Relationship between reaction time agility and linear speed of amateur male soccer players

Süleyman ŞAHİN [a], Yahya YILDIRIM [b,*], Duygu YILDIRIM [b]

[a] Uludağ Universitiy, Faculty of Sport Sciences, Bursa, Turkey
[b] Bursa Technical University, Department of Common Courses, Bursa, Turkey
*Corresponding author email: yahya.yildirim@btu.edu.tr

Abstract: This study aims to investigate the relationship between linear speed, agility and reaction time in amateur football players. Totally 15 male amateur soccer players with an average age of 20.00 ± 1.309 (years), average height 1.78 ± 0.058 (m), bodyweight average 70.05 ± 6.300 (kg) and body mass index average 22.18 ± 1.525 (kg / m2) voluntarily participated in the research. All participants completed a test battery involving linear sprinting (10, 20, 30 m), agility test (T test) and reaction time test. Fitlight TrainerTM device was used in all experiments. Pearson correlation analysis was performed to determine the relationship between linear speed, agility and reaction time. As a result of the investigation, statistically significant positive relationships were found between the reaction time and 10 m and 20 m linear speed, between agility and 20 m and 30 m linear speed, between 10 m and 20 m linear speed and between 20 m and 30 m linear speed ($p < 0.05$). As a result, according to this study, it can be said that features such as linear speed, agility and reaction time are related to each other in amateur soccer players.

Suleyman SAHIN is an associate professor in the Faculty of Sport Sciences at Bursa Uludag University since 2018. He worked as a Youth and Sports Manager in the Bursa province of Turkey for about six years. He has been serving as the Deputy General Manager of Investment and Enterprises, Ministry of Youth and Sports since 2019. He has many scientific studies in the fields of Sport Management, Sport Sociology and Training.

Yahya YILDIRIM is a lecturer in the Department of Common Courses at Bursa Technical University since 2017. He worked as a physical education teacher between 2010-2016. Research interest includes Movement and Training, Skill Learning and Assessment of Physical Fitness. He has taught courses for a Bachelor's degree: Wrestling, Chess, Tennis and Volleyball. He is current a PdD student at the Marmara University Faculty of Sport Sciences.

Duygu YILDIRIM is a PhD. Candidate in the area of physical education and sport at The Mugla Sitki Kocman University. Her research interests are sport and exercise physiology, obesity, physical fitness and health-related quality of life. She has been working at Bursa Technical University as a Lecturer since 2018. Also, she is handling teaching courses on Trekking, Turkish Folk Dances, Popularization of Sports Culture, Healthy Living and Exercise

1. Introduction

Football is a sport that is played on a field and within the framework. It has specific rules and requires and needs excellent technical and tactical skills [1]. When the ball reaches the goal, the team gets the score, which allows the winner and the defeated team to be determined, and the ball is played using all parts of her/his body except hand [2]. Football can be called the most common and most popular among sports in the world [3]. It is among the most preferred sports branches in a professional sense [2]. Today, the physiological needs of football players have changed dramatically compared to previous years. Recently, footballers have become athletes running longer distances, exhibiting more explosive movements, and competing at higher intensities than ever before [4]. Athletes must have some motor skills that give them an advantage for an excellent performance. These skills can be listed as strength, endurance, flexibility, balance and agility and can be improved through training. They work in collaboration with each other for aerobic and anaerobic systems that affect performance in both teams and individual sports [5]. Football and other field sports include numerous dynamic movements, including acceleration, deceleration and direction change while running [6]. The motor skills that provide these progressive movements are linear speed, agility and reaction time.

Linear speed is the ability to move fast on a ground, or quickly catch and throw using limbs. Linear speed depends not only on how fast a person can run or ride a bike, swim, but also accelerate, reach maximum movement speed and maintain it [7]. The ability to quickly and efficiently change all body movements in response to a stimulus is known as agility [6]. Agility is influenced by body balance, coordination, the position of the center of gravity, running speed and skill, and can be improved through training.

It can also be enhanced by studying the specific fitness features of linear speed, balance, strength and coordination [7].

The reaction time can be defined as the time between giving a person a stimulus and the first reaction of the person to that stimulus [9]. The reaction time counted as the determinants of performance in today's football and it can be associated with the ability to make decisions and react quickly while playing against time and opponent in limited space [2, 8]. Reaction time is affected by factors such as sensory organs, the intensity of incoming stimulation, environment and motivation.

The most appropriate contraction of the muscles can be associated with the reaction time. The athlete needs a certain period to achieve the necessary decrease after the warning for his preparation. If this time is short or long, it will affect the reaction time quality of the athlete [9].

It is thought that the characteristics of athletes such as linear speed, agility and reaction time are affected by each other. It is also thought that the studies to be carried out by examining these features will contribute to the planning of the training to increase the performance of the athletes. The aim of our study is to investigate the relationship between linear speed, agility and reaction time in amateur football players.

2 Methods

2.1 Subjects: 15 male amateur soccer players with the average age of 20.00 ± 1.309 (years), average height 1.78 ± 0.058 (m), bodyweight average 70.05 ± 6.300 (kg) and BMI average 22.18 ± 1.525 (kg / m2) voluntarily participated in the study. It was noted that the athletes included in the study did not interrupt training for the past 6 months due to disability or for any reason. Subjects were informed before the examination and approval forms were taken.

2.2 Body Weight and Height Measurement: The body weights of the participants were measured with light clothes and bare feet, with a digital scale (Omron) with a sensitivity of 0.1 kg, their body height was measured with a 0.1 cm precision stadiometer (Holtain) [10].

2.3 T Agility Test: To test the agility, T-Test was applied as created by Semenick [11]. The four cones were placed in the T shape, as shown in figure 1 and subjects were asked to touch the A-B-C-D-B-A cones by hand, respectively. In this test, the subject always looks in the same direction and performs the change of direction by sliding left and right or running backward. Time was measured with a Fitlight TrainerTM device sensitive to 0.01 s. The time starts automatically between the two photocell lights placed in the form of a door to the start funnel, while the time is stopped

and recorded in the second pass. The subjects repeated the test 2 times after the sufficient rest interval and the best score was used in the study.
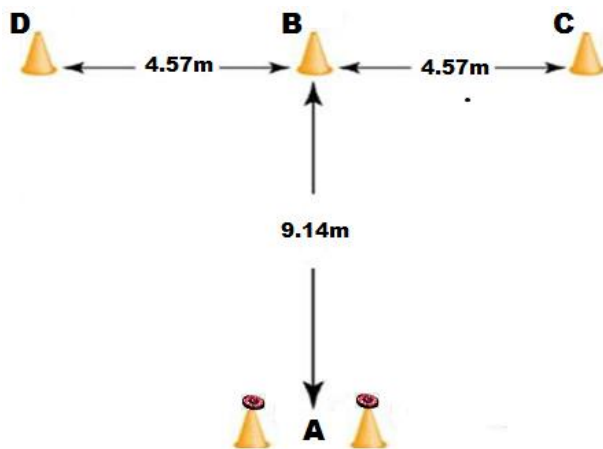

Figure 1. T agility test

2.4 Linear Speed Test: Fitlight TrainerTM device was used for linear speed measurement. 4 lights were placed at the starting point, 10th, 20th and 30th meters (Figure 2). The subjects ran 30 cm behind the starting line and ran for 30 m at maximum speed. After an adequate rest interval, the test was repeated twice and the best score was used in the study.
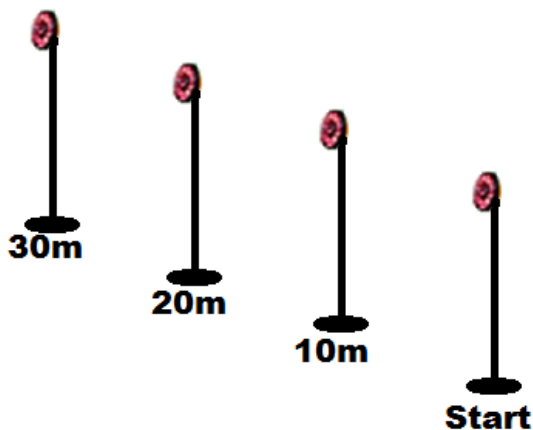

Figure 2. Linear speed test

2.5 Reaction Time Test: Four Fitlight lights were fixed to the ground at 1 m intervals, as shown in figure 3. The subject waited to stand at the mid-point of the lights, and extinguished it with the desired foot, to the randomly lit lights, 10 times in red, at intervals of 1 second. The lights were set to remain on for 3 seconds and 1 second after turning off so that the next light was turned on. The lights were adjusted to detect the foot up to 5 cm away. The average of the elapsed time until each light went out after recording was recorded. The subjects repeated the test 2 times after the

sufficient rest interval and the best score was used in the study [12].

2.6 Statistical Analysis: SPSS 24 package program was used to analyze the data. Average and standard deviation values were given as descriptive statistics. Pearson correlation analysis was performed to determine the relationship between linear speed, agility and reaction time. For the level of significance in the interpretation of statistical processes, $p < 0.05$ was accepted.

3 Results and Discussion

In table 1, the average and standard deviations of the results obtained from the physical properties of the participants, reaction time, agility and linear speed tests are given.

Pearson correlation test results showing the relationship between reaction time, agility and linear speed performances of soccer players are given in table 2. A statistically significant positive correlation was found between reaction time and 10 m linear speed ($r = .847$; $p < 0.05$) and 20 m linear speed ($r = .616$; $p < 0.05$).

A statistically significant positive correlation was found between reaction time and 10 m linear speed ($r = .847$; $p < 0.05$) and 20 m linear speed ($r = .616$; $p < 0.05$). A statistically significant positive correlation was found between agility and linear speed of 20 m ($r = .671$; $p < 0.05$) and linear speed of 30 m ($r = .774$; $p < 0.05$). A statistically significant positive correlation was found between 10 m linear speed and 20 m linear speed ($r = .640$; $p < 0.05$). A statistically significant positive correlation was found between 20 m linear speed and 30 m linear speed ($r = .729$; $p < 0.05$).

In this study, it was aimed to investigate the relationship between reaction time, agility and linear speed in amateur soccer players. Football is the most popular sport in the world, according to the International Football Federation (FIFA), 4% of the world's population is actively involved in football as a player or referee [13]. The physical and physiological characteristics of the players must be high for success in football [14]. Many physical tests have been applied in clubs and academic studies over the years to evaluate the physical performance of football players. Agility performance is an essential component in the physiological evaluation of soccer players [15,16].

Figure 3. Reaction time test

Table 1. Physical characteristics and test results of the subjects.

	Mean	Std. Deviation
BH (m)	1.78	0.058
BW (kg)	70.05	6.300
BMI (kg/m2)	22.18	1.525
Age (years)	20.00	1.309
10 m (sec)	1.78	0.079
20 m (sec)	3.19	0.070
30 m (sec)	4.27	0.079
Reaction time (sec)	0.50	0.048
Agility (sec)	10.61	0.544

(BH: Body height; BW: Body weight; BMI: Body mass index)

Table 2. The relationship between reaction time agility and linear speed of subjects.

		Reaction time	10 m	20 m	30 m
10 m	r	.847*			
	p	.000			
20 m	r	.616*	.640*		
	p	.014	.010		
30 m	r	.284	.328	.729*	
	p	.305	.233	.002	
Agility	r	.216	.143	.671*	.774*
	p	.439	.612	.006	.001

*. Correlation is significant: $p < 0.05$

Agility is a feature that allows footballers to change direction quickly, as well as reducing the risk of injury [17]. Data from the reaction, speed, and agility tests must be used together to provide a general indication of a player's ability to sprint and change direction quickly [15].

In the presented study, it is seen that as the reaction time of the subjects decreases, 10 m and 20 m linear speed running times decrease statistically significantly. This result indicates that the reaction time is useful in sprint runs with a shorter distance of 10 m and 20 m, but loses this effect as the range gets longer. In a study in the literature, there was no significant relationship between 30 m speed and reaction time, but 10 m and 20 m speed tests were not performed [18]. This study partially supports our study in terms of the relationship between 30 m speed run and reaction time. There are many studies in the literature showing that there is no significant relationship between speed and reaction time [19, 20].

In the study, as the agility time of the subjects decreased, the linear speed of 20 m and 30 m decreased statistically significantly. In comparison, there was no significant relationship between 10 m and agility. In a study, it was found that there was no meaningful relationship between shorter distance sprints and agility, while there was a meaningful relationship between 40 m speed and agility performance [21]. In another study, it was stated that agility test results were more related to longer distance (27.4 m and 36.6 m) speed tests rather than short distance (9.1 m, 18.3 m) speed tests [22]. These studies in the literature are largely similar to our study. In another study, it was stated that speed and agility are separate physical qualities and that straight speed training does not improve agility performance, which includes changes in direction [23]. In contrast, another study with soccer players stated that agility performance is an important component of physiological assessment in football, and the results from these evaluations should be used in conjunction with data from single sprints to provide a general indication of a player's ability to quickly sprint and change direction [15]. Although some studies have stated that they believe that there is a really strong relationship between flat sprint speed and direction change speed, no research evidence supporting this view has been found [24]. Acceleration, deceleration and change of direction are essential components of field sports, it seems advantageous to investigate the relationship between these features [21].

In the study, there was a statistically significant positive relationship between 10 and 20 m linear speed and between 20 m and 30 m linear speed. In comparison, no significant association was found between 10 m and 30 m linear speed. In a study with amateur footballers, the relationship between the linear speed at 9.1 m, 18.3 m, 27.4 m and 36.6 m distances was examined and it was found that all of them were statistically significantly positive [22]. In another study conducted with basketball players, it was stated that all the 5 m, 10 m and 20 m speed runs were positively correlated with each other [25]. Similarly, another study indicated that there was a positive relationship between 10 m, 20 m and 30 m speed times [26]. In another study, a positive correlation was reported between 10 m and 20 m sprint tests in a group of professional male football players [27]. All these studies support our present research.

4. Conclusion

As a result, in our study, it was observed that features such as linear speed, agility and reaction time were related to each other. It is known that sudden moves requiring short sprints, changes of direction and rapid reactions are frequently encountered in the game of football. Therefore, it is thought that the tests performed in this study are the harbinger of the footballers' performance and that such tests should be applied frequently. Soccer players typically start their movements during the match while they are already moving (running or walking). In this study, all tests were applied to subjects in the static starting position. This is an important limitation of our study. For this reason, it is thought that it will be beneficial to use both static and dynamic initials in the tests.

References

[1] İrge Şener, Ahmet Anıl Karapolatgil, Rules of the Game: Strategy in Football Industry, Procedia - Social and Behavioral Sciences, 207 (2015) 10-19.
https://doi.org/10.1016/j.sbspro.2015.10.143

[2] K. Göral, Ö. Saygın, G.B. İrez, Profesyonel futbolcuların oynadıkları mevkilere göre görsel ve işitsel reaksiyon sürelerinin incelenmesi, *Selçuk* University Journal of Physical Education and Sport Science, 14 (2012) 5-11.

[3] B. Marancı, S. Müniroğlu, Futbol kalecileri ile diğer mevkilerde bulunan oyuncuların motorik özellikleri, reaksiyon zamanları ve vücut yağ yüzdelerinin karşılaştırılması, Gazi Beden Eğitimi ve Spor Bilimleri Dergisi, 6 (2001) 13-26.

[4] K.D. Dodd, T.J. Newans, Talent identification for soccer: Physiological aspects, Journal of Science and Medicine in Sport, 21 (2018) 1073-1078. https://doi.org/10.1016/j.jsams.2018.01.009

[5] T. Atan, P. Akyol, Reaction times of different branch athletes and correlation between reaction time parameters, Procedia - Social and Behavioral Sciences, 116 (2014) 2886-2889. https://doi.org/10.1016/j.sbspro.2014.01.674

[6] J. Matláka, L. Ráczb, J. Tihanyi, Assessment of repeated reactive agility performance in amateur soccer playersÉvaluation des prestations de joueurs de football non-professionnels dans les courses d'agilité réactive, Science & Sports, 32 (2017) 235-238. https://doi.org/10.1016/j.scispo.2017.06.001

[7] Vladimir Zatsiorsky, Biomechanics in Sport: Performance Enhancement and Injury Prevention, Wiley-Blackwell, 2008. https://doi.org/10.1002/9780470693797

[8] O. İmamoğlu, E. Kılcıgil, Türkiye'deki minik futbolcularda reaksiyon zamanı, vital kapasite değerleri ve laterizasyon dağılımında solaklık sorunu, Spormetre Beden Eğitimi ve Spor Bilimleri Dergisi, 5 (2007) 95-100.

[9] M. Günay, K. Tamer, İ. Cicioğlu, Spor Fizyolojisi ve Performans Ölçümü, Ankara: Gazi Kitapevi, 2013: 467.

[10] B. Sanz, H. Arrieta, G. Hervas, C. Rezola-Pardo, F. Ruiz-Litago, M. Iturburu, S.M. Gil, A. Rodriguez-Larrad, J. Irazusta, Serum adiponectin is associated with body composition and cognitive and psychological status in older adults living in long-term nursing homes, Experimental Gerontology, 121 (2019) 1–9. https://doi.org/10.1016/j.exger.2019.03.005

[11] D. Semenick, Tests and Measurements: The T-test, Strength & Conditioning Journal, 12 (1990)36-37.

[12] T. Zwierko, B. Florkiewicz, S. Fogtman, A.K. Krzyzanowska, The ability to maintain attention during visuomotor task performance in handball players and non-athletes, Central European Journal of Sport Sciences and Medicine, 7 (2014) 99-106.

[13] T. Haugen, S. Seiler, Physical and physiological testing of soccer players: why, what and how should we measure? Sportscience, 19 (2015) 10-26.

[14] P.S. Bradley, C. Carling, A. Gomez Diaz, P. Hood, C. Barnes, J. Ade, M. Boddy, P. Krustrup, M. Mohr, Match performance and physical capacity of players in the top three competitive standards of English professional soccer, Human Movement Science, 32 (2013) 808-821. https://doi.org/10.1016/j.humov.2013.06.002

[15] M. Svensson, B. Drust, Testing soccer players. Journal of Sports Sciences, 23 (2005) 601-618. https://doi.org/10.1080/02640410400021294

[16] F.S. Çınarlı, A.Ş. Kafkas, M.E. Kafkas, Relationship between linear running and change of direction performances of male soccer players, Turkish Journal of Sport and Exercise, 20 (2018) 93-99. https://doi.org/10.15314/tsed.418840

[17] M. Jovanovic, G. Sporis, D. Omrcen, F. Fiorentini, Effects of speed, agility, quickness training method on power performance in elite soccer players, The Journal of Strength & Conditioning Research, 25 (2011) 1285-1292. https://doi.org/10.1519/JSC.0b013e3181d67c65

[18] A. Moradi, E.S. Damirchi, M. Narimani, S. Esmaeilzadeh, I. Dziembowska, L.B. Azevedo, W.L. Prado, Association between physical and motor fitness with cognition in children, Medicina, 55 (2019). https://doi.org/10.3390/medicina55010007

[19] Moradi A, Esmaeilzadeh S. Association between reaction time, speed and agility in schoolboys, Sport Sci Health, 11 (2015) 251-256. https://doi.org/10.1007/s11332-015-0230-4

[20] O. Şenel, H. Eroğlu, Correlation between reaction time and speed in elite soccer players, Journal of Exercise Science and Fitnesss, 4 (2006) 126-130.

[21] S. Jarvis, L.O. Sullivan, B. Davies, H. Wiltshire, J.S. Baker, Interrelationships between measured running intensities and agility performance in subelite rugby union players, Research in Sports Medicine, 17 (2009) 217-230. https://doi.org/10.1080/15438620903323892

[22] J.D. Vescovi, M.R. McGuigan, Relationships between sprinting, agility, and jump ability in female athletes, Journal of Sports Sciences, 26 (2008) 97-107. https://doi.org/10.1080/02640410701348644

[23] W.B. Young, M.H. McDowell, B.J. Scarlett, Specificity of sprint and agility training methods, Journal of Strength and Conditioning Research, 15 (2001) 315-319.

[24] J.M. Sheppard, W.B. Young, Agility literature review: Classifications, training and testing, Journal of Sports Science, 24 (2006) 919-932. https://doi.org/10.1080/02640410500457109

[25] A. Scanlan, B. Humphries, P.S. Tucker, V. Dalbo, The influence of physical and cognitive factors on reactive agility performance in men basketball players, Journal of Sports Sciences, 32 (2014) 367-374. https://doi.org/10.1080/02640414.2013.825730

[26] T. Gabbett, J. Kelly, J. Sheppard, Speed, change of direction speed, and reactive agility of rugby league players, The Journal of Strength and Conditioning Research, 22 (2008) 174-181. https://doi.org/10.1519/JSC.0b013e31815ef700

[27] T. Little, A.G. Williams, Specificity of acceleration, maximum speed, and agility in professional soccer players, Journal of Strength and Conditioning Research, 19 (2005) 76-78. https://doi.org/10.1519/14253.1

Conflict of interest

None of the authors have any conflicts of interest to declare.