance covered during a game was 9140 m, 2310± 580 m of which was moderate to sprint running. Average distances covered were: def- 9010 (7200- 9760 m), mid- 9640 (7620- 10960 m) and att- 8510 (8490- 9440 m).

Table 1. Locomotor activity profile of Australian international women soccer players.

Speed (km.h^{-1})	Locomotor Description	Match Total Distance	
		Mean (SD)	%
0-5	Slow walking	2400 (120)	26
5-8	Walking	2100 (110)	23
8-12	Low speed running	2330 (190)	26
12-16	Moderate speed running	1410 (160)	15
16-20	High speed running	620 (110)	7
20+	Sprinting	280 (80)	3
Total		9140 (1030)	

DISCUSSION The results of this study showed that Australian international women soccer players covered an average of 9140 m, which is less than the 10300 m reported by Krustrup et al. (2005). Possible reasons for these differences are the: 1) styles of play, 2) methods of analysis, 3) styles of play of the opposition, and 4) physical capacities of the players.

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KEY WORDS Global positioning system.

O-145 Work-rate analysis of elite female soccer players during match-play

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OBJECTIVE The physical demands of high-level male soccer have been studied extensively (Bangsbo et al., 1994; Mohr et al., 2003), however few studies exist (Davis et al., 1993) that have investigated the demands placed on females

during match-play. As the popularity of female soccer continues to grow understanding of the demands placed on female players during match-play would enable trainers and coaches to optimise the physical preparation of players. The purpose of this study was to characterise the work-rates of elite female soccer players during the 2005 Women's European Championships.

METHODS Thirty international female soccer players were filmed for the determination of work-rate profile. The camera was positioned overlooking the pitch, close to the half-way line. Movement categories for work-rate profile were: walk, walk back, jog, jog back, sideways movement, cruise and sprint. Total distance was calculated by the method of Reilly and Thomas (Reilly et al., 1976).

RESULTS The total distance covered during 90 minutes of match-play was 11979±1325m (Table 1). There was no significant reduction in the total distance covered in the second half compared to the first. Activity for the total distance covered during match-play consisted of 45% jogging, 26% walking, 13% cruising, 3% sprinting and 13% utility movements.

Table 1. Total distance covered by playing position for elite female soccer players.

Position (n=30)	Distance Covered M (SD)
Full Back	12636 (419)
Centre Back	11099 (1399)
Midfield	12971 (537)
Forward	11804 (1276)
Mean	**11979 (1325)**

DISCUSSION The distances covered by the players in the present study are similar to those that have been observed in top male players. This study suggests that female players tax the aerobic and anaerobic energy systems like male players, although gender differences for speed and power need to be considered in a future study. This has implications for the physical preparation of female players.

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KEY WORDS Elite female soccer, motion analysis, work rate.

O-146 Differences in physical match performance at two levels in female soccer

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OBJECTIVE Physical match performance and fatigue development in soccer has been studied intensively in professional male players, but information about these aspects of the game in elite female players is limited. The aim of the study was to examine the differences in physical demands and match performance of female soccer players in relation to their level of competition.

METHODS The participants were 19 top-class female national team players employed as professional players in the US top league and 14 moderate level non-national team players from the top Scandinavian league. The players were individually video-filmed in competitive matches in their respective leagues and computerized time-motion analyses were performed.
RESULTS The top-class players ran 28% longer ($P<0.05$) at high intensities than moderate level players and sprinted 24% longer ($P<0.05$). The top-class group had a decline ($P<0.05$) of 25-57% in high intensity running in the final 15 min compared to the first four 15-min intervals, while the moderate level group had a decline ($P<0.05$) in high intensity running in the last 15 min of each half.

DISCUSSION In conclusion, 1) top-class international players work at higher intensities than elite players at a lower level 2) fatigue occurs in female soccer, but seems to develop differently depending on the level of play.

KEY WORDS Female soccer, fatigue development, match performance.

O-147 Differences in movement pattern, heart rate and fatigue development in international versus national league matches of Swedish & Danish elite female soccer players

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OBJECTIVE The match schedule for female soccer has been extended in the last decade. More nations are participating in the qualifying group stage for international Championships, e.g. 30 teams will participate in 2009 European Championships. For club teams there has also been an increase in international matches, 44 teams are participating in the UEFA Women's Cup in 2006. International games (INT) are considered to be more physical demanding than national league games (NLG). However, the physical load of international games has not been evaluated for female soccer players. The purpose of this study was therefore to examine the movement pattern and aerobic loading for a group of Nordic elite female soccer players during INT and compare the results with NLG.

METHODS 11 elite female players (mean±SD,26.7±0.8yrs, 168.2±1.5cm and 61.0±1.4kg) participated in the study. Match intensity was measured by using time-motion analysis of locomotor activities and registering the players' heart rate (HR). The same player was observed individually by video filming up to 3 INT and 3 NLG. The players had the same position on the field in both the international and national game.

RESULTS Total distance covered was higher ($P<0.05$) in INT (mean±SD), 10.0±0.5 km compared to NLG, 9.7±0.6 km. The amount of high intensity running (HIR) was higher ($P<0.05$) in INT vs NLG (1.6±0.4 vs 1.4±0.4 km). There was a reduction of HIR in the last 15 min of both INT and NRG, with a tendency for a greater decline in INT. The HR decreased in the 2nd half did but did not differ between INT and NLG.

DISCUSSION There was a higher physical loading during INT compared to NLG, throughout the international game. It has previously been shown that amount of HIR is related to a player's physical capacity (Krustrup et al., 2005). This may indicate that the players were not physical fit to manage the intensity of INT as there was a tendency for a greater decline in HIR towards the end of INT. This needs to be further investigated.

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Krustrup et al. (2005) *Medicine and Science in Sports and Exercise* **37**, 1242-1248.

KEY WORDS Female, soccer, movement pattern, heart rate

O-148 Muscle strength, kicking and sprinting performance parameters in elite female soccer players

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OBJECTIVE Kicking is the one of the most important skills in soccer, with the full-instep kick and the inside-of-foot-passing shot being the most frequently used ones. Full-instep kick is normally used for generating fast ball speed and this type of kick was used in this study. The relation between muscle strength, sprinting ability and athlete performance on the field (like kicking performance) is a subject of controversy not only in biomechanics, but also in other research fields dealing with muscle power. Objective of this study is to determinant the correlation between kicking and sprinting performance and how strength influence sprinting and kicking performances.

METHODS Twenty-four Croatian female football team members (U-19) (mean (SD) age 17.2 (0.8) years, height 165.6 (5.9) cm, weight 57.9 (8.4) kg) were tested for maximal sprinting ability, leg muscle strength and kicking performance. Kicking performance was evaluated with ball velocity after the full-instep kick performance which was measured by a Stalker Radar Gun,Texas.

RESULTS The mean performance of the sprinting test over 5m (sp5) was 1.54 (0.1) sec, 10m (sp10) 2.35 (0.11) sec, 20m (sp20) 3.79 (0.14) sec and over 30m (sp30) was 5.17 (0.22) sec. Mean ball velocity measured by radar kicking by the preferred and non preferred leg was 82.6 (7.3) and 69.8 (9.3) km/h respectively. Unexpectedly, we didn't find sig-

nificant correlation between kicking and sprinting performance. Sprinting and kicking performance was correlated with strength (1RM).

DISCUSSION In soccer, sprinting performance affects kicking performance and can be influenced by the number of meters in the run up and foot velocity in the moment of contact with the ball. Because of insufficient technique authors' didn't found significant correlation between kicking and sprinting performance. When kicking performance is been tested level of technique must be sufficient.

KEY WORDS Muscle strength, kicking performance, sprinting performance, Croatian female soccer players.