FITNESS PROFILING IN SOCCER: PHYSICAL AND PHYSIOLOGIC CHARACTERISTICS OF ELITE PLAYERS

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ABSTRACT

Sporis, G, Jukic, I, Ostojic, SM, and Milanovic, D. Fitness profiling in soccer: physical and physiologic characteristics of elite players. J Strength Cond Res 23(7): 1947–1953, 2009—The purpose of this study was to evaluate whether players in different positional roles have a different physical and physiologic profile. For the purpose of this study, physiologic measurements were taken of 270 soccer players during the precompetitive period of 2005/06 and the precompetitive period of 2006/07. According to the positional roles, players were categorized as defenders (n = 80), midfielders (n = 80), attackers (n = 80), and goalkeepers (n = 30). Analysis of variance (ANOVA) was used to determine differences between team positions. Goalkeepers are the tallest and the heaviest players in the team. They are also the slowest players in the team when sprinting ability over 10 and 20 meters is required. Attackers were the quickest players in the team when looking at sprint values over 5, 10, and 20 meters. There were statistically significant differences between attacker and defenders when measuring vertical jump height by squat jump. Goalkeepers were able to perform better on explosive power tests (squat jump and countermovement jump) than players in the field. Midfielders had statistically significant superior values of relative oxygen consumption, maximal heart rate, maximal running speed, and blood lactate than defenders and attackers. Defenders had more body fat than attackers and midfielders (p < 0.05). Coaches are able to use this information to determine which type of profile is needed for a specific position. It is obvious that players in different positions have different physical and physiologic profiles. Experienced coaches can use this information in the process of designing a training program to maximize the fitness development of soccer players with one purpose only, to achieve success in soccer.

INTRODUCTION

Soccer is the world’s most popular sport, being played in every nation without exception. In recent years, there has been a remarkable expansion of sport science. The subject area is now recognized both as an academic discipline and a valid area of professional practice. Coaches and soccer players are more open to contemporary scientific approaches to prepare for competitions. One of the problems scientists have to deal with when investigating problems concerning a game of soccer is sample size. The number of participants who are involved in the studies are mostly under 30 (2–4,6–8,14,21,23,25). In soccer science, we still have a problem with a lack of descriptive date concerning the characteristics of elite soccer players that are achieved using large samples. During the last 10 years, Croatian soccer players have established a well-known and successful style of play. The Croatian National team won the third place at the World Championship in France and was able to qualify for the World Championship in Japan and South Korea and Germany. They played in the European Championship in Portugal, and they recently qualified for the European Championship in Switzerland and Austria, being first in their group. According to International Federation of Association Football world ranking, the Croatian National team is in 10th place. The physique of the soccer players may be one of the essential factors that have contributed to the success of the Croatian national team in international competition. Aspects such as experience, body composition, endurance, and balance between aerobic and anaerobic power are important in evaluating elite soccer players. Even though soccer is dominantly an aerobic game, the anaerobic component is of high importance for the overall performance of an elite soccer player (1,2). Anaerobic energy is essential to perform sprints, high-intensity runs, and duel plays, all of which may contribute to the final result (2). The term "anaerobic threshold" (AT) is defined as the level of work or oxygen consumption just below that at which metabolic acidosis and the associated changes in gas exchange occur (23). The AT has been shown to be highly correlated to performance in aerobic events and is valuable in the determination of optimal training loads and the fitness level of the soccer players (1). Previous studies have determined a correlation between maximal oxygen uptake (VO2max) and the distance run during a match (31,34). Positional

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differences have been the subject of interest of sport scientists for years (1, 4–6, 10, 26). These differences have been examined by football matches being recorded by video camera and subsequently analyzed. The researchers wanted to know what activities players engaged in during a match. They realized that there were differences between the distances run by the strikers, defenders, and midfielders during a match. A football player runs a total of 8 to 12 km during a match (4, 5, 10, 35). However, for coaches and scientists, the distance a player sprints is more relevant than the total distance he runs. Assessments of physical fitness allow for a more accurate evaluation of the effects of the conditioning program and are also more likely to identify the areas of weakness and strength of the soccer players. Overall physical fitness is important for functioning of the soccer players at a professional level. The significance of this study is that the results may serve to validate current physical fitness assessments practice or indicate the need for different assessment and training methods for soccer players. For the purposes of this study, the most frequently used fitness test for soccer players was performed (VO2max test followed by measurement of maximal blood lactate [BL] concentration, sprint, and explosive power tests), and morphologic characteristics were tested (body height, weight, and percentage of body fat). The purpose of this study was to describe the structural and functional characteristics of elite Croatian soccer players and to evaluate whether the players in different positional roles (goalkeepers, defenders, midfielders, and attackers) have different physical and physiologic profiles.

**METHODS**

**Experimental Approach to the Problem**

A battery of physical fitness tests was used to establish a fitness profile for elite soccer players. First, the morphologic characteristics were measured (body height, weight, and percentage of body fat). Sprint and explosive power were tested, followed by the VO2max test. These assessments are commonly performed, provide valid and reliable data, and are associated with the largest database of normative data. They were selected because they provide the best information about the fitness status of soccer players. Each player was instructed and verbally encouraged to give his information about the fitness status of soccer players. They were selected because they provide the best information on what activities players engaged in during a match. They realized that there were differences between the distances run by the strikers, defenders, and midfielders during a match. A football player runs a total of 8 to 12 km during a match (4, 5, 10, 35). However, for coaches and scientists, the distance a player sprints is more relevant than the total distance he runs. Assessments of physical fitness allow for a more accurate evaluation of the effects of the conditioning program and are also more likely to identify the areas of weakness and strength of the soccer players. Overall physical fitness is important for functioning of the soccer players at a professional level. The significance of this study is that the results may serve to validate current physical fitness assessments practice or indicate the need for different assessment and training methods for soccer players. For the purposes of this study, the most frequently used fitness test for soccer players was performed (VO2max test followed by measurement of maximal blood lactate [BL] concentration, sprint, and explosive power tests), and morphologic characteristics were tested (body height, weight, and percentage of body fat). The purpose of this study was to describe the structural and functional characteristics of elite Croatian soccer players and to evaluate whether the players in different positional roles (goalkeepers, defenders, midfielders, and attackers) have different physical and physiologic profiles.

**Subjects**

Physiologic measurements were taken of 270 soccer players during the precompetitive period of 2005/06 and the precompetitive period of 2006/07. According to the positional roles, the players were categorized as defenders (n = 80), midfielders (n = 80), attackers (n = 80), and goalkeepers (n = 50). All the subjects were tested over a period of 2 years, and the tests were performed in the same order. Twelve men’s soccer teams participated in the study. All of the teams in the study competed in the professional First National League. All the subjects gave their informed consent and volunteered to participate in the study. The study had the approval of the Ethical Committee of the Faculty of Kinesiology, Zagreb, Croatia. All participants were fully informed about the nature and demands of the study, as well as the known health risks. They completed a health history questionnaire and were informed that they could withdraw from the study at any time.

**Testing Protocol**

The duration of the testing period technical-tactical preparation as well as the intensity and extensity of those in training were strictly controlled. The warm-up phase of each training session lasted 20 minutes, and players performed 20-minute speed, agility, quickness training and 30 minutes of technical/tactical soccer training.

Upon entering the laboratory, the players’ morphologic characteristics were measured. According to the instructions of the International Biological Program (18), the following anthropometric variables were measured: body height, body mass, and skinfold thickness. In the process of morphologic measurement, the players were interviewed about playing experience and playing position with their medical charts taken into consideration; only healthy players were allowed to participate in the study. Body height was measured using an anthropometer to the nearest 0.5 cm. Body mass was obtained to the nearest 0.1 kg using a balance beam scale (Seca, Hamburg, Germany). The skinfold thickness at 7 sites (triceps, subscapularis, midaxilaris, anterior suprailiac, chest, abdomen, and thigh) were measured (John Bull Caliper, Novel Products, Inc., Holland, ML) by an expert technician. An average of the 3 measurements was used to represent the skinfold thickness. The percentage of fat was determined according to the athlete-specific equation of Jackson and Pollock (18).

Vertical jump height and power were measured using a force platform (Quattro Jump, Kistler Switzerland Paren Co.). The types of tests used were the squat jump (SJ) and the countermovement jump (CMJ). Players had 2 preparatory
measurements. An average of the 3 measurements was used to represent the result in the SJ and the CMJ. Sprints over 5, 10, and 20 meters (SP5, SP10, and SP20) were measured using a telemetric photocell system (RS Sport, Zagreb), and an average value from the 3 sprint attempts was taken as the final result. Times were recorded in 100ths of a second. The final test was a 1-minute incremental maximal exercise test on a motor-driven treadmill (Run Race, Technogym, Italy) with 1.5% inclination. A portable breath-by-breath gas analysis system (Quark k4 b2, Cosmed, Italy) was used for respiratory gas exchange monitoring. Heart rate was monitored using a heart rate monitor (Polar Vantage NV, Polar, Finland). The maximal exercise test was interrupted when a plateau of oxygen consumption was noted or when the subject perceived volitional fatigue. The AT was assessed by a nonlinear increase in carbon dioxide to oxygen consumption ratio (V-slope method). For this purpose, 4 spiroergometric parameters were calculated and analyzed (VO2max, maximal heart rate [HRmax], maximal running speed [MRSAT], heart rate at anaerobic threshold). After the completion of the test, the subjects underwent measurement of maximal BL concentration using a simplified BL test meter (Lactate Pro LT-1710). The study was funded by the Croatian Football Federation and performed together with the Faculty of Kinesiology University of Zagreb and Sport Diagnostic Center-Zagreb at the Faculty of Kinesiology, Croatia.

**Statistical Analyses**

The Statistical Package for Social Sciences SPSS (v13.0, SPSS, Inc., Chicago, IL) was used for statistical analyses. Descriptive statistics (mean ± SD and range) were calculated for all experimental data. Statistical power and effect size were calculated using the GPOWER software (11,13). Statistical analysis was performed using ANOVA to determine the differences among the defenders, midfielders, attackers, and goalkeepers. The relationship between the subjects’ physique (height and weight) and body fat, VO2max, HRmax, sprint test (SP5, SP10, and SP20), SJ, CMJ, and BL was determined using the Person product-movement correlation coefficient. p ≤ 0.05 was considered statistically significant. The reliability of the test was determined using the reliability analysis (alpha), test-retest method and by interclass correlation coefficient (ICC).

**RESULTS**

The analyzed tests had high values of reliability coefficients (alpha), SP5 (α = 0.89), SP10 (α = 0.78), SP20 (α = 0.81), SJ (α = 0.73), CM (α = 0.91). All the analyzed sprint tests and 2 anaerobic power tests had high values of ICC: SP5 (ICC = 0.89), SP10 (ICC = 0.80), SP20 (ICC = 0.81), SJ (ICC = 0.75), CM (ICC = 0.88). The test-retest values for all the physical fitness tests used in this study ranged between 0.89 and 0.95. The effect size for analysis of variance was medium (f = 0.25), but statistical power was high (power = 0.95). The effect size for the correlation coefficient was large (r = 0.50), as were the values of statistical power (power = 0.95). The defenders were older and more experienced than both the midfielders and attackers. The midfielders were the shortest players in the team. The attackers were taller and heavier than the midfielders, and the attackers were taller than the defenders.
The defenders had more body fat than the attackers and midfielders. The midfielders were the players with the lowest percentage of body fat (Table 2). The goalkeepers had longer playing experience than the outfield players. The goalkeepers are the tallest and the heaviest players in the team. They are also the slowest players in the team when sprinting ability for SP10 SP20 is required. Attackers were the fastest players in the team regarding sprint values SP5, SP10, and SP20. The best average results concerning vertical jump power were detected among the goalkeepers. There were statistically significant differences between the attackers and defenders when measuring vertical jump height by SJ. The goalkeepers were able to perform better at explosive power tests (SJ and CMJ) than the players in the field (attackers, midfielders, and defenders). No statistically significant differences were determined between the defenders, midfielders, and attackers for CMJ. Midfielders had statistically significant superior values of VO2max, HRmax, MRSAT, and BL than the defenders and attackers. The lowest values of VO2max and BL were found among the goalkeepers (Table 2).

A strong negative correlation was found between body fat and SP5 \( r = -0.86 \), SJ \( r = -0.78 \), and CMJ \( r = -0.92 \). Body fat was in negative correlation with VO2max \( r = -0.72 \) and HRmax \( r = -0.95 \). MRSAT was in negative correlation with body weight \( r = -0.71 \). Blood lactate was in a positive correlation with body height \( r = 0.82 \) and body weight \( r = 0.87 \).

**DISCUSSION**

To the authors’ knowledge, this study provides the most comprehensive comparison among the positional roles in top-level soccer players. This is one of the largest studies in regard to sample size \( n = 270 \). As expected, the results of this study have shown that there is a strong correlation between body composition, aerobic fitness, anaerobic power, and positional roles in elite soccer players. Before analyzing the results of this study, we must take into consideration the specifics of the sample. Croatian soccer players play in a league of 12 soccer clubs. Heterogeneity of players is obvious among teams and among players in a team, especially because of the differences in nationality (in particular, players from South America, Germany, Bosnia, and Herzegovina). The average age of elite Croatian soccer players was 27.3 ± 3.1 years (range: 24.2 ± 3.1 to 31.5 ± 2.3). The average professional experience was 13.4 ± 2.1 years (range: 10.2 ± 2.4 to 12.5 ± 2.5). The average height was 177.2 ± 6 cm (range: 169.4 ± 5.6 to 180.7 ± 3.4). The average body weight was 74.5 ± 5.7 kg (range: 64.4 ± 3.2 to 81 ± 2.3). The average VO2max was 59.2 ± 0.73 mL kg\(^{-1}\) min\(^{-1}\) (range: 44.2 ± 2.1 to 50.5 ± 2.7). The average HRmax was 187.2 ± 2.3 \( b min^{-1}\) (range: 181.2 ± 2.1 to 198.5 ± 1.9). The average maximal running speed was 16.2 ± 2.1 km/h (range: 18.3 ± 2.1 to 15.4 ± 2.4).

**TABLE 2.** Physical and physiologic characteristics of elite Croatian soccer players.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Defenders ((n = 80))</th>
<th>Middelfeers ((n = 80))</th>
<th>Attackers ((n = 80))</th>
<th>Goalkeepers ((n = 30))</th>
<th>Total ((n = 270))</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>27.3 ± 2.3‡</td>
<td>25.1 ± 3.1‡</td>
<td>24.2 ± 3.2‡</td>
<td>31.5 ± 2.3‡#</td>
<td>28.3 ± 5.9‡</td>
<td>19.4–34.5‡</td>
</tr>
<tr>
<td>Professional experience (yr)</td>
<td>13.4 ± 2.1§</td>
<td>10.2 ± 2.4</td>
<td>12.5 ± 2.5‡</td>
<td>16 ± 2.8¶#</td>
<td>14.7 ± 2.3§</td>
<td>9.2–18.9§</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>177.2 ± 4.5§</td>
<td>169.4 ± 5.6</td>
<td>180.7 ± 3.4‡</td>
<td>185 ± 3.1¶</td>
<td>181.4 ± 2.5‡</td>
<td>164.3–190.3‡</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>74.5 ± 5.6‡</td>
<td>64.4 ± 3.2‡</td>
<td>78.4 ± 5.2§</td>
<td>81 ± 2.3§#</td>
<td>78.4 ± 3.1‡</td>
<td>62.1–84.5‡</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>12.2 ± 2.9†</td>
<td>8.4 ± 2.9†</td>
<td>10.2 ± 2.1§</td>
<td>14.2 ± 1.5¶#</td>
<td>11.9 ± 3.1‡</td>
<td>6.3–19.5‡</td>
</tr>
<tr>
<td>Sprint over 5 meter (s)</td>
<td>1.43 ± 0.5</td>
<td>1.47 ± 0.6</td>
<td>1.49 ± 0.5§</td>
<td>1.54 ± 0.7§</td>
<td>1.44 ± 0.5</td>
<td>1.39–0.47</td>
</tr>
<tr>
<td>Sprint over 10 meter (s)</td>
<td>2.13 ± 0.6</td>
<td>2.23 ± 0.5</td>
<td>2.35 ± 0.8¶</td>
<td>2.52 ± 0.6</td>
<td>2.47 ± 0.6</td>
<td>2.13–2.36</td>
</tr>
<tr>
<td>Sprint over 20 meter (s)</td>
<td>3.36 ± 0.6</td>
<td>3.43 ± 0.8</td>
<td>3.51 ± 0.9§</td>
<td>3.76 ± 1.0§</td>
<td>3.38 ± 0.7</td>
<td>3.27–3.52</td>
</tr>
<tr>
<td>Squat jump (cm)</td>
<td>42.3 ± 2.1</td>
<td>41.49 ± 4.0</td>
<td>44.2 ± 3.2‡</td>
<td>46.8 ± 1.4¶</td>
<td>44.1 ± 1.3</td>
<td>40.4–48.3‡</td>
</tr>
<tr>
<td>Countermovement jump (cm)</td>
<td>44.2 ± 1.9</td>
<td>44.26 ± 2.1</td>
<td>45.3 ± 3.2</td>
<td>48.5 ± 1.5¶#</td>
<td>45.1 ± 1.7</td>
<td>41.4–50.1‡</td>
</tr>
<tr>
<td>Relative oxygen consumption (mL kg(^{-1}) min(^{-1}))</td>
<td>59.2 ± 1.5</td>
<td>62.3 ± 3.1†</td>
<td>58.9 ± 2.1</td>
<td>50.5 ± 2.7¶#</td>
<td>60.1 ± 2.3</td>
<td>50.3–65.3‡</td>
</tr>
<tr>
<td>Maximal heart rate (b min(^{-1}))</td>
<td>187.2 ± 2.3</td>
<td>191.1 ± 2.1†‡</td>
<td>188.1 ± 2.1</td>
<td>188.5 ± 1.9</td>
<td>189.1 ± 1.9</td>
<td>185.4–193.3‡</td>
</tr>
<tr>
<td>Maximal running speed (km/h)</td>
<td>16.2 ± 2.1</td>
<td>18.3 ± 2.1†‡</td>
<td>16.9 ± 3.1</td>
<td>15.4 ± 2.4</td>
<td>16.9 ± 3.2</td>
<td>13.3–20.1</td>
</tr>
<tr>
<td>Blood lactate (mmol/L)</td>
<td>10.5 ± 3.1</td>
<td>13.3 ± 1.9†‡</td>
<td>10.9 ± 2.1</td>
<td>9.3 ± 3.1¶#</td>
<td>11.0 ± 2.3</td>
<td>7.9–15.1</td>
</tr>
</tbody>
</table>

*Values are expressed as mean ± SD.†Statistically significant at \( p < 0.05 \) for defenders vs. midfielders.‡Statistically significant at \( p < 0.05 \) for midfielders vs. attackers.§Statistically significant at \( p < 0.05 \) for defenders vs. attackers.¶Statistically significant at \( p < 0.05 \) for defenders vs. goalkeepers.#Statistically significant at \( p < 0.05 \) for midfielders vs. goalkeepers.
players is 28.3 ± 5.9 years, which is in agreement with previous studies (1,2,9,12–14,17,24,26,32,33). Goalkeepers are the tallest and the heaviest players in the team. They are also the slowest players in the team when sprinting ability for SP10 SP20 is required. The best average results concerning vertical jump power were detected among goalkeepers. Goalkeepers were able to perform better at explosive power tests (SJ and CMJ) than players in the field (attackers, midfielders, and defenders). The lowest values of VO2max and BL were found among goalkeepers (Table 2). For goalkeepers, it is not unusual to play at top level in their 30s (e.g., Peter Schmeichel). This may be related to the special requirements of the position and players maturing in tactical judgment with experience in the game. It may also be related to a lower incidence of chronic injuries and degenerative trauma in goalkeepers compared with outfield positions.

Defenders are the players with significantly higher experience than midfielder and attackers. In modern soccer, we can observe a trend of prolonged player experience. Players are able to play until they reach their mid-30s. The development of appropriate sport medicine and responsive injury management strategies within the clubs is much better than in previous decades, and this might affect a player’s career and may also have contributed to the trend of professionals staying active for longer than they previously have. The fact that defenders are the oldest and most experienced players in the team may be related to the specific requirements of the position. It is known that defenders cover, on average, 8.4 km, attackers 9.8 km, whereas midfielders cover the greatest number of kilometers during a match (approximately 10.9 km) (4, 5, 10, 35). Because of the lower distance covered and smaller number of sprints required during a soccer game, defenders have less tissue damage and are able to play for a longer period than their midfielder and attacker team mates.

Midfielders are the shortest players and with the smallest amount of body fat as compared with the other positional roles. Moreover, midfielders cover far greater distances as compared with attackers and defenders. In the phase of attack, midfielders take a ball to the opponent’s half, whereas the defenders, in most cases, make a slight shift forward, and the attackers wait for the ball from the midfielders. In the defensive phase, attackers run (short runs at low intensity), midfielders run back, and the defenders wait for the opposing players. The specific role of midfielders on the team could be responsible for their physical characteristics. Nevertheless, lack of height is not in itself a bar to success in soccer; it represents just one of the criteria for positional role selection.

Attackers appear to be the fastest players on the team. Significant differences were found between attackers and midfielders, with no significant differences found between attackers and defenders. This was expected because attackers have to be fast if they want to pass defenders, and defenders have to be fast if they want to stop attackers in their intention to score a goal. Sprints of 1 to 5 m and 5 to 10 m account for most of the sprinting actions of soccer players (3). When comparing the results of the sprint test with the results from other studies, we can conclude that the players from our study have quite similar results to those soccer players from France (9), Norway (17), Germany (19), and England (20). When comparing results from other studies, we have to be very careful because there are many differences in study design.

The test of anaerobic power showed that Croatian soccer players had better results than elite players from Portugal, Italy, Spain, Norway, and Scotland (14,15,17,21). Attackers had significantly higher values of anaerobic power than midfielders, whereas no significant difference was found between attackers and defenders in anaerobic power. These results were expected and are logical when taking into consideration the positional differences gained in the sprint tests. In a previous study (36), the authors found a strong positive correlation between sprinting and jumping performance. Furthermore, no significant differences were found between team positions with CMJ, but, on average, the attackers had higher values of vertical jump height as measured by CMJ. It appears that Croatian soccer players have a larger potential in anaerobic power than players from Portugal, Italy, Spain, and Turkey (14,15,34). Goalkeepers were the players with the greatest anaerobic power potential. This was expected because anaerobic power manifested through the vertical jump (SJ and CMJ) is essential for successful goalkeeping. According to the determined average values of VO2max (60.1 ± 2.3 mL/kg/min), Croatian players have similar results as world top football players, whose values vary from 55 to 67 mL/kg/min (16,17,22,27–29,35). The values of VO2max indicate a moderate conditioning fitness (endurance) of attackers and defenders, whereas values of the midfielders are in the upper boundaries (average values 62.3 ± 3.1 mL/kg/min). The Croatian midfielders have superior values of VO2max compared with attackers and defenders because midfielders have to cover more distance during a game. Midfielders are the players with greater values of HRmax and MRS at ventilatory threshold. We can conclude that midfielders are the players with the highest aerobic capacity, whereas attackers are the players with the highest anaerobic capacity.

Goalkeepers had the lowest VO2max values. When taking into consideration that, on average, a goalkeeper during a game covers 4 km (27), these results were expected. Anyone professionally involved in soccer is aware of the game’s high aerobic demands, but anaerobic power is also crucial for success in soccer. Soccer is still often perceived as an aerobic-anerobic sport. Most action is performed in aerobic conditions by anaerobic activities, which make a difference between winning and losing. Most studies present the BL values at the end of the first and second half of a soccer game (4,10,30,35). In our study, BL was measured after the maximal exercise tests on a motor-driven treadmill. The obtained values were higher (on average 11.0 ± 2.3) than BL values gained after the first and second period of the
game. During the game, the players almost never come to a state of total exhaustion as they do during a maximal aerobic test on a motor-driven treadmill. This is one of the reasons why the results of the BL concentration obtained from the players in our study are higher than the results reported in other studies (4, 10, 35).

We found that body fat was in a negative correlation with sprinting performance, anaerobic power, CMJ, and VO2max and HRmax. According to the gained results, we can conclude that soccer performance is highly dependent on the physical characteristics of an individual soccer player. If the values of body fat and weight are not adequate to the player’s height and specific positional demands, then the player’s physique will have a negative influence on his soccer performance. Soccer is a very complex sport, and ideal physique and physiology are not sufficient for excellence in soccer. Other components such as technique, tactics, and strategy of the coach play a key role in the final results.

The results of our study demonstrated the relationship between aerobic and anaerobic power and the positional roles in soccer. Profiling may be useful in a player’s selection and development and for specific training programs. The coach may use this scientific information to avoid errors and to maximize the chance of preparing the team well. A scientific approach toward preparation for play when taking into consideration the players physical and physiologic characteristics can nevertheless enhance the enjoyment of both players and spectators.

**Practical Applications**

The results of this study show there are differences in the physical and physiologic characteristics in different positional roles of elite soccer players. Fitness for soccer cannot be determined by a single parameter because the game demands a large number of physical and physiologic capabilities, as presented in this study. Successful play at top level in contemporary soccer depends on how individuals are knitted together into a competent unit, and so the combination of physical and physiologic characteristics may vary from player to player. Coaches can use this information to determine which type of profile is needed for a specific position. Experienced coaches can use this information in the process of designing a training program to maximize the fitness development of soccer players with one purpose only, to achieve success in soccer.

**References**


