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Investigation of some physical characteristics of young elite soccer players in different age groups

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ABSTRACT

The aim of the research is to investigate the physical characteristics of young elite soccer players who play soccer in different age groups. 60 young elite soccer players who play soccer in the U13, U14, U15 and U16 categories of MKE Ankaragücü Soccer Club voluntarily participated in the research. After determining the age, height, weight and body mass index of the soccer players, five different measurements were applied: sprint performance at 10-20-30 meters distance, vertical jump and change of direction performances. SPSS package program was used to analyze the data. The measurement values were compared with the ANOVA test according to the age categories of the athletes and with the Kruskal Wallis test for the 10-meter sprint data. A statistically significant difference was found in all parameters between the groups ($p < 0.05$). As a result of the study, it is observed that the physical development of young athletes develops with age, and the sprint, vertical jump and change of direction characteristics develop along with it. It is thought that the training methods prepared by considering the developmental periods can contribute to the development of young individuals who are interested in sports.

Keywords: Soccer, young soccer player, sprint, change of direction, physical features.

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INTRODUCTION

It is known that soccer players need advanced technical, tactical, mental and conditional skills in order to show maximum performance. Soccer is an aerobic-based anaerobic sport in which physical parameters have a direct effect on performance, in which short and long-distance running at variable intensities, sudden changes of direction and tackles take place (Dolci et al. 2018; Köklü, 2008; Stølen et al., 2005). During 90 minutes of a soccer match, athletes perform many movements that require effort such as sprinting, changing direction, and positive and negative acceleration at different times (Bangsbo et al., 2006). The requirements in soccer are constantly changing and developing. Knowing the structure of soccer by coaches and determining the training method within this knowledge and developing it with different methods have become very important today (Gamble, 2007; Taylor, 2004). There are many factors affecting the players such as field conditions, talent, game rules, communication and position during training and competition in soccer (Reilly, 1996). The fact that the players are faster than their opponents, their jumping performance is better, they are stronger than their opponents, and their endurance level is better during the competition will both contribute to their success in performance and be effective in protecting them from injuries. Especially in young soccer players, it is important to develop physical skills as well as technical-tactical skills and gain them at an early age. Today, for the formation of the element of success in soccer, first of all, players who are prone to soccer must be brought into soccer and their physical performance must be developed. The responses of young soccer players to training, especially those with different growth stages, are that their conditional characteristics will be affected by

training as well as growth and development (Açıkada, 2004; Borms, 1986; Koşar and Demirel, 2004). It is thought that it is important to examine the young athletes who are the future athletes and their performance changes and differences in different age categories. In this context, this study aims to investigate some physical characteristics of young soccer players in different age groups.

METHODOLOGY

15 elite soccer players from each category and a total of 60 young elite soccer players in the U13, U14, U15 and U16 age categories in the youth setup of the MKE Ankaragücü club voluntarily participated in the study.

Measurements of all categories were made on different days, and anthropometric, height and body weights were recorded, respectively. The measurements were started with the U13 team and the U14, U15 and U16 teams were taken respectively. The collection of all data was completed in 16 days. Sprint, vertical jump and change of direction measurements, which are physical performance tests, were taken on different days in all categories, and the athletes were measured after a 10-minute warm-up run and then dynamic warm-up movements. Adequate rest periods were given between the tests, allowing the athletes to recover.

Anthropometric and physical performance measurements

The ages of the participants were determined based on the birth dates on their birth certificates. Height was measured with a Holtaine (England) brand stadiometer by keeping them standing upright with bare feet. Body weight was measured with the Jawon Segmental Body Composition Anilator (Made in Korea) with bare feet and sports clothing.

Implementation of the sprint test: A standard 10-minute dynamic warm-up protocol was applied to the athletes before starting the test (Atan, 2019).
10-20 and 30-meter sprint measurements were made. The athlete started the test with the mark on the starting line one meter behind the starting photocell. Measurements were made with a photocell placed at the 10th, 20th and 30th meters of the 40-meter running distance. The athletes were given a full rest interval and the measurements were made twice, and the best degree was recorded in seconds/milliseconds.

Implementation of vertical jump test: My jump2 is an application that calculates the vertical jump height after determining the time the athletes stay in the air during jumping using the notation method with the smart tablet application. With this application, the moment when the toes of the participants leave the force platform and re-deploy during the jump is determined manually and the flight time in the jump is calculated (Balsalobre-Fernándeza et al., 2015). Countermovement jump hands-free (CMJ) measurements were taken from the athletes with this application. Participants made three technically correct jumps. The CMJ is performed with the arms free and assesses the explosive strength of the lower extremity. Each test was repeated three times and the best-obtained degree was used (Glatthorn et al., 2014).

Shuttle Sprint Test was used in the implementation of the change of direction test. Photocell (Microgate brand) was used to obtain the data. With this test, speeding and acceleration degrees were measured at short distances (5, 6, 9 and 10 m) with rapid changes in direction. The test consists of four sprints and three 180-degree turns (Huijgen et al., 2013; Lemmink et al., 2004). The test was carried out with a photocell placed at the start and finish lines. When the athletes were ready one meter behind the starting line, the test was started, the athletes were given full rest time and the test was carried out twice, the best degree was recorded in seconds/milliseconds.

Analysis of data

SPSS package program was used to analyze the data. Skewness and kurtosis values were calculated in order to determine the conformity of the obtained data to the normal distribution. The values of kurtosis and skewness of the data between +3 and -3 are considered sufficient for normal distribution (Groeneveld and Meeden, 1984; Moors, 1986; Hopkins and Weeks, 1990; De Carlo, 1997). According to the obtained skewness and kurtosis values, shuttle sprint (without ball), height, weight, BMI, 20 m, 30 m and explosive power distribution are in accordance with the normal distribution. For this reason, parametric methods were preferred in the analyses carried out. However, non-parametric methods were used because the 10 m data did not conform to the normal distribution. The measurement values were compared with the ANOVA test according to the groups of the athletes and with the Kruskal Wallis test for the 10 meters data. According to the results of the correlation test of the data obtained from the athletes, 0-0.19 means very weak, 0.20-0.49 weak, 0.50-0.69 medium, 0.70-0.89 strong, 0.90-1.00 very strong correlation (Schmidt and Osebold, 2017; Raithel, 2008). Pearson Correlation test was used for shuttle sprint (without ball), height, weight, BMI, 20 m, 30 m and explosive power data, which were found to have normal distribution, and Spearman test was used

for 10 m data that did not show normal distribution.

RESULTS

As shown in Table 1, skewness and kurtosis values were calculated to determine the conformity of the obtained data to the normal distribution. The values of kurtosis and skewness of the data between +3 and -3 are considered sufficient for normal distribution (Groeneveld and Meeden, 1984; Moors, 1986; Hopkins and Weeks, 1990; De Carlo, 1997). According to the obtained skewness and kurtosis values, shuttle sprint (without ball), height, weight, BMI, 20 m, 30 m and explosive power distribution are in accordance with the normal distribution. For this reason, parametric methods were preferred in the analyses carried out. On the other hand, non-parametric methods were used since the 10 m data did not conform to the normal distribution.

Table 2 shows the comparison of the measurement values with the ANOVA test according to the groups of the athletes and with the Kruskal Wallis test for the 10 m data. According to the results of the analysis, a statistically significant difference was found between the groups in terms of Shuttle Sprint (Without Ball) data ($p < 0.05$). According to this, the Shuttle Sprint (Without Ball) values of the U16 group are the highest and the U13 group is the lowest.

A statistically significant difference was found between the groups in terms of height data ($p < 0.05$). Accordingly, the height values of the U13 group are the lowest.

A statistically significant difference was found between the groups in terms of weight data ($p < 0.05$). Accordingly, the weight data of those in the U13 group were significantly lower than those in the U15 and U16 groups.

A statistically significant difference was found between the groups in terms of 10meter sprint data ($p < 0.05$). Accordingly, the 10-meter sprint data of the athletes in the U13 group is the lowest.

Table 1. Descriptive statistics.

	Avg.	Sd.	Min.	Max.	Skewness	Kurtosis
Shuttle Sprint (Without Ball) (Minute, Second)	8.51	0.45	7.72	9.90	0.521	0.246
Height (cm)	166.68	10.43	140.00	185.00	-0.598	0.097
Weight (kg)	51.75	7.05	35.50	65.00	-0.607	0.224
BMI	18.65	1.72	14.80	23.60	0.342	0.988
10m	1.91	0.19	1.61	2.89	2.561	11.499
20m	3.43	0.46	2.73	4.90	1.075	0.816
30m	4.74	0.53	3.92	5.90	0.679	-0.428
Explosive Power (Cmj Hands Free)	30.30	7.85	17.50	49.00	0.032	-0.896

Table 2. Comparison of groups according to measurement data.

	U13		U14		U15		U16		F	p
	Avg.	Sd.	Avg.	Sd.	Avg.	Sd.	Avg.	Sd.		
Shuttle sprint (Without Ball) (Min, sec)	8.99	0.38	8.63	0.26	8.43	0.29	8.00	0.13	47.557	0.000*
Height (cm)	156.67	11.24	168.07	9.15	169.80	7.16	172.20	6.68	6.941	0.001*
Weight (kg)	46.19	9.23	51.49	6.23	54.35	4.17	54.96	4.06	4.325	0.012*
BMI	18.89	2.09	18.27	2.16	18.87	1.23	18.56	1.28	0.427	0.734
10 m**	2.03	0.12	1.89	0.11	1.96	0.28	1.76	0.08	29.182	0.000*
20 m	4.09	0.32	3.29	0.23	3.29	0.18	3.04	0.14	44.712	0.000*
30 m	5.46	0.34	4.73	0.24	4.60	0.31	4.18	0.15	63.361	0.000*
Explosive Power (Cmj Hands Free)	32.74	5.55	32.74	5.55	20.03	2.06	35.67	6.12	58.580	0.000*

**Kruskal Wallis.

A statistically significant difference was found between the groups in terms of 20 meters sprint data ($p < 0.05$). Accordingly, while the 20-meter sprint data of the athletes in the U16 group is the highest, the ones in the U13 group are the lowest.

A statistically significant difference was found between

the groups in terms of 30 meters sprint data ($p < 0.05$). Accordingly, while the 30-meter sprint data of the athletes in the U16 group is the highest, the ones in the U13 group are the lowest.

A statistically significant difference was found between the groups in terms of Explosive Power (Cmj Hands-Free) data ($p < 0.05$). Accordingly, the athletes in the U16 group have the highest Explosive Power (Cmj Hands Free) data.

Table 3 shows the results of the correlation test of the data obtained from the athletes. According to the correlation test, 0-0.19 means very weak, 0.20-0.49 weak, 0.50-0.69 moderate, 0.70-0.89 strong, 0.90-1.00 very strong correlation (Schmidt and Osebold, 2017; Raithel, 2008). Pearson Correlation test was used for shuttle sprint (without ball), height, weight, BMI, 20 meters, 30 meters and explosive power data, which were found to have normal distribution, and Spearman test was used for 10 meters data that did not show normal distribution.

Table 3. Correlation test.

		Shuttle sprint (without ball) (min, sec)	10 m	20 m	30 m	Explosive power (Cmj hands free)
Height (cm)	r	-0.406	-0.260	-0.543	-0.522	-0.112
	p	0.001*	0.045*	0.000*	0.000*	0.394
Weight (kg)	r	-0.365	-0.234	-0.428	-0.401	-0.169
	p	0.004*	0.072	0.001*	0.001*	0.196
BMI	r	-0.009	0.026	0.111	0.132	-0.120
	p	0.944	0.843	0.397	0.315	0.361
10m	r	0.551		0.752	0.764	-0.069
	p	0.000*		0.000*	0.000*	0.602
20m	r	0.649			0.894	0.065
	p	0.000*			0.000*	0.620
30m	r	0.671				0.055
	p	0.000*				0.674
Explosive power (Cmj hands free)	r	-0.062				
	p	0.637				

According to the results of the analysis, there is a moderate positive correlation between Shuttle Sprint (Without Ball) data and data of 10 meters ($r = 0.551$), 20 meters ($r = 0.649$) and 30 meters ($r = 0.671$) ($p < 0.05$).

There is a strong positive correlation between the 10-meter data and the 20-meter ($r = 0.752$) and 30 meter ($r = 0.764$) data ($p < 0.05$).

There is a strong positive correlation between the 20-meter data and the 30-meter data ($r = 0.894$) ($p < 0.05$).

DISCUSSION

A total of 60 young elite soccer players, 15 from each group, playing in the U13, U14, U15 and U16 age categories within the body of MKE Ankaragücü Soccer Academy, participated in this research named "Investigation of Some Physical Characteristics of Young Elite Soccer Players in Different Age Groups". The body mass indexes of the soccer players in question were calculated by measuring their height (cm) and body weights (kg). Then, 60 soccer players' 10-20-30 meter sprint times, vertical jumps (Counter Movement Jump Hands Free), and the shuttle sprint parameters, in which the ability to change direction without the ball is measured were measured and recorded.

Looking at the results of the analysis, the average height, body weight and body mass indexes of 15 athletes in the U13 age category in our study are 156.67 cm, 46.19 kg and 18.89, respectively. The average

height, body weight and body mass indexes of 15 athletes in the U14 age category are 168.07 cm, 51.49 kg and 18.27, respectively. The average height, body weight and body mass indexes of 15 athletes in the U15 age category are 169.80 cm, 54.35 kg and 18.87, respectively. The average height, body weight and body mass indexes of 15 athletes in the U16 age category are 172.20 cm, 54.96 kg and 18.56, respectively.

The World Health Organization (WHO, 2007) stated that the average height of children at the age of 12 is 152.19 cm, the average height of children at the age of 13 is 159.37 cm, and the average height of children at the age of 14 is 165.98 cm. In this context, when the data of the World Health Organization on children at the mentioned ages are compared with the height data of the young elite athletes who make up our study, it is seen that the average height of the young elite soccer players is higher. It is known that active children who engage in sports activities, especially during their adolescence, develop faster than those who do not, and their height grows in this direction (İbiş et al., 2004). The reason for this difference is thought to be an active lifestyle by engaging in sports.

Kamiloğlu, in his study with 629 children aged between 4-13 and engaged in sports, stated that the average body weight of 12-year-old children was 47.16 kg and the average body weight of 13-year-old children was 52.66 (Kamiloğlu, 2013). In our study, the average body weight of the 12-year-old elite athletes was 46.19, and the average body weight of the 13-year-old elite athletes was 51.49. In this context, it can be said that body weights between age groups are close to each other.

The World Health Organization defines a body mass index value as 25 and above as overweight, and 30 and above as obesity risk in adults (WHO, 1998). However, the data in question varies for children. In their study, Cole et al. reported the limit of classification as obese as a result of BMI for boys as 26.02, 26.84, 27.63 and 28.30 for 12-13-14 and 15-year-old boys, respectively. (Cole et al., 2000).BMI in the mentioned age groups of our study was 18.89, 18.27, 18.87 and 18.56, respectively. The average of 60 athletes engaged in active sports is below the obesity limit.

When the sprint results of the study are examined, it is seen that the average sprint times of 10, 20 and 30 meters, respectively, of the 15 athletes in the U13 age category were 2.03, 4.09 and 5.46 seconds; the average sprint times of 10, 20 and 30 meters, respectively, of the 15 athletes in the U14 age category were 1.89, 3.29, 4.73 seconds; the average sprint times of 10, 20 and 30 meters, respectively, of the 15 athletes in the U15 age category were 1.96, 3.29 and 4.60 seconds; the average sprint times of 10, 20 and 30 meters, respectively, of the 15 athletes in the U16 age category were 1.76, 3.04 and 4.18 seconds.

When the literature is examined in terms of the sprint performance of young soccer players, it is seen that there are approximate values similar to the results of the groups in our study. Şahin (2017), in his research titled "Physical performance and body composition norm study of children aged 7-14 in Turkey", the 10 m, 20 m and 30 m degrees of the 13-year-old soccer players reached the results of 2.01, 3.54 and 5.04, respectively, while the 10 m, 20 m and 30 m degrees of the 14-year-old soccer players reached the results of 1.9, 3.33 and 4.73 seconds, respectively. Diker and Müniroğlu (2015) determined the 10 m and 20 m sprint degrees of 13-year-old soccer players as 1.9 and 3.4 seconds, respectively. In another study, Saygın et al. (2011), found the 30-meter sprint time of 12-year-old soccer players as 5.6 seconds. Kaplan et al. (2016) found sprint times of 10 m, 20 m, and 30 m as 2.24, 3.95 and 5.47 seconds, respectively in his study he investigated the effects of physical characteristics of 9-13 age group soccer players on vertical jump, acceleration and speed performance. In another study on the sprint times of young soccer players, Toktaş and Gökhan (2012) found the 30 m sprint values of soccer players to be 4.45 seconds. In another study, Köklü et al. (2009), reported 10 m sprint times of young soccer players as 1.70 and 30 m sprint times as 4.10 seconds. Again, Polat (2003), as a result of their examination of 15-year-old soccer players, reached the result of 30 m sprint values of 4.84 seconds. Eyuboğlu and Aslan (2016) determined 10 m sprint times as 1.84 and 30 m sprint times as 4.50 in his study on young soccer players. In his research, Güler (2016) found the 30-meter sprint time of young soccer players to be 5.68 seconds. Seyhan (2019) reached the result of 10 m and 30 m sprint times as 1.65 and 4.16 seconds, respectively in the research on the 23 soccer players of Akhisarspor's soccer team playing in the U16 league. In another study, the 30m sprint values of elite soccer players with an average age of 16.40 years and non-elite soccer players with an average age of 16.40 were determined as 4.31 and 4.46 seconds, respectively (Reilly et al., 2000).

Considering the results of the vertical jump performance, which is another parameter determined by the athletes in our study; it is seen that the countermovement jump hands-free averages of 15 athletes in the U13-U14-U15 and U16 age categories are 32.74, 32.74, 20.03 and 35.67 cm, respectively. When the body of literature is examined, Kumartaşli et al. (2014) found the vertical jump variables to be 21.4 cm on average in their study with young soccer players between the ages of 10-12. Pienaar and Viljoen (2010) found the vertical jump average of 14-year-old boys to be 29.4 cm in the study they conducted with boys aged 10 to 15 (n = 604) living in South Africa. Kaplan et al. (2016) determined the vertical jump values of 24.0 cm in the study, he conducted with soccer players in the 9-13 age

group. Polat (2003) found the vertical jump of the soccer players to be 47.78 cm as a result of the study they carried out with 37 soccer players in the 15 age group. Eyuboğlu and Aslan (2016) found the vertical jump values as 53.0 cm in the research he conducted on the U15 category soccer players. In another study, Güler (2016) found the average vertical jump value to be 27.01 cm in his study on the 10-16 age group. Seyhan (2019) found the vertical jump performance to be 38.9 cm in the research he conducted on soccer players competing in the U16 league. It is thought that the differences in the studies in the literature are due to the individual differences and the positional differences of the athletes participating in the measurements. As a matter of fact, the vertical jump performances of young athletes participating in the study in the U14 age category were found to be higher than the U15 team.

Considering the results of the shuttle sprint, which is the last parameter in our study, it is seen that the average of the shuttle sprint test results of 15 athletes in the U13-U14-U15 and U16 age categories are 8.99, 8.63, 8.43 and 8.00 seconds, respectively. Zago et al. (2016) examined the effect of 22-week technical training in their study on young soccer players aged 12 years on average. It was determined that the control group was 8.31 seconds and the experimental group 8.26 seconds in the post-tests at the end of the research. Huijgen et al. (2013) determined shuttle sprint scores of 12, 13, 14, 15, 16, 17, 18, and 19-year-olds were 8.69, 8.48, 8.42, 8.27, 8.08, 8.03, 8.01 and 8.02, respectively in their study on young soccer players aged 12-19. Similar periods are noteworthy between our study and previous studies. There is a similarity between the results of the ability to change direction without the ball obtained as a result of our study and the results of Huijgen et al. (2013) study.

Conclusion

When the results of this study are examined, it can be a guide in the training planning of the trainers and in determining the performance levels, strengths and weaknesses of the athletes. In addition, it can be said that the differences in the performance parameters between the soccer player groups in the U13, U14, U15 and U16 categories can be important in terms of development. According to the results obtained in this research, it is seen that the physical performance of soccer players increases with the increase in the age categories they play, and there is a parallel increase as a performance parameter. There are studies in the literature that show that training age increases physical performance along with age (Diker and Müniroğlu, 2016). In the meantime, it is thought that planned training programs will be effective in terms of development and performance.

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