FACTA UNIVERSITATIS
Series: **Physical Education and Sport** Vol. 15, N° 2, 2017, pp. 295 - 307
https://doi.org/10.22190/FUPES1702295S

Original research article

INVESTIGATION OF PHYSICAL FITNESS LEVELS OF SOCCER PLAYERS ACCORDING TO POSITION AND AGE VARIABLES

UDC 796.332.015

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Abstract. *One hundred fifty-two soccer players participated in this study playing in A, A2 and youth teams between the ages of 14-20 (mean age 17.48 ±2.89 yrs). Measured variables of height, weight, body mass index, body fat percentage, flexibility, speed, agility, anaerobic power, anaerobic capacity, aerobic capacity were compared among the groups of playing positions which is defined as goalkeepers, defenders, midfielders and strikers and among age groups separated as ≤ 16 and ≥17 ages. The differences among positions analyzed with the One Way ANOVA test and pairwise comparisons between groups using the Bonferroni test. Age groups were compared with the independent samples t-test. Goalkeepers' weight and height were higher than strikers and body fat percentages were higher than all other positions. In ≥17, goalkeepers 30m sprint time is slower than all other groups. The maximal oxygen uptakes of midfielders were higher than strikers. Flexibility, agility, anaerobic power, anaerobic capacity, recovery values were not significantly different among positions. For all these variables ≥17 had higher and better performance values than ≤16. There are no determinant performance differences among the positions except for goalkeepers. It may be profitable to evaluate goalkeepers independently from other positions. It can be said that motor and physical differences are considered to be more evaluable in more distinct periods starting with age 17 and onwards. It may be an accurate approach for deciding the players' positions and guiding them accordingly after that age level.*

Key words: *Soccer, fitness, playing position, age, aerobic, anaerobic condition.*

Received February 17, 2016/ Accepted November 9, 2017
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INTRODUCTION

Soccer is a sport played actively by over 240 million players besides having spectators whose number reaches billions. When analyzed statistically, the game of soccer has gone through numerous changes over the years. This change caused by popularity and the competitive environments has made soccer a sport which requires more strength, power, endurance, speed, aggressiveness and talent. In turn, this has created the need to increase the performances of soccer players and determine in particular the physiological profiles of soccer players. It has been proven through scientific research that factors such as aerobic and anaerobic efforts, speed, agility, endurance and balance affect the performance dramatically (Weineck, 2007) and it is considered that only when the training depends on the physiological basics which affect these factors does the performance of the players increase.

There are four positions which are accepted as a basis. These have been classified as goalkeepers, defenders, midfielders and strikers. As it is normal for one player to play in more than one position, it is known that certain positions carry unique player characteristics. However, in today's modern soccer, the strategy defined as *total football*, the players' distribution on the field leads these basic positions to be separated into different characteristics and positions in themselves (Urartu, 1994). For instance, in a team that uses three players as a defense line, the defensive and offensive duties of wing-midfield players increase and this causes players with higher aerobic endurance to be preferred for that position. Or a player who plays as a single striker needs to have higher ball hiding and struggling skills to be able to carry his team players forward and that means that a strong player with a higher level of technical skills and game knowledge and certain anthropometric characteristics would be more suitable for that position. For instance, taller players are playing in positions where this advantage is made use of (goal-keeper, stopper, forward). Ninety-five soccer players who played at the Copa America, it was seen that even the goal-keepers and stoppers, who were the younger players of the tournament, were taller than the other players (Reilly, Williams, Nevill, & Franks, 2000). On the other hand, the analysis of over 300 soccer players at the 20 Spain La Liga and the 10 Champions League matches in terms of the relationship between their running speed and running distance, significant changes can be seen among positions. While between 0-19 km, the players who run the most are midfielders and strikers; defense and wing players run more distance in higher intensity runs (Di Salvo et al., 2007). The physiological needs among the positions change for that reason. While the endurance characteristics of midfielders are in the foreground, anaerobic skills can create greater advantages for strikers.

In this study, the differences among positions, age groups and positions in each age group were analyzed. We attempted to present the differences which emerged in the anthropometric and field measurements between the ages and playing positions. It is considered that the study will be helpful in the planning of soccer exercises and selection of players.

METHODS

Participants

A total of 152 players playing in the Turkish Super League and Turkish First League A, A2 and youth teams participated in the study. The mean age of the players was 17.48 ±2.89 yrs. The players were classified as goalkeepers (n=15), defense players (n=52), midfielders (n=60) and strikers (n=25). According to their age groups, they were analyzed in two groups as ≤ 16 (n=65) and ≥17 (n=87). For their *anthropometric* comparisons, height, weight and body fat percentage averages were taken (Zorba, 2004). Heart rates were determined with Polar S610i watches while resting, during and after the shuttle-run test. Six different field *performance* tests such as *flexibility* were determined with the sit and reach (Chillón et al., 2010), *agility* with the t-agility (Sheppard & Young, 2006), *speed and acceleration* with the 10m, 30m dash tests (Arslanoğlu, Sever, Arslanoğlu, Şenel, & Yaman, 2013), *anaerobic strength* with the vertical jump (Ostojić, Stojanović, & Ahmetović, 2010), *anaerobic capacity* with running-based anaerobic sprint test - RAST (Aziz, Mukherjee, Chia, & Teh, 2008) and *aerobic capacity* with the 20m shuttle-run tests (Ramsbottom, Brewer, & Williams, 1988). All players and their parents and coaches were fully informed and gave their consent in writing. The measurements were performed according to the ethical standards of the Helsinki Declaration.

Data analysis

The distributions according to groups were analyzed and the normality and homogeneity of the variances were evaluated. The differences among the positions were tested with the One-Way Analysis of Variance (One Way ANOVA) and the paired comparisons for a group with significant differences were done with the Bonferroni test. The age groups were compared with the independent samples t-test, with the level of significance set at $p<0.05$.

RESULTS

Comparison of Anthropometric Measurements

Table 1 compares the players' height, weight, BMI (body mass index) and BFP (body fat percentage) values among playing positions and age groups. With the exception of BMI, it was statistically proven that the other variables are different among the positions. Height and weight of the goalkeepers are significantly higher than midfielders and strikers and the BFP is significantly higher than in all the other positions. There are differences between the age groups for all variables. Height, weight, BMI and BFP values are higher in ≥17. When the difference among the positions is analyzed according to the age groups, only the goalkeepers' height was found to be higher than the midfielders within ≤16, whereas it was determined that all variables displayed a difference in ≥17. According to this, the goalkeepers are taller, heavier and have higher body fat percentage compared to all the other groups. In same age group, they have higher BMI compared to other positions with the exception of defense players.

Table 1 Comparison of anthropometric measurements according to playing positions and age groups

		N	Mean	Std.Dev.	F	p
Height (cm)	Goalkeeper[a]	15	178.6	6.76		
	Defender[a,b]	52	172.5	8.90		
	Midfielder[b]	60	168.9	9.67	**5.143***	**0.002**
	Striker[b]	25	169.8	9.22		
	All	152	171.3	9.46		
	<= 16	65	165.30	9.61	**-7.57***	**0.000**
	>= 17	87	175.73	6.43		
Weight (kg)	Goalkeeper[a]	15	71.5	11.87		
	Defender[a,b]	52	63.2	12.52		
	Midfielder[b]	60	59.7	12.21	**3.943***	**0.010**
	Striker[b]	25	61.2	11.21		
	All	152	62.3	12.48		
	<= 16	65	52.58	10.42	**-10.93***	**0.000**
	>= 17	87	69.65	8.16		
BMI	Goalkeeper	15	22.3	2.61		
	Defender	52	21.0	2.74		
	Midfielder	60	20.7	2.62	1.481	0.222
	Striker	25	21.1	2.21		
	All	152	21.0	2.62		
	<= 16	65	19.06	2.28	**-10.15***	**0.000**
	>= 17	87	22.50	1.74		
BFP (%)	Goalkeeper[a]	15	12.6	3.09		
	Defender[b]	52	10.4	2.57		
	Midfielder[b]	60	10.5	2.53	**3.047***	**0.031**
	Striker[b]	25	10.2	3.00		
	All	152	10.6	2.74		
	<=16	65	9.9	2.98	**-7.57***	**0.000**
	>=17	87	11.1	2.44		

a>b, *=Significant at the 0.05 level, BMI: Body mass index, BFP: Body fat percentage.

Comparison of Flexibility, Speed and Agility

As seen in Table 2, players' flexibility, the 10m, 30m dash and agility test scores do not display any differences among the positions. Flexibility, speed and agility abilities are more developed in ≥17. When flexibility, the 10m, 30m dash and agility tests are compared separately for each age groups among the positions, although the goalkeepers are slower in speed and agility tests, the only difference determined statistically slower was the 30m dash of goalkeepers in ≥17.

Table 2 Comparison of agility, flexibility, 10m-30m sprint scores among playing positions and age groups

		N	Mean	Std.Dev.	**F - t**	**p**
Flexibility (cm)	Goalkeeper	15	25.533	7.492		
	Defender	52	25.692	6.881		
	Midfielder	60	25.000	6.465	1.328	0.268
	Striker	25	22.560	6.049		
	All	152	24.888	6.672		
	<= 16	65	21.415	5.265	**-6.196***	**0.000**
	>= 17	87	27.483	6.450		
10 m (s)	Goalkeeper	15	1.725	0.134		
	Defender	52	1.694	0.161		
	Midfielder	60	1.671	0.170	0.544	0.653
	Striker	25	1.705	0.189		
	All	152	1.690	0.166		
	<= 16	65	1.798	0.125	**8.389***	**0.000**
	>= 17	87	1.609	0.146		
30 m (s)	Goalkeeper	15	4.439	0.262		
	Defender	52	4.286	0.331		
	Midfielder	60	4.311	0.347	0.804	0.494
	Striker	25	4.327	0.383		
	All	152	4.318	0.340		
	<= 16	65	4.552	0.313	**8.801***	**0.000**
	>= 17	87	4.142	0.240		
T-Agility (s)	Goalkeeper	15	10.955	0.826		
	Defender	52	10.849	0.855		
	Midfielder	60	10.889	0.845	0.169	0.917
	Striker	25	10.778	0.812		
	All	152	10.864	0.835		
	<= 16	65	11.462	0.809	**9.131***	**0.000**
	>= 17	87	10.417	0.513		

*=Significant at the 0.05 level

Comparison of Anaerobic Power and Anaerobic Capacity

There is no difference in the anaerobic power and anaerobic capacity among the positions (Table 3). A significant difference was determined in all the variables for age groups. The anaerobic power, vertical jump and fatigue index values are higher in the ≥17. RAST (6 x 35m) average sprint time was longer in the ≤16. When the anaerobic power and anaerobic capacity among the positions were compared for age groups, no difference was found among the positions with the exception of the mean RAST time of the ≥17. In ≥17 group the goalkeepers completed the RAST for a longer duration compared to the defense and midfield players.

Table 3 Comparison of anaerobic power and capacity among playing positions and age groups

		N	Mean	Std.Dev.	F - t	p
Vertical Jump (cm)	Goalkeeper	15	46.067	6.552		
	Defender	52	46.000	7.187		
	Midfielder	60	44.283	7.499	0.957	0.415
	Striker	25	43.560	7.142		
	All	152	44.928	7.246		
	<= 16	65	40.308	7.434	**-8.127***	**0.000**
	>= 17	87	48.379	7.134		
AnaerobicPower (kg·m/s)	Goalkeeper	15	120.414	19.018		
	Defender	52	114.852	18.105		
	Midfielder	60	109.107	19.013	1.902	0.132
	Striker	25	113.174	16.368		
	All	152	112.857	18.459		
	<= 16	65	100.236	18.105	**-9.019***	**0.000**
	>= 17	87	122.286	17.368		
RAST Max. Power (W)	Goalkeeper	15	711.444	244.580		
	Defender	52	668.224	232.795		
	Midfielder	60	627.019	255.394	0.755	0.521
	Striker	25	617.865	213.750		
	All	152	647.941	239.715		
	<= 16	65	465.458	245.334	**-10.775***	**0.000**
	>= 17	87	784.279	223.730		
RAST Min. Power (W)	Goalkeeper	15	371.664	136.198		
	Defender	52	388.575	129.888		
	Midfielder	60	368.708	142.629	0.388	0.762
	Striker	25	355.611	126.056		
	All	152	373.642	134.287		
	<= 16	65	275.634	132.624	**-10.013***	**0.000**
	>= 17	87	446.867	126.153		
RAST Avarage Time (s)	Goalkeeper	15	5.644	0.395		
	Defender	52	5.447	0.379		
	Midfielder	60	5.475	0.461	0.992	0.399
	Striker	25	5.551	0.490		
	All	152	5.494	0.433		
	<= 16	65	5.768	0.492	**7.532***	**0.000**
	>= 17	87	5.290	0.385		
RAST Avarage Power (W)	Goalkeeper	15	532.745	177.289		
	Defender	52	515.415	172.126		
	Midfielder	60	493.183	192.867	0.444	0.722
	Striker	25	477.610	162.739		
	All	152	502.132	178.744		
	<= 16	65	363.301	188.867	**-11.161***	**0.000**
	>= 17	87	605.856	173.744		
Fatigue Index (%)	Goalkeeper	15	10.250	4.771		
	Defender	52	8.921	4.692		
	Midfielder	60	8.321	5.606	0.744	0.528
	Striker	25	8.136	3.866		
	All	152	8.686	4.957		
	<= 16	65	5.877	5.306	**-6.911***	**0.000**
	>= 17	87	10.785	4.836		

*=Significant at the 0.05 level

Comparison of Aerobic Capacity and Recovery

One significant difference was determined in the Max VO2. It is the per minute oxygen consumption of the midfield players which is statistically higher compared to the forward players as seen in Table 4. With the exception of the Final HR value, all of the other values are statistically different between the age groups. While the MaxVO2 and HR difference is higher in ≥17, Resting HR and after 3min HR is higher in ≤16. When the age groups are separated, a statistical difference was not observed for aerobic capacity and resting values among all positions.

Table 4 Comparison of aerobic power and HR measurements among playing positions and age groups

		N	Mean	Std. Dev.	F	p
MaxVO2 (ml/kg/min)	Goalkeeper	15	44.049[a.b]	7.689		
	Defender	52	46.362[a.b]	5.708		
	Midfielder	60	47.484[a]	5.534	3.036*	0.031
	Striker	25	43.888[b]	5.123		
	All	152	46.170	5.885		
	<= 16	65	43.584	5.694	**-5.048***	**0.000**
	>= 17	87	48.101	5.277		
Resting HR (bpm)	Goalkeeper	15	71.13	9.471		
	Defender	52	72.02	9.432		
	Midfielder	60	72.88	9.226	0.217	0.884
	Striker	25	73.00	8.016		
	All	152	72.43	9.066		
	<= 16	65	75.169	8.228	**3.320***	**0.000**
	>= 17	87	70.391	9.168		
Final HR (bpm)	Goalkeeper	15	192.067	11.973		
	Defender	52	192.865	15.268		
	Midfielder	60	195.983	15.341	2.046	0.110
	Striker	25	201.240	14.928		
	All	152	195.395	15.116		
	<= 16	65	194.631	16.202	-0.557	0.592
	>= 17	87	195.966	14.320		
After 3min HR (bpm)	Goalkeeper	15	128.867	22.029		
	Defender	52	132.135	18.454		
	Midfielder	60	131.100	15.469	0.280	0.840
	Striker	25	133.720	16.285		
	All	152	131.664	17.243		
	<= 16	65	137.231	12.579	**3.782***	**0.000**
	>= 17	87	127.506	19.063		
HR Diff. (bpm)	Goalkeeper	15	63.200	21.697		
	Defender	52	60.731	20.684		
	Midfielder	60	64.883	20.531	0.697	0.555
	Striker	25	67.520	21.587		
	All	152	63.730	20.808		
	<= 16	65	57.400	18.311	**-3.350***	**0.001**
	>= 17	87	68.460	21.395		

a>b, *Significant at the 0.05 level, HR: Hearth rate, BPM: Beat per minute

DISCUSSION

Anthropometry

In terms of physical characteristics and body composition, it can be seen that there is a specific soccer player body shape and composition. According to this, the height is 180 cm and a mesomorph somatotype with body fat percentage of 7-12% (Arnason et al., 2004; Reilly, Bangsbo, & Franks, 2000; Strudwick, Reilly, & Doran, 2002). In this study, the reason why all players' height (171.27 ± 9.46) and weight (62.35 ± 12.48) averages are low can be explained with their low mean age (17.48 ± 2.89). However, the players' BFP (10.6 ± 2.74) and BMI (21.0 ± 2.62) values display a similar feature to the other studies. When all the players are considered, while the goalkeepers' height and weight are statistically higher than that of forward players, the BMI values do not differ among the positions. When the BFP averages are analyzed, once again the goalkeepers have a higher average compared to the players in all of the other positions. When the same analysis is done separately in ≤16 and ≥17 age groups, it is seen that the difference is due mostly to the ≥17. It is seen clearly that this difference among the positions increases with age. It has been shown in other similar studies as clearly that goalkeepers have higher height, weight and BFP values in comparison to the other positions (Davis, Brewer, & Atkin, 1992; Revan, 2003; Rogan, Hilfiker, Clarys, Clijsen, & Taeymans, 2011). Soccer players who participated in the 2002 and 2006 world cups display differences among the positions. In terms of weight and height, goalkeepers have higher values compared to all groups, defense players have higher values compared to midfield and forward players. Goalkeepers have higher values compared to all the groups in terms of BMI (Wong, Chamari, Dellal, & Wisløff, 2009). In yet another study, the goalkeepers were found to have higher height and weight averages and more monomorphic characteristic compared to other positions (Rogan et al., 2011). This feature may be the reason why BFP differences do not appear in some studies (Karavelioğlu, 2008) and that difference may be due to height, weight and muscle mass percentage which is greater among goalkeepers.

Flexibility

The flexibility test mean of the players who participated in the study was measured with the sit and reach test as 24.88 ± 6.67cm. It did not display differences among the positions. This is valid for both age groups. However, the flexibility of ≥17 (27.48 ± 6.45) is statistically higher than ≤16. In one study, a systematic difference between the flexibility of the soccer players of different ages, skill levels (Rösch et al., 2000) and different positions (Karavelioğlu, 2008) was been observed. Although these results were obtained in the sit and reach test, in some more extensive flexibility studies, it has been shown that the flexibility characteristics of goalkeepers are better than those of other players (Oberg, Ekstrand, Möller, & Gillquist, 1984; Rösch et al., 2000).

Agility

The scores of the players' agility tests were generally close to each other and a statistical difference was not observed among positions. Similarly, a difference was not determined among the positions within the age groups. However, while the mean time of the ≤16 was 11.46, the mean time of ≥17 was faster, 10.41. As it has been shown in other studies as well, this result indicates that anaerobic performance develops with age (Bale, Mayhew, Piper, Ball, & Willman, 1992). In a study which followed the development of

soccer players from the age of 12 to the age of 19, the players' slalom sprint and dribbling performances increase with age (Huijgen, Elferink-Gemser, Post, & Visscher, 2010). The reason for no difference being found among positions has been explained in Taka's thesis as agility being a special skill which cannot be developed enough through training (Taka, 2012). This is open to debate.

Speed

The players' 10m acceleration and 30m sprints gave very close results based on positions. However, for the 30m sprints among positions in ≥17, it was seen that the goalkeepers are slower compared to the other positions. In addition, the 10m – 30m scores of ≥17 are statistically lower than the ≤16. Speed development with age has been shown in another study as well (Huijgen et al., 2010). In fact, this increase is higher than the increase of the slalom (agility) ability. Thus, it might be said that speed develops more evidently compared to agility (Huijgen et al., 2010). Goalkeepers having lower speed compared to the players in other positions has been shown in some other studies as well (Karavelioğlu, 2008; Sporis, Jukic, Ostojic, & Milanovic, 2009). Forward players constitute the fastest group, although this does not display a statistical significance.

Anaerobic Power

The players' anaerobic power was measured with the vertical jump test. Although the jumping distances (cm) and the calculated anaerobic power (kg·m/s) seem higher in goalkeepers and defense players, this did not create a difference among the positions. This is valid for both of the age groups. When the comparison between the age groups is analyzed, it was expected that the anaerobic power and jumping distance of the ≥17 is statistically higher. Since the jumping ability has quick response and tackle features, it may be considered that the anaerobic power of defense players and goalkeepers being higher is normal. However, the weight parameter used in the calculation of anaerobic power should be considered an important aspect for the produced power to be high. Similar results can be seen in other studies. Reilly states that in particular goalkeepers and defense players reach high values in terms of anaerobic power (Reilly, 1979). The anaerobic power of the national youth team's players consisting of 16 player age groups increases linearly with age (le Gall, Carling, Williams, & Reilly, 2010). While there is no difference among positions in some studies (Huijgen et al., 2010), it is seen that in some other studies goalkeepers (Doğan, 1995) and defense players (Güllü & Abdullah, 1996) have a higher jumping skill.

Anaerobic Capacity

The anaerobic capacity of the players who participated in the study was measured with the RAST test. With this test, which consisted of 6x35 meters and 10 seconds of rest between each pace, the players' highest and lowest power values and fatigue indexes were calculated through the difference between these values. There is no difference for all positions for Highest Power, Lowest Power, Average Time, Average Power and Fatigue Percentage. When the average time was analyzed, although the goalkeepers ran slowly, they have the highest value in the maximum power parameter. This is due to the inclusion of the body weight of the goal-keepers in the formula used. It was seen that the RAST average running time of the ≥17 goalkeepers was slower compared to all the other positions. However, this difference did not cause a difference among the positions in the same group's RAST Average Power variable. No difference being found among the

groups in terms of anaerobic capacity may be due to the fact that the players follow similar training programs. However, when the Fatigue Index Values were analyzed, it can be stated that even they are not statistically significant, the goalkeepers' capacity to maintain their initial running time is lower compared to the other players.

The ≥17 age group has better values in the RAST Max. Power, Min. Power, Average Time, Average Power variables. However, it was seen that the Fatigue Index in ≤16 are lower and that this age group maintains starting velocity better. It is considered that this is due to the maximal power produced in this age group being low and maintaining this power compared to the higher age groups being easier. Because, the repetitive sprint skill develops with age and thus the times decrease (Dellal & Wong, 2013). The results also show that the Fatigue Index of players with high Maximal Power is high as well. When the correlation between Maximal Power and Fatigue Index is analyzed, a high positive correlation (r=0.882) verifies this evaluation. This aspect makes the evaluation of the players using the RAST test difficult and indicates that the Fatigue Index by itself should not be important data. The results of the best time, average time, lowest time and fatigue index of 85 players from different amateur teams have been compared among the positions through the repetitive sprint test developed by Bangsbo, significance has not been found and it has been stated that the players were able to maintain the same pace up to the 5^{th} sprint (Kaplan, 2010). In some studies, the forward players (Aziz et al., 2008; Taoutaou, Bounekar, Arafa, & Baz, 2007) and in some others defense players have produced higher power (Soltani, Attarzadeh Hosseini, Farahnia, & Hojati, 2012). Similar to this study, these studies also show that the goalkeepers in the anaerobic capacity values have slower repetitive sprint times compared to other positions (Özdemir, Yılmaz, & Kinişler, 2014).

Aerobic Capacity and 3-minute Recovery HR

The O_2 consumption of the goalkeepers, defense, midfield and forward players were: 44.049, 46.362, 47.484, 43.888, 46.170 ml/kg/min respectively. $MaxVO_2$ values of the midfield players are statistically higher than the forward players. When the players were separated according to their age groups, it was seen that while the midfield players still have high aerobic capacity, this difference does not display a statistical significance. The $MaxVO_2$ of ≤16 is 43.584 ± 5.694 and ≥17 is 48.101 ± 5.277 ml/kg/min. O_2 consumption capacity shows a direct increase within these age groups. The increase in the maximum oxygen consumption and the endurance capacity is both related to growth and exercise level (Weineck, 2007). However, this increase is due to the difference in the relative oxygen consumption of adolescents and adults resulting from the calculations about running speed and the covered distance. In fact, the direct measurement results show that the relative oxygen consumption does not change with age in the developmental period (Daniels, Oldridge, Nagle, & White, 1978). For instance, in a study conducted in the USA on 1478 males aged 12-18, it has been determined that there is a small amount of increase in the maximal oxygen consumption values per kilogram between the ages 12-15 and fixed level in the later ages (Eisenmann, Laurson, & Welk, 2011). When other studies are analyzed, it is seen that the oxygen consumption of midfield soccer players is more developed compared to the players in the other positions. The reason is considered to be midfield players having to do both defensive and offensive runs and as stated above, having to cover more distance compared to the players in the other positions. It has been stated in many studies that, the maximum oxygen consumption of elite soccer players is around 56 to 69 ml. min/kg (Reilly & Williams,

2003). In the study carried out with 152 soccer players with an age average of 24.4, it has been determined that the MaxVO2 value of midfield players was 61.4 ± 3.4 ml.min./kg and emphasized that they have a more developed aerobic capacity compared to defense players (Davis et al., 1992).

While the maximum HR of the groups are not different at the end of running, their values measured on Resting and After 3min were determined to be statistically higher in ≤16. Accordingly, the HR difference (Final HR-After 3min HR) in ≥17 is higher than ≤16. Although the Final and After 3 min HR change is different in the age groups, Resting HR value being higher in the ≤16 might mean that the groups' difference rates are close to each other and there is no difference between the recovery skills of the age groups. These values did not display a statistical difference in the comparison analyses of the positions in which all of the players were included and separated according to their ages. In a study, the HRs of the players as a result of the Yo-yo interval running test has been determined respectively for goalkeepers, defense, midfield and forward players as 179.3 ± 8.5, 186.0 ± 6.5, 185.0 ± 11.0, 188.4 ± 7.53 and their recovery time in the same order has been determined as 3.89 ± 0.5 3.49 ± 0.5 3.44 ± 0.6 3.38 ± 0.6 minutes. As it can be seen, the recovery time of the goalkeepers has taken a longer time compared to the players in other positions (Cihan, Can, & Seyis, 2012). The closeness and the indifference among the positions in the recovery values presented in the study can be attributed to the closeness in the aerobic capacity of the players with the exception of one relationship (the midfield players have a higher MaxVO2 compared to the forward players). Because it is known that there is a positive relationship between aerobic capacity and recovery time (Cihan et al., 2012; Tomlin & Wenger, 2001).

CONCLUSION

When all the data are considered, it is seen that there are no extremely significant performance differences among the positions. It can be considered that the arising differences are usually due to the goalkeepers and that it may be beneficial to evaluate goalkeepers separately. Similar training programs being applied to all the players for long years may explain the similarity of the performance adaptations of the players. However, in terms of the playing positions other than the goalkeepers, for soccer players it may not be an accurate approach to decide on the positions and guide them accordingly by considering their physical and motor characteristics especially from an early age. For this study, it can be said that motor and physical differences are considered to be more evaluable in more distinct periods starting from the age of 17 and onwards.

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ISTRAŽIVANJE NIVOA FIZIČKE SPREMNOSTI NA PRIMERU FUDBALERA U ODNOSU NA VARIJABLE STARTNE POZICIJE U TIMU I GODINA STAROSTI

U ovoj studiji učestvovalo je pedeset i dva fudbalera koji igraju u A, A2 i omladinskim timovima, starosti između 14-20 godina (srednji uzrast 17,48 ± 2,89 godina). Izmerene varijable visine, težine, indeksa telesne mase, procenta telesne masti, fleksibilnosti, brzine, agilnosti, anaerobne moći, anaerobnog kapaciteta, aerobnog kapaciteta, upoređivane su na osnovu grupa određenih pozicijom igrača u timu: golmani, igrači odbrane, vezni igrači i igrači na poziciji napadača. Starosne grupe određene su kao ≤16 i ≥17 godina. Razlike među pozicijama analizirane su pomoću One-way ANOVA testa i upoređivanjem grupa upotrebom Bonferonijevog testa. Starosne grupe upoređivane su t-testom za nezavisne uzorke. Težina i visina golmana bile su veće od istih vrednosti igrača na poziciji napadača, a procenat telesne masti bio je veći nego kod svih ostalih pozicija. U ≥17 grupi, vrednosti koje su golmani postizali za sprint od 30m niže su nego kod svih ostalih grupa. Maksimalna potrošnja kiseonika bila je veća nego kod igrača na poziciji napadača. Fleksibilnost, agilnost, anaerobna moć, anaerobni kapacitet, vrednosti oporavka nisu se bitno razlikovali među pozicijama. Za sve ove varijable, ispitanici grupe ≥17 imali su veći i bolji učinak od ispitanika grupe ≤16. Nisu utvrđene razlike u performansama među pozicijama, osim u slučaju golmana. Možda je neophodno analizirati golmane nezavisno od igrača na drugim pozicijama. Može se zaključiti da se motoričke i fizičke razlike lakše mogu analizirati u toku određenih vremenskih perioda počevši od 17-te godine, pa nadalje. To može da bude prikladan pristup u odlučivanju o poziciji igrača i njihovom daljem razvoju i nakon tog starosnog doba.

Ključne reči: *fudbal, fizička spremnost, startna pozicija u timu, starosno doba, aerobni, anaerobni uslovi*