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Research on the Impact of Technical and Conditional Studies Applied on the Footballers at the Age Group of 13-15 on Certain Physical and Biomotoric Parameters

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Abstract It was aimed in our study to research the impact of certain physical parameters on components of motoric features such as speed, strength and flexibility in boys aged 13 to 15 years old playing football through regular exercises of 6-week training program. A training program of 6 weeks that includes motoric feature components were applied on a total of 56 male athletes playing football in a licensed U13-U14-U15 teams of Beylikgücü Sports Football Club in Beylikdüzü county of Istanbul. The trainings continued as 4 days a week and a game in the weekend. The first day the footballers participated in the study, their preliminary test values were taken and following the six-week training program, their last measurements were taken and later these were compared. Descriptive statistics were used in the analysis of the data acquired in the study, and Wilcoxon analysis was used as non-parametric methods in hypothesis tests. The reason why non-parametric tests were preferred was because the variables were determined not to have distributed normally in Kolmogorov Smirnov test conducted to determine whether the dependent variables showed normal distribution. The acquired findings were evaluated in the confidence interval of 95% and at the significance level of 5%. A significant difference ($p<0.01$) was determined between the calf, back, biceps, femur, subscapularis, triceps, abdomen, suprailiac circumference and fat measurements and right hand grip and left hand grip strength, ten meters (sprint) running, flexibility and sit and lie down measurements of the test subjects before and after the 6-week training program. In spite of this, it was seen that there was no significance difference in vertical jumping, sit-up, push-up and thirty meters (sprint) measurements. As a result, almost a twofold increase was observed in the hand grip strengths of the age group 13 – 15 in comparison to the age groups of 10-12 and 11-13, and while our study shows parallelism with the adolescent age groups in literature, it draws the attention to the twofold increase in the age group of 15.

Keywords: *adolescent, football, motoric components*

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1. Introduction

In football, a sports branch with vast audience and fans, the importance of the talents, physical fitness and biomotoric characteristics is an undeniable truth. In addition, the anthropometric features of the footballers have an important factor in determining their success and failures in the field. Because, football is in a sense "a sports branch, in which aerobic and anaerobic exercises are used together and subsequently, biomotoric factors such as strength, speed, endurance, flexibility, coordination, quickness and balance are intertwined, and at the same time technical and tactical unity is presented". Especially performance is totally related with the strength, height, body weight, arm, leg and joint mobility and athlete's level of flexibility [1]. The footballer wants to have a fast, strong, durable and perfect technique in return for his intense training program and the works he did selflessly and in a full-motivated way. Therefore, the physical, physiological and biomotoric characteristics of the trainings the athlete performs during his trainings must be compatible with the type of sports he does. If these factors are brought together, it is unavoidable to have success as a result of a good organization of these factors [2]. It is seen that, among the biomotoric characteristics in football, endurance, strength and speed comes to the forefront. The main criterion for becoming a good footballer is to use the biomotoric features in the field, during the game, in the most efficient way depending on the position. Naturally, in terms of movement capabilities, the physical and physiological features are important as well. In addition to these, the suitability of the physical condition to the sports branch and having a high physiological capacity are among the important criteria in terms of performance [3]. In that sense, the impacts of technical and coordination trainings to be performed for 6 weeks by the footballers in the age group of 13-15 in Istanbul Beylikgücü Football club on the physical and biomotoric parameters was analyzed.

2. Material and Method

2.1. Sample

The sample of the study is comprise of all the 56 male athletes playing football in licensed U13-U14-U15 team of Beylikgücü Sports Football Club in Beylikdüzü county of Istanbul.

2.2. Collection of the Data

Anthropometric Measurements of the athletes were taken. These measurements were started in the first week of November 2015 and terminated in the second week of December 2015. The heights of the footballers were measured in bare feet, wearing only shorts by stepping on sıcala brand length measuring machine and standing with their backs against it and from the highest point. **Body Weights** were measured in bare feet with shorts via BASTER brand scale of 0.1 kg sensitivity in kilograms. **Circumference Measurements** of the calf, biceps and femur regions were taken 2 times from the right sides of the athletes and recorded as an average value. A bendable, steel tape measure with 7 mm width and a sensitivity degree of 0,1 cm was used for the circumference measurements. The tape measure was encircled around the regions to be measured with "0" end of the tape measure on the left hand and the remaining end on the right hand, and the number on top of the "0" point was recorded in cm. It was ensured that "0" end of the tape measure and the measured number did not come on top of each other but rather next to each other when making measurement. The tape measure was applied on body parts vertically and measure was made without squeezing much [4]. **In Subcutaneous Fat Measurements,** Holtain brand skinfold caliper that applies 10 g/sq mm pressure on every angle was used in order to determine the fat percentage of the body. The measurements were taken from the right side of the Suprailiac, Subscapula, Biceps, Triceps and Abdominal regions while the athlete was standing erect. In the measurement of skin thickness, subcutaneous fat layer between the thumb and index finger was slightly pulled up to separate it from the muscle tissue. Caliper was placed 1 cm away from the fingers and the thickness of the held skin fold was recorded in mm within 2-3 seconds based on the indicator on the caliper [5] **Push-up Test** was conducted via TRY-9004 100 Memory Mode brand chronometer by counting 30 seconds. The athletes were ensured to be in a face down position lying on the mat with only their toes touching the ground, hands opened up shoulder-wide and arms and body to be tense with the command "Ready!". From "Start!" command to "Stop" command, the number of repetitions they could perform in 30 seconds without any breaks was recorded. **Sit-up Test** was measured through TRY-9004 100 Memory Mode brand chronometer by counting 30 seconds. The athletes got into the position with their back on the mat, and hands open shoulder-wide with arms and body to be tense with the "Ready!" command. The number of repetitions they performed with their feet on the ground and their leg held from "Start!" command until "Stop!" command within 30 seconds without any breaks were recorded at the end of measurement. **Ten (10), Thirty (30) meters Sprint Tests** were conducted through Tecnequie brand photocell and programmed computer system that acquired the value by exiting (via the program) from 50 cm front sides of the initial photocells and passing through other mid-transition points with photocell in the athlete high output technique in value seconds milliseconds. Following athletes' first run, whose values were recorded twice, their jock was checked, and the athletes were made to run again after their pulses came back to normal, and this process was applied to all the athletes. For **Flexibility Measurement,** the athletes were asked to sit down and reach towards the stretching table with their bare feet in a straight position, with their hands before their bodies to reach the farthest place with their finger tip on the ruler that is placed on top of the stretching table. The conducted measurement value was taken. **In vertical jumping test**, the distance where the athletes can stretch while standing before the wall marked in cm with their legs spread shoulder-wide with their bodies sideways to the wall. Later, each athlete is given 3 trial rights for the same position, and the best of these were taken into consideration. The distance the subjects can reach while standing and the distance they can touch by jumping was found in meters and taken into consideration. [6] **In hand gripping strength test**, (Takei Scientific) brand hand dynamometer was used for measuring right and left hand gripping strength. While the subjects were standing, they were asked to tightly squeeze the dynamometer without bending the arm and touching the body. The best out of 2 try out for each arm was recorded and taken into consideration [7].

2.3. Analysis of the Data

The information and data acquired as a result of the measurements made within the framework of experiment method, were analyzed by using SPSS (Statistical Package for Social Sciences) for Windows 21.0. Descriptive statistics and hypothesis tests were used in the analysis of the data. In the descriptive statistics and hypothesis test used in the analysis of the data acquired from the study, Wilcoxon analysis was used as non-parametric methods. The reason for preferring non-parametric tests is because it was determined that variables were not distributed normally in Kolmogorow Smirnov test conducted in order to determine whether the dependent variables showed normal distribution depending on the groups. The acquired findings were analyzed at the confidence interval of 95% and a significance level of 5%.

3. Findings

Table 1. Some Personal Information of the Training Group that Participated in the Research

	N	Min.	Max.	Avg.	Ss
Age	56	13,00	15,00	13,83	,781
Height	56	144,0	185,0	164,73	9,54
Weight	56	33.40	77,20	55,125	9,62
Athlete Age	56	2,00	3,0	2,6	,492

56 footballers aged from 13 to 15 participated in the study. Some of the personal characteristics of the subjects are given in Table 1. In that sense, the average age of the subjects that participated in the study was determined to be 13.83±0,781 years, heights 164,73±9,54 cm and weights 55,12±9,62 kg, and the athletes aged to be 2,60±0.49.

Table 2. Post-test Comparison in Regard to their Circumference and Fat Measurements

Measurements	Before		After		N	Z	p
	Avg.	Ss	Avg.	Ss			
Calf (Circumference)	34,18	3,83	34,62	3,86	56	-3.271	0,001*
Waist (circumference)	71,76	6,52	71,82	5.92	56	-0.009	0.992
Biceps (circumference)	24,44	2,57	25,28	2,79	56	-4,971	0,000*
Femur (circumference)	47,41	5.19	47.89	5.28	56	-2.637	0,008*
Subscapular (Fat)	6,21	3.09	6,73	2.86	56	-5,038	0,000*
Triceps (Fat)	6,82	3,21	7,32	3,07	56	-3,777	0,000*
Biceps (Fat)	5,14	2,21	5,75	2,08	56	-3.892	0,000*
Abdomen (Fat)	7,91	3,37	8,25	2,98	56	-2,771	0,006*
Suprailiac (Fat)	7,00	2,87	7,80	2,41	56	-4,794	0,000*

The comparison of the test results in regard to the subjects' circumference and their pretest and post-test results are given in Table 2. As a result of the matched group Wilcoxon test conducted so as to determine whether the calf, biceps, femur circumference measurement of the subjects, subscapular, triceps, biceps, abdomen, suprailiac fat measurement pre-test and post-test averages show any significant difference, the difference between the arithmetic averages were found to be statistically significant ($p<0,01$). However no significant difference between the pre-test and post-test averages of waist circumference measurement was found ($p>0,01$).

Table 3. Comparison of pre-test and post-tests in regard to the Subjects' Performance Tests

Measurements	**Before**		**After**		**N**	**Z**	**p**
	Avg.	**Ss**	**Avg.**	**Ss**			
Vertical Jumping	37,62	10.53	37.96	9.62	56	-1.961	,050*
Sit-up (Strength)	37,62	4.72	24.83	4.13	56	-,422	0.673
Push-up (Strength)	26,25	4.46	26.16	3.80	56	-,529	,597
Right Hand Grip (Strength)	30,20	9.02	30.96	8.93	56	-5.613	0,000*
Left Hand Grip (Strength)	28,74	8.59	29.59	8.78	56	-5.497	0,000*
Ten Meters (Sprint)	2,42	0.371	2.45	0.385	56	-3.044	0,002*
Thirty Meters (Sprint)	4,84	0.356	4.84	0.345	56	-,797	0.425
Sit lie down (flexibility)	17,67	8.21	18.82	7.50	56	-4.914	0,000*

The results regarding the pre-test post-test comparison regarding the subjects' performance tests can be viewed in Table 3. As a result of the matched group Wilcoxon test conducted so as to determine whether the pre-test and post-test averages of the vertical jumping, right hand grip (strength), left hand grip (strength), ten meters (sprint), sit lie down (flexibility) measurement of the subjects show any significant difference, the difference between the arithmetic averages were found to be statistically significant ($p<0,01$). In contrast, no significant difference was found between the pre-test and post-test averages of sit-up, push-up, thirty meters (sprint) measurements.

4. Discussion and Result

4.1. Discussion

Pekel et. al stated that physical and physiological test applied on the children are used in order to evaluate the impacts of the regular physical activity on growth, development and health and to analyze the trainability of the children in adolescence; and they also added that the long term tendencies of the children and their acute reactions towards exercises of various intensities in growth, maturing and physical fitness models of the children can be determined through these tests. Ziyagil et. al, in a study they conducted in order to research on the annual changes of the physiological characteristics of young national wrestling team wrestlers of 16-17 ages; they measured right hand gripping strength values as 34,92 kg in pre-test and 42,46 kg in post-test, left hand gripping strength values as 33,50 kg in pre-test and 43,33 in post-test. In a study conducted by Ziyagil et. al on children doing sports, the hand gripping strength of the age group of 10 was determined as 15,20±4,07 kg., age group of 11 as 15,88±1,75 kg. and age group of 12 as 17,00±3,02 kg. The parallel and positive increase of age and strength during adolescence, supports pre-test and post-test measurements of our 6-week long study. [8] In a similar study, Pekel et. al found the right and left hand gripping strength averages of children aged 11 to 13 to be 20,8±6,51 19,9±5,5 kg [9], in a study conducted by Tınazcı et. al on boys aged 11, the right hand gripping strength was found to be 17,90±2,74 kg., left hand gripping strength was found to be 16,61±2,57 kg [10]. In a study conducted by Karacabey et. al on footballers aged 10 - 12, right hand gripping strength was found to be 15,7±2,79 kg., and left hand gripping strength to be 15,29±2,93 kg [11]. Gökdemir et. al, in a study they conducted on a total of 46 young wrestlers in the age group of 12 - 15, they determined the right hand gripping strength as 25.69 kg., and left hand gripping strength as 25.18 kg [12]. As a result of the literature study conducted, it was seen that hand gripping strengths of age groups of

10-12 was an average of 15,00-17,00 kg, and for the age group of 11-13, it was an average of 20,00 kg [8,9], and in our study, right hand gripping strength was found to be 30,58 kg and left hand gripping strength was found to be 29,16 kg. It is observed that almost a twofold increase occurred in hand gripping strengths of age groups of 13 - 15. While our study shows parallelism with literatures, the twofold increase in the age group of 13-15 attracts the attention [15].

In their study that was conducted in 2014; Bakırçı and Kılıç investigated the effect of combined trainings applied during the preparation period upon the performance of university's basketball team. As a result of their study, they determined the biceps regions of basketball players as 8.8±7.3 mmHg. before the training and 6.1±5.8 mmHg. after the training. Comparing the measurement findings before and after the training; a significant difference was determined ($p<0.05$). [25]

Abdominal regions of basketball players were determined as 23±12.4mmHg. before the training and 18.6±12.4mmHg. after the training. Comparing the measurement findings before and after the training; a significant difference was determined ($p<0.05$). [25]

Suprailiac regions of basketball players were determined as 19±11.4mmHg. before the training and 13±9.5 mmHg. after the training. Comparing the measurement findings before and after the training; a significant difference was determined ($p<0.05$) [25].

As a result of their study, they determined the vertical jumping values of basketball players as 51.9±9.8cm. before the training and 58.3±12.3cm. after the training. There was a significant difference between vertical jumping values before and after the training ($p<0.05$) [25].

As a result of their study, they determined the right hand grip of basketball players as 46.1±5.3 kg. before the training and 45.6±6.2 kg. after the training, which posed a significant difference ($p<0.05$). They determined the left hand grip as 43.8±6.7 kg. before the training and 42.7±6.9. after the training, which posed a significant difference ($p<0.05$) [25].

As a result of their study, they determined the flexibility measurements of basketball players as 23.8±7.6 cm. before the training and 25.7±7.6 cm. after the training. There was a significant difference between flexibility measurement findings before and after the training ($p<0.05$) [25].

As a result of their study, they determined the sit-up tests of basketball players as 26.2±4.2 total/30sec. before the training and 29.6±3.8 total/30sec. after the training. There was a significant difference between sit-up test findings before and after the training ($p<0.05$) [25].

As a result of their study, they determined the push-up tests as 25.9±8.4 total/30sec. before the training and 28.2±6.7 total/30sec. after the training. There was a significant difference between push-up measurement findings before and after the training; however, it was not statistically significant ($p>0.05$) [25].

As a result of their study, they determined the Ten (10) m speed tests as 2±0.2 sec. before the training and 1.86±0.2 sec. after the training. They determined the 30 m speed tests as 4.87±0.6 sec. before the training and 4.45±0.5 sec. after the training. There was a significant difference between speed test measurement findings before and after the training ($p<0.05$) [25].

In their study that was conducted with handball players aged 15-17 in 2014; Ürer and Kılınç compared the test values of handball players before and after the research and determined that there was no significant difference in their 20 m. and 40 m. speed performances [25].

Evaluating the effects of plyometric studies upon some strength parameters of handball players; significant developments were observed on certain performances of handball players (like health, tossing ball, doing push-ups, sit-ups and pull-ups) at the end of the training program [25].

While the vertical jumping and anaerobic strength values of the age group of 11 were found to be higher in comparison to Katie et. al, Hoffman et. al and Polat and Saygın, Ziyagil et. al's age group of 9, no significant differences were found among other age groups. While no significant difference was found in vertical jumping, anaerobic and aerobic strength parameters among the age groups of 11 and 10 and 10 and 9 at the level of $p>0,05$, a significant difference was found among the age group of 11 and 9 at the level of $p<0,05$ and $p<0,01$[8-16].

The studies show that significant differences can occur in vertical jumping, anaerobic and aerobic strength values of the children doing sports in their early adolescent and adolescent periods, and many study results also support these findings. It is emphasized that, a period of at least 2 years is required for a regular training in order to improve the vertical jumping and anaerobic strength values among the age groups of 9 - 11. While Çoban, in a study he conducted found pre-test results for vertical jumping as 32,57±4,51 cm. and post-test as 35,71±3,96 cm. [15], Yörükoğlu and Koz determined the vertical jumping value during the basketball training held in different frequencies among the age group of 10 - 13 as 36,01 ± 5,86 cm for sports club and as 34,26 ± 6,18 for sports school [16]. (Yörükoğlu, Koz, 2007). In our study, the pre-test 37,62±10,53 cm and post-test 37,96±9,62 cm averages Z= -1,961 p=, 050 ($p<0,05$) show significant parallelism with the conducted study and literatures.

Wisloff et. al 10 m sprint time 1.82±0.3 sec., 20 m sprint time 3.0±0.3 sec. ve 30 m sprint time 4.0± 0.2 sec [17].

In a study conducted by Meylan and Malatestia on 14 boys with the age average of 13.3±0.6, they observed that increase rate of 2.11% and 3.72% respectively occurred in 5 m sprint and 10 m sprint times following the plyometrics training of 8-weeks. Similarly, in a study conducted by Rimmer and Sleivert, 26 male athletes were made plyometrics training of 8 weeks special for their sprint ability. At the end of the training period, it was observed that a significant improvement occurred in 10 m sprint performance (1.96 sec. / 1.91 sec.) [18], and that Diallo et. al found significant differences in 20, 30 and 40 m sprint values as a result of the trainings applied for 3 days on children aged 10 – 12 [19].

Saçaklı, found 30 m sprint averages of footballers aged 14 to be 4,65 sec [20]. While Loko et. al state that children aged 10-17 are faster than the children in the age and type found in his study [21], Kien et. al found that middle school children aged 10 - 12 who participated that recreation programs were faster than the same age group that did not participate in the recreative sports activities [22]. Ziyagil, in a study he conducted, found 20 m sprint variables as 4,99 ± 0,73 sec., and 20 m sprint variables as

4,68±0,28 sec in control group; in our study the Ten Meters (Sprint) measurement pre-test 2,42±0,37 and post-test 2,45±0,38 averages were found to be as Z= -3,044 p= 0,002 (p<0,01) and also an increase parallel with the conducted studies was observed. Thirty Meters (Sprint) measurement pre-test 4,84±0,35 post-test 4,84±0,34 averages could not be found significant (p>0,05) as in Z= -,797 p= 0,425, however it shows direct similarities with the studies conducted in terms of numbers [8]. Gökdemir et. al Determined the 20 m run of subject group before the quick power trainings of the wrestlers of the age group of 16-17 as 2,85 sec., and as 2,78 sec. after the trainings, and 20 m run of the control group was determined to be 2,87 sec before the training and 2,91 sec. after the training [23].

Açıkada et. al in their study called "Profile of the Physical and Physiological Characteristics of Second League Football Team During the Preparation Period Prior to the Season", found that studies to be conducted on 10 and 30 m sprint, sprinting with and without ball can have a positive effect on the performance to be shown during the whole season and that the measurements to be made can improve the sprint characteristic at a certain level. This result supports our study [24].

The improvement of basic performance ability is special and methodical. In the process of developing a certain physical performance (strength), other physical performance characteristics (sprint, endurance) are also indirectly affected. This effect can be negative or positive. Therefore, in addition to the development period characteristics of the child, the physical performance characteristic desired to be improved must be well known as well [8].

According to the study results of Pekel et. al, in boys and girls at the age group of 10 - 13 doing sports, positive relationships that generally range from low to high levels between the diameter, circumference and length measurements among the anthropometric features and the speed, power and strength test performances [9].

The competition performance in sports necessitated the physical preparation in order to take the anthropometric measurements and physiological performance levels together with the technical and tactical works to the highest point. As known, the children are in a development and growth period. The physiological systems of these young children within this period are not at a level sufficient enough to meet the burdens necessitated by the intense trainings.

4.2. Result

In this study, conducted on a total of 56 male athletes playing in licensed U13 - U14 - U15 teams of Beylikgücü Sports Football Club in Beylikdüzü county of Istanbul, a 6-week training program was applied on the footballers. The trainings continued 4 days a week and game in the weekends. Pre-test values of the footballers were taken on the first day they participated in the study, and their post-test measurements were taken after the six-week training program. The values before the start of the trainings and after the trainings were compared.

As a result of this comparison, a significant difference was found between the calf, waist, biceps, femur, subscapularis, triceps, abdomen, suprailiac circumference and fat measurements of the subjects and right hand grip and left hand grip strength, ten meter (sprint) runs, flexibility and sit lie down measurement (p<0.01). In contrast, no significant difference was observed in vertical jumping, sit-up, push-up and thirty meter (sprint) measurements.

As a result, almost a twofold increase was observed in the hand grip strengths of the age group 13 – 15 in comparison to the age groups of 10-12 and 11-13, and while our study shows parallelism with the adolescent age groups in literature, it draws the attention to the twofold increase in the age group of 15.

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