

## GOAL SCORING CHARACTERISTICS IN SOCCER: ARE THEY TECHNIQUE AND TIME DEPENDENT?

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### Abstract

The purpose of the present study is to examine the goal scoring patterns of the Greek soccer league. Eight seasons of the league (2001-2002 to 2008-2009) were analyzed. The games were divided into: two-45 minute periods, six-15 minute periods and home and away games. Similarly, the scoring technique and the month at which the goals were scored were also recorded. The results showed a significant increase in the frequency of goal scoring at the second half and at the home conducted games. Analysis of variance showed statistically significant differences for the goals scored across the six, 15-min periods and the month in which the goals were scored. The kick was the most efficient goal scoring technique. The results have shown that the frequency of goals scored and the technique used for scoring are time dependent. Therefore, similar lines for the aim of the training sessions could be used.

**Keywords:** Athletic Training, Coaching, Motion Analysis, Goals, Soccer

### Introduction

Soccer is one of the most spectacular and popular team sports worldwide with thousands of players and millions more spectators [1]. Different skills and actions (dribbling, passing, heading, kicking, running, cutting, etc) are commonly present during a 90 min game [2]. The low frequency of goals scored during soccer games compared to other team sports gives greater importance and value to each goal, while knowledge of the patterns used for goal scoring provides useful information to soccer coaches.

A goal scoring pattern is defined as the time at which the goals are scored during a soccer game [3]. Studies examining scoring patterns mainly focused on the frequency of goals scored in the first and the second half or at different time periods [4,5]. Moreover, the attacking methods used for goal scoring [6], the number of players who contact the ball prior to a scored goal, the number of passes performed prior to each scored goal and the attacking reaction time [7] have also been part of goal scoring examination.

Jinshan et al [6] analyzed the goals scored in the 14<sup>th</sup> World Cup in Italy and reported that the number of goals scored increased with time especially in the last 15 minutes of the game. During the 17<sup>th</sup> World Cup, goal scoring also peaked between the 75<sup>th</sup> and the 90<sup>th</sup> time period [8]. Similar results were reported by Ekblom [5] for the Scottish National League. The fall in work-

rate, the mental fatigue, the increased efforts of the teams at the end of the game and the “chase” for a result were suggested as the main reasons for the above observations [5].

Previous studies have also examined the techniques used for goal scoring and reported that the most successful technique for goal scoring was the instep kick (28.7%), followed by heading and inside foot kick (24.4%), while more scoring chances were created from set-plays such as free kicks, penalty kicks and corner kicks [6]. In other studies, the importance of home advantage was examined. Pollard and Pollard [9] reported that home teams in soccer win approximately 60-70% of the games. The support of the local crowd, the familiarity with local conditions, referee bias, special tactics and psychological factors were reported as the main factors responsible for home advantage [10].

Abt et al [3] examined the goal scoring patterns of the Australian National Soccer League by separating the 90 minute soccer game into three different duration periods. The results indicated that the goals scored were time dependent, as more goals were scored at the end of each half. However, the goals scored at the extra time of each half were not separated for examination, but they were included in the last periods of the games, which would have probably lead to conflicting results. Moreover, the role of home advantage [9] and information regarding scoring technique were not examined. Therefore, a study examining these variables during a soccer game could be proved a useful tool for coaches in organizing the training process and for players to pay attention in specific intervals of the game.

The purpose of the present study was to examine goal scoring patterns of the Greek National Soccer League (Super League). There were three research questions: First, is there a relationship between goals scored and time of scoring? Second, is there a relationship between goal scoring techniques and time of scoring? Third, is there a relationship between goals scored and the place of the game (home or away) or the month the game took place? Based on these questions, there were five research hypotheses: first, that higher frequency of goal scoring at the second half would be observed; second, that more goals will be scored during the last periods across the 6-15 minute periods; third, that the goal scoring techniques are time dependent; fourth, that more goals would be scored in the home games and fifth, that there would be no effect of the month the game is conducted on goal scoring.

## **Methods**

### **Sample**

Eight seasons of the Greek National Soccer League (2001-2002 to 2008-2009) were analyzed based on documents from the Greek Football Federation. The 90 minute soccer game was divided into a) two-45 minute periods and b) six-15 minute periods. Scoring techniques included: kicking (all the types of kicking techniques), headers, penalties, own goals and free kicks (kicks performed after a set play).

The league begins in August with the last games taking place in May. Therefore, a tenth month period (August to May) was included in the examination. Moreover, each game was separated into goals scored at home and goals scored at away games. The total number of goals, the time and the month at which the goals were scored and the scoring technique were recorded.

### **Statistical Analysis**

Paired Student t-tests were applied to compare goals scored in the first and the second half, in the home and the away games and the goals scored at the extra time of each half.

A one way analysis of variance (ANOVA) was used to examine the differences in the 15-minute periods, in goal scoring technique and the time at which the goals were scored and in goal scoring patterns and the month in which goals were scored between all eight seasons. Significant differences were followed by applying simple effects and, if significant, post-hoc Tukey tests were applied to examine significant differences between pairs of means. The level of significance was set at  $P < 0.05$ .

## Results

Overall, 4511 goals out of 1876 matches were totally analyzed (517 goals out of 196 matches of the first season, 615 goals out of 240 matches of the second season, 627 goals out of 240 matches of the third season, 559 goals out of 240 matches of the fourth season, 544 goals out of 240 matches of the fifth season, 527 goals out of 240 matches of the sixth season, 590 goals out of 240 matches of the seventh season and 532 goals out of 240 matches of the eighth season, respectively). An average of 2.4 goals per match was found (Table 1).

Table 1. Goals scored during each season of the Greek National Soccer League.

SEASON	GAMES	GOALS	GOALS PER GAME
2001 - '02	196	517	2,63
2002 - '03	240	615	2,56
2003 - '04	240	627	2,61
2004 - '05	240	559	2,32
2005 - '06	240	544	2,26
2006 - '07	240	527	2,19
2007 - '08	240	590	2,45
2008 - '09	240	532	2,21
<b>SUMMARY</b>	<b>1876</b>	<b>4511</b>	<b>2,40</b>

T-test analysis indicated a statistically significant increase in the frequency of goal scoring at the second half ( $T_7 = 4.916$ ;  $P < 0.05$ ; Figure 1) and at the extra time of each half ( $T_7 = 6.882$ ;  $df = 7$ ;  $P < 0.05$ ; Figure 1).

\*

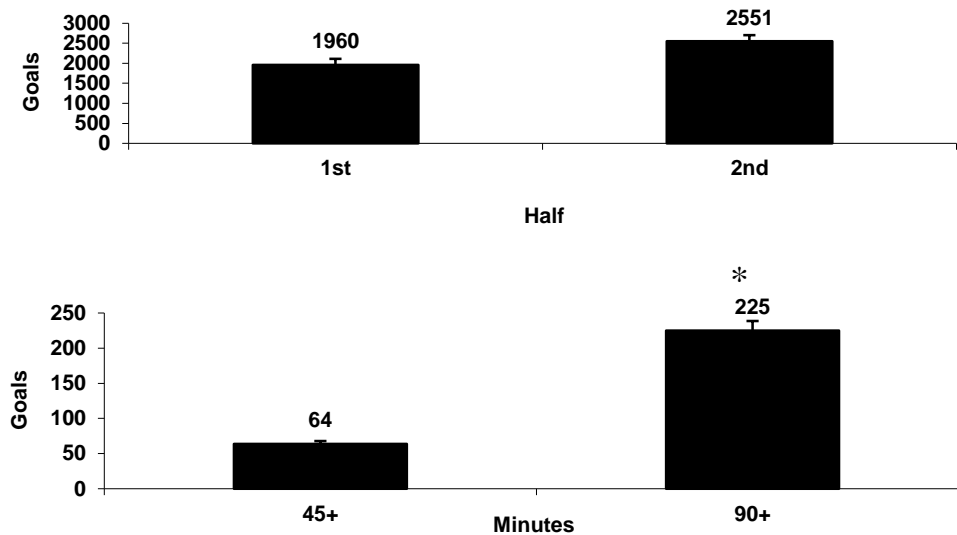


Figure 1. Goals Scored During Each Half (Upper Graph) and During the Additional Time of Each Half (Lower Graph) (\* = significantly different at  $P < 0.05$ ).

Figure 2 presents the frequency of goal scoring across the 15-min periods. The ANOVA results indicated a significant difference in goal scoring across the 6-15 min time periods ( $F_{5,42} = 21.470$ ;  $P < 0.05$ ). Post-hoc Tukey's tests indicated that goals scored at the last period of the game (76<sup>th</sup> to 90<sup>th</sup> minute) were significantly higher compared to the goals scored at the other periods (Figure 2).

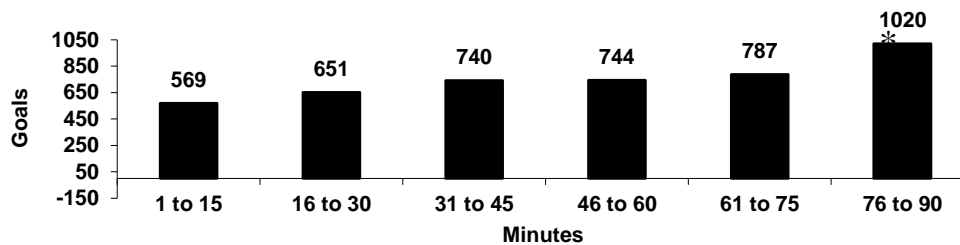


Figure 2. Goal Scoring Pattern During the Six, 15-min Periods. (\* = significantly different at  $P < 0.05$ ).

The ANOVA results showed a significant difference in goal scoring regarding the scoring technique ( $F_{4,35} = 450.441$ ;  $P < 0.05$ ). Post-hoc Tukey's tests indicated that goals scored under kick and head technique situations were significantly higher compared to other scoring techniques (Figure 3). Furthermore, the results showed that kick was the most efficient goal scoring technique representing the 67.1% of the totally goals scored, followed by headers (18.4%), penalty (8.1%), free kick (4.2%) and own goals (2.2%), respectively (Figure 3).

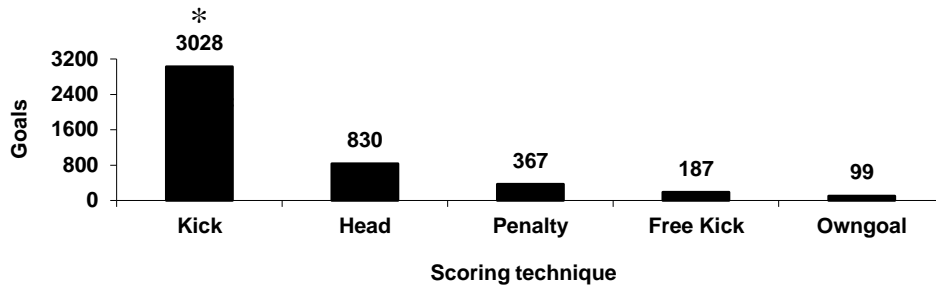


Figure 3. Goal Scoring Values for Each of the Scoring Technique. (\* = significantly different at  $P < 0.05$ ).

Figure 4 presents the frequency of goal scoring under kicking and heading situations across the 15-min periods. The ANOVA results indicated a significant difference in goal scoring for the kicking technique across the 6-15 min time periods ( $F_{5,42} = 15.010$ ;  $P < 0.05$ ). Post-hoc Tukey's tests indicated that goals scored with kicking technique at the last period of the game (76<sup>th</sup> to 90<sup>th</sup> minute) were significantly higher compared to the goals scored at the other periods (Figure 4). Similarly, the ANOVA results indicated a significant difference in goal scoring for the heading technique across the 6-15 min time periods ( $F_{5,42} = 5.303$ ;  $P < 0.05$ ). Post-hoc Tukey's tests indicated that goals scored with heading technique at the first period of the game (1<sup>st</sup> to 15<sup>th</sup> minute) were significantly lower compared to the goals scored at the fifth (61<sup>st</sup> to 75<sup>th</sup> minute) and the sixth (76<sup>th</sup> to 90<sup>th</sup> minute) period (Figure 4).

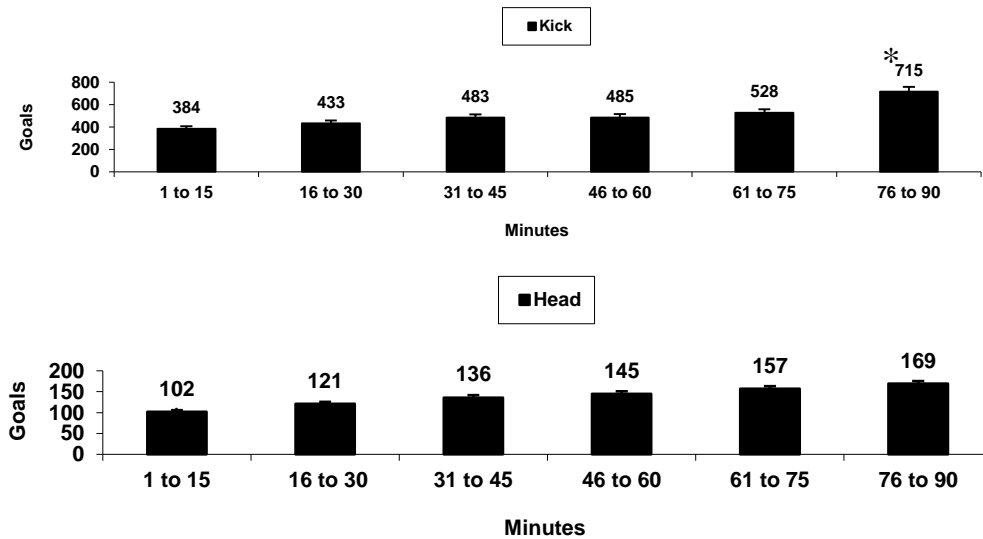


Figure 4. Goal Scoring Values for Kicking Technique (Upper Graph) and Goal Scoring Values for Heading Technique (Lower Graph) During the Six, 15-min Periods. (\* = significantly different at  $P < 0.05$ ).

The t-test showed a significant difference in scored goals between home and away games ( $T_7 = 4.916$ ;  $P < 0.05$ ). This accounted for a 21% increase in the frequency of goals scored in home games compared to the away games (Figure 5).

The ANOVA results indicated a significant difference in goal scoring across the tenth month period ( $F_{9,70} = 26.633$ ;  $P < 0.05$ ). Post-hoc Tukey's tests indicated that goals scored at the first

(August) and the last (May) month of the playing season were significantly lower compared to the goals scored at the other periods (Figure 5).

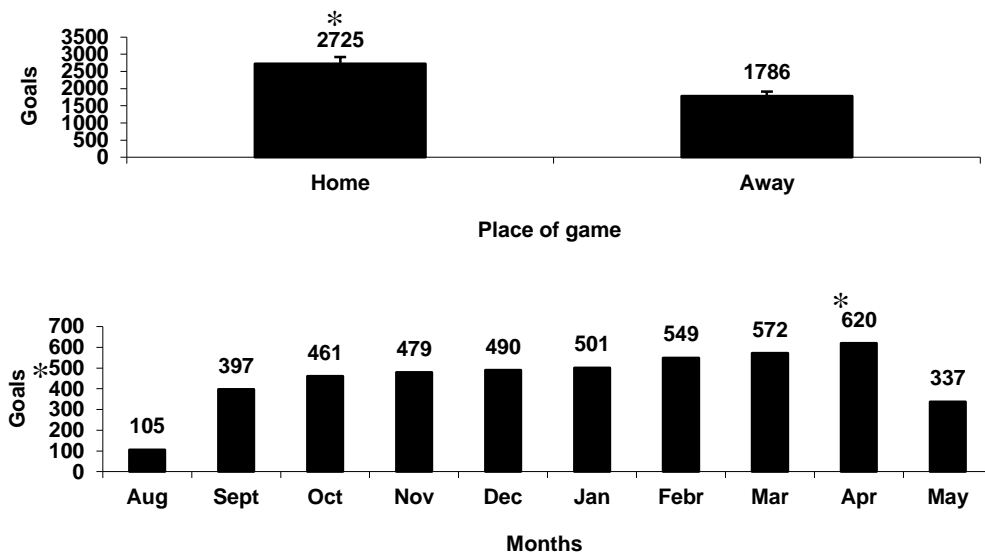


Figure 5. Goal Scoring Values for the Place of Game (Upper Graph) and for Each Month (Lower Graph) (\* = significantly different at  $P < 0.05$ ).

### Discussion

The study examined the goal scoring characteristics of the Greek National Soccer League. The main findings were that goal scoring is time and technique dependent. Moreover, significantly more goals were scored in home games and an increase in goal scoring was found during the last months of the season.

The goals scored in the second half of the present study were 11% higher compared with the goals scored in the first half. This finding is in agreement with previous studies [3,6]. It seems that the efforts by both teams increase in the second half in order to win the game. Ekblom [5] suggested that the “chase” for a result is more characteristic during the second half and especially during the last minutes of a game. However, the increase in the offensive efforts could lead to a defense imbalance and, therefore, permitting to the opponent team to take advantage of this imbalance for goal scoring.

The peak in scored goals was found during the last 15 minutes of the game. This corresponds to the 76<sup>th</sup> to 90<sup>th</sup> minute period. Similar results were reported for World Cup matches [6,8,11] and other National League matches [3,5]. One may suggest that fatigue is responsible for the above observation, as a reduction in physical condition is observed during the last stages of the match. Previous studies reported decreased sprint abilities and distance covered as a consequence of fatigue [12,13]. Therefore, a team with higher levels of physical condition has more chances to succeed a goal.

During the last minutes of the game, all players tend to increase the intensity of their efforts. This involves a higher number of players attacking to the opponent area. On the contrary, the increased number of attackers could affect the defense balance of both teams [5], thus leading to increased goal scoring opportunities for both teams. A worth noting observation is that

approximately 6.5% of the goals were scored at extra time of each half (Figure 1). Ekblom [5] attributed this finding to mental fatigue of the players, which could lead to lack of concentration. Therefore, the trainer's tactic instructions could not be followed, thus leading to increased mistakes, particularly from the defenders.

The kicking skill proved as the most efficient technique for goal scoring as approximately the 2/3 of the goals were score by kicking. This finding is in agreement to previous studies [6], underlying the importance of the kicking skill and the necessity for further study on the characteristics of this skill. During the last minutes of the game, more kicks were performed (Figure 4). Although research studies found that the kicking ability is affected by fatigue which observed during the last minutes [14,15], the increased number of kicks in relation to goalkeeper's fatigue could lead to a higher frequency of goals.

The second most frequent scoring technique was the header (18.5%) [6]. Similarly, increased frequency of goals scored by headers was found during the last minutes of the game. Frequently, time pressure together with the need for a better result leads players to perform long passes inside the opponent area. This leads to more efforts with the head as it is the most efficient part of the body for scoring, when such a strategy is followed. These findings indicate to coaches and trainers the importance for specific training programs to improve this skill [16].

An interesting finding of the present study was the higher frequency of scored goals in home games compared with the away games. Approximately 21% more goals were scored at home games, which confirms the importance of home advantage. The existence of supporters and the crowd noise seems to play a significant role in the psychology of the home team players and the result of the game. Nevill et al [17] suggested that crowd noise significantly affected not only the home team players, but also the referees' decisions in favor of the home team. Similarly, home teams are awarded more penalties and receive fewer bookings than away teams [18].

The soccer season lasts ten months with fewer games conducted in August and May, thus leading to a lower number of scored goals during these two months. The results of the present study indicated an increase in the frequency of goal scoring across the tenth month period (August to May) with a peak of scored goals observed during the last months of the season. During the last months of a competitive season most teams battle for the championship or to win a ticket for the European Cups or to avoid regulation. It is, therefore, reasonable to increase their effort during the final games of a season. To achieve this, however, the physical performance of soccer players should maintain or improved in higher levels towards this period [19]. The periodization, therefore, of soccer teams seems to be planned in a way that soccer players are capable to reach their best performance during the last games of a season.

### **Practical Implications**

The study examined the goal scoring patterns of the Greek National Soccer League (Super League). Soccer games in the Greek National League are conducted under hot and humid conditions and the League differs in quality and it is also less competitive compared with other leagues. However, similar results were reported for other National [3,5] and World Leagues [6,11] indicating that there is a common goal scoring pattern. Suggestions, therefore, for better performance could be applicable to the majority of the soccer teams and coaches could have similar lines for the aim of the training sessions according to goal scoring patterns. Particularly, coaches and trainers could schedule training programs focusing in sustaining players to a high level of performance during the 90+ minutes of a game. Moreover, the periodization of teams should aim to keep soccer players in best conditioning performance exactly when needed, especially during the last games of the season.

## Conclusion

The results have shown that the frequency of goals scored over the course of a match and the technique which used for scoring these goals are time dependent. The last minutes of a game seem to be crucial for scoring a goal. Home team players appear to score more goals compared with away team players. These results could be proved useful tools for coaches in planning appropriate training sessions and giving special attention during specific game periods.

## References

- [1] Ekblom, B., Applied Physiology of Soccer, *Sports Medicine*, 1986, 3, 50-60.
- [2] Rahnama, N., Reilly, T. and Lees, A., Injury Risk Associated with Playing Actions During Competitive Soccer, *British Journal of Sports Medicine*, 2002, 36, 354-359.
- [3] Abt, G., Dickson, G. and Mummery, W.K., Goal Scoring Patterns Over the Course of a Match: An Analysis of the Australian National Soccer League, in Sprinks, T., Reilly, T. and Murphy, A., eds., *Science and Football IV*, Routledge, London and New York, 2002, 106-111.
- [4] Jinshan, X., The Analysis of the Techniques, Tactics and the Scoring Situations of the 13<sup>th</sup> World Cup, *Sandong Sports Science and Technique*, 1986, 4, 87-91.
- [5] Ekblom, B. *Football (Soccer)*. Oxford: Blackwell Scientific, 1994.
- [6] Jinshan, X., Xiaoke, C., Yamanaka, K. and Matsumoto, M., Analysis of the Goals in the 14<sup>th</sup> World Cup, in: Reilly, T., Clarys, J. and Stibbe, A., eds., *Science and Football II*, E & FN Spon, London, 1993, 203-205.
- [7] Garganta, J., Maia, J. and Basto, F., Analysis of Goal-Scoring Patterns in European Top Level Soccer Teams, in: Reilly, T., Bangsbo, J. and Hughes, M., eds., *Science and Football III*, E & FN Spon, London, 1997, 246-250.
- [8] Njororai, W., Analysis of the Goals Scored at the 17<sup>th</sup> World Cup Soccer Tournament in South Korea-Japan 2002, *African Journal for Physical, Health Education, Recreation and Dance*, 2004, 10, 326-332.
- [9] Pollard, R. and Pollard, G., Long-Term Trends in Home Advantage in Professional Team Sports in North America and England (1876-2003), *Journal of Sports Sciences*, 2005, 23, 337-350.
- [10] Pollard, R., Home Advantage in Soccer: a Retrospective Analysis, *Journal of Sports Sciences*, 1986, 4, 237-248.
- [11] Armatas, V., Yiannakos, A. and Sileloglou, P., Relationship Between Time and Goal Scoring in Soccer Games: Analysis of Three World Cups, *International Journal of Performance Analysis in Sport*, 2007, 7, 48-58.
- [12] Bangsbo, J. and Lindquist, F., Comparison of Various Exercise Tests with Endurance Performance During Soccer in Professional Players, *International Journal of Sports Medicine*, 1992, 13, 125-132.
- [13] Kollath, E. and Quade, K., Measurement of Sprinting Speed of Professional and Amateur Soccer Players, in: Reilly, T., Clarys, J. and Stibbe, A., eds., *Science and Football II*, E & FN Spon, London, 1993, 31-36.
- [14] Apriantono, T., Nunome, H., Ikegami, Y. and Sano, S., The Effect of Muscle Fatigue on Instep Kicking Kinetics and Kinematics in Association Football, *Journal of Sports Sciences*, 2006, 24, 951-960.
- [15] Kellis, E., Katis, A. and Vrabas, I., Effects of an Intermittent Exercise Fatigue Protocol on Biomechanics of Soccer Kick Performance, *Scandinavian Journal of Medicine and Science in Sports*, 2006, 16, 334-344.
- [16] Erkmen, N., Evaluating the Heading in Professional Soccer Players by Playing Positions, *Journal of Strength and Conditioning Research*, 2009, 23, 1723-1728.
- [17] Nevill, A.M., Balmer, N.J. and Williams, A.M., The Influence of Crowd Noise and Experience Upon Refereeing Decisions in Football, *Psychology of Sport and Exercise*, 2002, 3, 261-272.



[18] Nevill, A.M., Newell, S. and Gale, S., Factors Associated With Home Advantage in English and Scottish Soccer, *Journal of Sports Sciences*, 1996, 14, 181-186.

[19] Silvestre, R., et al., Body Composition and Physical Performance During a National Collegiate Athletic Association Division I Men's Soccer Season, *Journal of Strength and Conditioning Research*, 2006, 9, 962-970.