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The current status of morphological characteristics and health related fitness of youth football academies

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Abstract
The purpose of this study was to shows the current status of morphological characteristics and health related fitness of youth football players. Cross-sectional study design was employed for this study. The subjects of the study were youth footballers of Ambo FIFA goal project; Ethiopian youth sport academy and Tirunesh Dibaba training Centre. The total of 222 male and female subjects under the age categories of U15 and U17 was selected using purposive sampling technique, among this number 120 male and 102 was female. The data was collected through the appropriate demographic characteristics, morphological characteristics; and Health related fitness tests were used. Descriptive statistics Mean ± SD and frequency was used and also ANOVA was used to determine the differences of youth sport academies. The result shows that the players have an ideal BMI in all academies as compared with the normal range of 18.5-24.9 kg/m^2 of BMI. The significant difference was observed in waist, thigh, calf, hip circumference, leg length and sitting height except, in arm span. A significance difference was not observed between youth sport academies in body fat %, cardio vascular endurance, abdominal and back muscle strength and endurance and Illinois agility tests.

Keywords: health related fitness, morphological characteristics, and youth football players

Introduction
Football is the most popular sport worldwide for adults and youth (Kucera, *et al.,* 2005) [5]. This means that around four per-cent of the world population (or 1 in 25people) are directly involved with soccer (FIFA Communications Division, 2007) [1]. Many factors are important in determining the success of a soccer player and the requirements for top-level play are multifactorial, ensuring that the process of forecasting eventual performance potential at an early age is difficult and complex (Reilly *et al.,* 2000*a*) [8]. Currently, studies have not been focused on the anthropometrics and fitness features of football players considering their successes (Jankovic *et al.,* 1993; Reilly *et al.,* 2000a; Gil *et al.,* 2007a) [3, 8].
Physical fitness is a significant part of life indicator, which shows whether you have the ability to perform and enjoy day-to-day physical activities with comfort. It is usually attained through physical activity and exercise, balanced nutrition, sufficient rest, stress management and relaxation (Kemi *et al.,* 2003) [4]. Fitness is an important factor of all levels of the game, essential for highest players, useful for beginners who will improve both their efficiency and delight through good standards of fitness. Fitness testing provides feedback to athletes and coaches on how the athlete will develop their various components of physical fitness (Gabbett *et al.,* 2007) [2].
To become successful in a team sport, football players need the optimal combination of technical, tactical, physical characteristics and motivation (Bangsbo & Michalsik, 2002) [8]. Many professionals in the football, such as coaches, team manager, and sports scientists believe that the success of this sport can be linked with anthropometric characteristics of players. Also, some previous studies have devoted on the relationship between anthropometric profiles of players and their typical positions (Rienzi, *et al.,* 2000; Gil, *et al.,* 2007b) [9].
Therefore, youth football players, in these features are often determined by the level of maturation and growth of the individual. At certain ages, players may be benefited or not benefited in terms of physical ability and coaches and scouts tend to help physically advanced players as these are shown to be better performers in physical tasks compared with late maturing peers (Malina *et al.,* 2000, 2004) [6-7]. Therefore, the purpose of this study was to show the current status of morphological characteristics and health related fitness of youth football academies.

Methodology of the study
Study Area
The study was conducted in an Ethiopian youth sport academy, which is found in the capital of Ethiopia (Addis Ababa) youth sport academy and Terunesh Dibaba training centre Asella camps and also Ambo FIFA goal project sport academy which is found at Ambo, Ethiopia.

Study Design
Cross-sectional study design had been involved to investigate the morphological characteristics and health related fitness of Ethiopian youth sport academy soccer players

Participants of the Study
Participants of the study were Ethiopian youth sport academy soccer players signed and having training in 2017-2018. The reasons for choosing them are the trainees having regular training in their respective academies, they are living together and they are categories in different age and sex categories.

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Samples and Sampling of the Study

The total of 222 male and female subjects under the age categories of U15 and U17 was selected using purposive sampling technique from Asela, Ambo and Addis Ababa youth sport academies based on the inclusion criteria of those who are soccer trainee of Asela, Ambo and Addis Ababa youth sport academies and those who are under the age categories of U15 and U17 while, they were excluded those who were in injury, those who were other sports trainee and those who were graduated from the respective academies.

Data Collection Instruments

The data collection instruments for this study were used in order to record information about the players. Quantitative data was used through the appropriate demographic characteristics of the players (age, sex, and playing position), Morphological characteristics of the players (Height, Weight, BMI, Waist Circumference, Thigh Circumference, Calf Circumference, Arm Span, Leg Length, and Sitting Height) and Health related fitness test (Body Composition, Cardiovascular Endurance, Muscular Strength and Endurance, Flexibility Speed and Agility).

Method of Data Analysis

Mean ± standard deviation and frequency was used to determine the morphological characteristics and health related fitness of youth football players. ANOVA was used to show the differences of morphological characteristics and health related fitness between sport academies. The significance level was set at $p<0.05$. Statistical Package for the Social Science (SPSS) 20 version software was used for all statistical analysis.

Result and Discussion

Characteristics of the Subjects

Table: 1. shows the characteristics of the study participate. As indicated the total number of the subject was 222. Among them 120 (54.1%) was male, under this the playing category of the subjects were U15 / U17 (60; 50%) and the reset 102 (45.9%) was female, under this the playing category of the subjects were U15 / U17 (17; 50%).

Table 1: Demographic characteristics of the Subjects

Academy	Male		Female		Total
	U15	U17	U15	U17	
AA	20	20	17	17	74
TD	20	20	17	17	74
Ambo	20	20	17	17	74
Total	60	60	51	51	222

Figure: 1 shows the characteristics of the study participate in playing position. Defensive players were recorded as the largest frequency 78 (35.1%), followed by midfielder, 72 (32.4%), striker, 42 (18.9%) and Goalkeepers, 30 (13.5%).

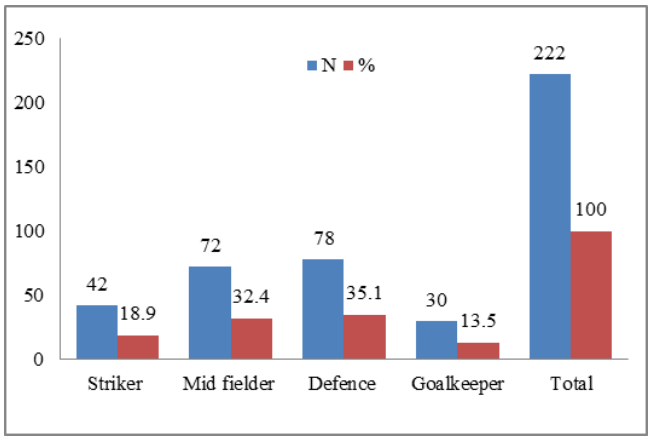

Fig 1: Playing Position

Anthropometric and Morphological Characteristics of the Players

Table: 2. Presents, the Ethiopian Youth Sports Academy Addis Ababa (EYSA), Tirunesh Dibaba Training Centre (TDTC) and Ambo FIFA Goal Project (AFIFAGP) players' height, weight and body mass index. The mean height of the players were 1.65 ± 0.09 m, the mean weight of the players were51.57 ± 6.35 and the BMI of the youth sport academies showed that 20.1 ± 1.82 kg/m^2. From the result we can understand that the players have an ideal BMI in all academies as compared with the normal range of 18.5-24.9 kg/m^2 of BMI.

Table 2: Players Characteristics in Mean ± SD of Youth Sport Academies

Youth Sports Academies	Height in meter	Weight in Kg	BMI
EYSA	1.64 ± 0.09	51.57 ± 6.35	18.9 ± 1.49
TDTC	1.65 ± 0.09	57.05 ± 6.67	20.8 ± 1.57
AFIFAGP	1.65 ± 0.08	56.08 ± 7.09	20.6 ± 1.81
Total	1.65 ± 0.09	54.90 ± 7.09	20.1 ± 1.82

The below table: 3 can shows that the analysis of variance between youth sport academies in their anthropometric characteristics of height, weight and BMI. As the result indicated that significant differences was not observed between all academies in the height of the players. While, the weight of the players showed that highly significance differences with a p value of 0.000 between EYSA and TDTC with a mean difference of – 5.482 and between EYSA and AFIFAGP with a mean difference of – 4.509. But there was no significance difference between TDTC and AFIFAGP. From the result we can understand that TDTC and AFIFAGP youth football players have a higher weight than EYSA. The other significance difference was observed in BMI between EYSA and TDTC with a mean value of – 1.86 with $P < 0.000$ and between EYSA and AFIFAGP with a mean value of – 1.64 with $P < 0.000$. The result indicated that EYSA has the lower BMI than TDTC and AFIFAGP football players.

Table 3: The Analysis of variance in Anthropometric Characteristics between Youth Sport Academies of Football Players

Dependent Variable	(I)	(J)	Mean Diff (I-J)	Sig.	95% Confidence Interval	
					LB	UB
Height	EYSA	TDTC	-.00568	.697	-.0344	.0230
		AFIFAGP	-.00338	.817	-.0321	.0253
	TDTC	AFIFAGP	.00230	.875	-.0264	.0310
Weight	EYSA	TDTC	-5.482*	.000	-7.66	-3.31
		AFIFAGP	-4.509*	.000	-6.68	-2.34
	TDTC	AFIFAGP	.973	.379	-1.20	3.15
BMI	EYSA	TDTC	-1.8580*	.000	-2.385	-1.331
		AFIFAGP	-1.6380*	.000	-2.165	-1.111
	TDTC	AFIFAGP	.2200	.412	-.307	.747

*. The mean difference is significant at the 0.05 level.

Morphological Characteristics Football players of Youth Sport Academies

Table 4 and 5 presents, the EYSA, TDTC and AFIFAGP academies players' waist, thigh, calf, hip circumference, arm span, leg length and sitting height in cm. As the table shows the total mean value of the players morphological characteristics in all academies were, 74.10 ± 5.81 of waist circumference, 49.33 ± 3.39 of Thigh Circumference, 32.07 ± 1.80 of Calf Circumference, 75.45 ± 6.58 of Hip Circumference, 166.99 ± 10.34 of Arm Span, 85.10 ± 5.40, Leg Length and 83.26 ± 4.49 of Sitting height. The result indicated that the players found almost equal in all morphological characteristics.

Table 4: Players girth measurement in Mean ± SD of Youth Sport Academies

Youth Sports Academies	Waist Circumference	Thigh Circumference	Calf Circumference	Hip Circumference
EYSA	70.21 ± 4.92	47.24 ± 2.62	31.39 ± 1.61	80.97 ± 5.92
TDTC	77.41 ± 4.42	50.94 ± 2.88	32.37 ± 1.75	72.19 ± 4.46
AFIFAGP	74.66 ± 5.62	49.82 ± 3.52	32.45 ± 1.85	73.10 ± 5.37
Total	74.10 ± 5.81	49.33 ± 3.39	32.07 ± 1.80	75.45 ± 6.58

Table 5: Players body length measurement in Mean ± SD of Youth Sport Academies

Youth Sports Academies	Arm Span in cm	Leg Length in cm	Sitting height in cm
EYSA	165.27 ± 9.72	84.21 ± 5.55	84.78 ± 4.69
TDTC	168.55 ± 11.59	86.18 ± 5.82	82.10 ± 4.12
AFIFAGP	167.15 ± 9.44	84.91 ± 4.64	82.90 ± 4.27
Total	166.99 ± 10.34	85.10 ± 5.40	83.26 ± 4.49

Table: 6. presented the analysis of variance in morphological characteristics between the three academies of youth football players. As indicated in the table, the significant difference was observed in all variables except, in arm span.

Waist Circumference of youth football players highly significance differences was observed between EYSA and TDTC with a mean difference of -7.19 cm at a $p < 0.000$, another highly significance differences was also observed between EYSA and AFIFAGP with mean difference of -4.44 cm at a $p< 0.000$ and also a significance difference was observed between TDTC and AFIFAGP with a mean difference of 2.75 cm at a $p < 0.001$. This indicates that TDTC youth football player has the highest waist circumference than AFIFAGP and EYSA youth football players.

Thigh Circumference of youth football players highly significance differences was observed between EYSA and TDTC with a mean difference of -3.70 cm at a $p < 0.000$, another highly significance differences was also observed between EYSA and AFIFAGP with mean difference of -2.58 cm at a $p< 0.000$ and also a significance difference was observed between TDTC and AFIFAGP with a mean difference of 1.11 cm at a $p < 0.026$. This indicates that TDTC youth football player has the highest thigh circumference than AFIFAGP and EYSA youth football players.

Calf Circumference of youth football players highly significance differences was observed between EYSA and TDTC with a mean difference of -0.98 cm at a $p < 0.001$, another highly significance differences was also observed between EYSA and AFIFAGP with mean difference of -1.06 cm at a $p< 0.000$, while insignificance difference was observed between TDTC and AFIFAGP with a mean difference of -0.07 cm at a $p < 0.781$. This indicates that EYSA youth football player has the lowest calf circumference.

Hip Circumference of youth football players highly significance differences was observed between EYSA and TDTC with a mean difference of 8.77 cm at a $p < 0.000$, another highly significance differences was also observed between EYSA and AFIFAGP with mean difference of 7.87cm at a $p< 0.000$, while insignificance difference was observed between TDTC and AFIFAGP with a mean difference of -0.91 cm at a $p < 0.298$. This indicates that EYSA youth football player has the highest hip circumference than TDTC and AFIFAGP. While, arm span of youth football players' insignificance differences was observed between EYSA, TDTC and AFIFAGP.

Leg Length of youth football players significance differences was observed between EYSA and TDTC with a mean difference of -1.97cm at a $p < 0.026$, whereas, insignificance differences was observed between EYSA and AFIFAGP and also between TDTC and AFIFAGP.

Sitting Height of youth football players highly significance differences was observed between EYSA and TDTC with a

mean difference of 2.68 cm at a p < 0.000, another significance differences was also observed between EYSA and AFIFAGP with mean difference of 1.88cm at a p< 0.009, while insignificance difference was observed between TDTC and AFIFAGP with a mean difference of -0.79 cm at a p < 0.270. This indicates that EYSA youth football player has the highest sitting height than TDTC and AFIFAGP.

Table 6: Analysis of variance in Morphological Characteristics between Youth Sport Academies of Football Players

Dependent Variable	(I)	(J)	Mean Diff. (I-J)	Sig.	95% Confidence Interval	
					LB	UB
Waist Circumference	EYSA	TDTC	-7.1986*	0.000	-8.822	-5.575
		AFIFAGP	-4.4459*	0.000	-6.070	-2.822
	TDTC	AFIFAGP	2.7527*	0.001	1.129	4.376
Thigh Circumference	EYSA	TDTC	-3.7027*	0.000	-4.684	-2.721
		AFIFAGP	-2.5878*	0.000	-3.569	-1.607
	TDTC	AFIFAGP	1.1149*	0.026	0.134	2.096
Calf Circumference	EYSA	TDTC	-0.9811*	0.001	-1.545	-0.417
		AFIFAGP	-1.0608*	0.000	-1.625	-0.497
	TDTC	AFIFAGP	-0.0797	0.781	-0.644	0.484
Hip Circumference	EYSA	TDTC	8.7784*	0.000	7.067	10.490
		AFIFAGP	7.8716*	0.000	6.160	9.583
	TDTC	AFIFAGP	-0.9068	0.298	-2.618	0.805
Arm Span	EYSA	TDTC	-3.284	0.054	-6.62	0.05
		AFIFAGP	-1.878	0.268	-5.21	1.46
	TDTC	AFIFAGP	1.405	0.407	-1.93	4.74
Leg Length	EYSA	TDTC	-1.973*	0.026	-3.71	-0.24
		AFIFAGP	-0.703	0.426	-2.44	1.03
	TDTC	AFIFAGP	1.270	0.151	-0.47	3.01
Sitting Height	EYSA	TDTC	2.680*	0.000	1.26	4.09
		AFIFAGP	1.885*	0.009	0.47	3.30
	TDTC	AFIFAGP	-0.795	0.270	-2.21	.62

*. The mean difference is significant at the 0.05 level.

Players' health related fitness measurement in Mean ± SD of Youth Sports Academies

Table: 7. shows that, the players' health related fitness. The body fat in % of the players was found in the normal body fat in %, with a total mean of 10.43 ± 6.09 distributed in academies such as EYSA (9.80 ± 7.08), TDTC (10.93 ± 4.91) and AFFAGP (10.55 ± 6.11). The players cardiovascular endurance was tested using 1.5 mile run and they cover the given mile with the total mean value of 12.47 ± 2.54 in minute and specifically in each academies EYSA (12.54 ± 2.56), TDTC (12.35 ± 2.50) and AFFAGP (12.51 ± 2.58). Sit and reach test of the players was scored with a total mean of 11.94 ± 5.11 centimetres but in EYSA (10.57 ± 5.01), TDTC (13.08 ± 4.97) and AFFAGP (12.47 ± 4.44). The abdominal and back muscle strength and endurance of the players was assessed with one minute sit-up, they succeeded with a total mean of 39.89 ±11.94 in repetitions per minute with each of the academies EYSA (41.23 ± 12.49), TDTC (38.72 ± 11.87) and AFFAGP (39.72 ± 11.46). The one min push-up strength and endurance test of the players was indicted the total mean value of 27.00 ± 13.67 in repetitions per minute and the respected academies scored EYSA (23.74 ± 13.79), TDTC (25.74 ± 13.49) and AFFAGP (31.49 ± 12.75). The speed of the players in all academies used the total mean of 6.15 ± 0.67 second to cover thirty five meter and the academies showed that EYSA (6.09 ± 0.69), TDTC (6.03 ± 0.53) and AFFAGP (6.37 ± 0.80). The agility of the players was assessed using Illinois agility test and the players were scored, the total mean value of 17.36 ± 0.80 second and specifically in their respected academies EYSA (17.32 ± 0.89), TDTC (17.36 ± 0.65) and AFFAGP (17.40 ± 0.86).

Table 7: Players health related fitness measurement in Mean ± SD of Youth Sports Academies

Health related fitness	Sports Academies Mean ± SD			
	EYSA	TDTC	AFIFAGP	Total
Body Fat in %	9.80 ± 7.08	10.93 ± 4.91	10.55 ± 6.11	10.43 ± 6.09
1.5 Mile Run	12.54 ± 2.56	12.35 ± 2.50	12.51 ± 2.58	12.47 ± 2.54
Sit and Reach	10.57 ± 5.01	13.08 ± 4.97	12.47 ± 4.44	12.04 ± 4.91
1min Sit-up	41.23 ± 12.49	38.72 ± 11.87	39.72 ± 11.46	39.89 ± 11.94
1min Push-up	23.74 ± 13.79	25.74 ± 13.49	31.49 ± 12.75	27.00 ± 13.67
35 meter Run	6.09 ± 0.69	6.03 ± 0.53	6.37 ± 0.80	6.15 ± 0.67
Illinois Agility	17.32 ± 0.89	17.36 ± 0.65	17.40 ± 0.86	17.36 ± 0.80

Table: 8. Presents, the EYSA, TDTC and AFIFAGP academies players differences of health related fitness. From the table a significance difference was not observed between youth sport academies in body fat %, 1.5 mile run, 1 min sit-up and Illinois agility tests, while a significance difference was observed in sit and reach test between EYSA and TDTC with a mean differences of – 2.51 at p< 0.002, and also between EYSA and AFIFAGP with a mean value of -1.89 at p<0.017. However, there was no a significance difference between TDTC and AFIFAGP. This indicates that EYSA has the lowest performance in sit and reach test. In the strength and endurance tests the abdominal and back

muscle strength and endurance assessed using one minute sit-up test was not show a significant differences between that academies. While, the upper body strength and endurance of the players tested using one minute push-test was show a significance differences between the academies of EYSA and AFIFAGP with a mean difference of -7.74 at p< 0.001 and also between TDTC and AFIFAGP with a mean difference of -5.74 at p< 0.009 however, there was no significance difference between EYSA and TDTC. This can show that AFIFAGP has the highest performance of upper body strength and endurance than EYSA and TDTC.

Speed and agility of the players were computed between each of the academies. In speed test a significance differences was shows between the academies of EYSA and AFIFAGP with a mean difference of -0. 24 at p< 0.027 and also between TDTC and AFIFAGP with a mean difference of -0.31 at p< 0.005 however, there was no significance difference between EYSA and TDTC. This can show that AFIFAGP has the highest performance of speed than EYSA and TDTC. In agility test the result can showed that insignificance differences between all academies. This indicates that the players have balanced performance of agility in all academies.

Table 8: Analysis of variance between health related fitness of football players youth sport academies

Dependent Variable	(I)	(J)	Mean Diff. (I-J)	Sig.	95% Confidence Interval	
					LB	UB
Body Fat in %	EYSA	TDTC	-1.13514	0.259	-3.1116	0.8413
		AFIFAGP	-0.75676	0.451	-2.7332	1.2197
	TDTC	AFIFAGP	0.37838	0.706	-1.5981	2.3548
1.5 Mile Run	EYSA	TDTC	0.19297	0.645	-0.6317	1.0176
		AFIFAGP	0.02878	0.945	-0.7959	0.8534
	TDTC	AFIFAGP	-0.16419	0.695	-0.9888	0.6605
Sit and Reach	EYSA	TDTC	-2.50676*	0.002	-4.0658	-0.9477
		AFIFAGP	-1.89865*	0.017	-3.4577	-0.3396
	TDTC	AFIFAGP	0.60811	0.443	-0.9509	2.1671
1min Sit-up	EYSA	TDTC	2.514	0.202	-1.36	6.38
		AFIFAGP	1.514	0.442	-2.36	5.38
	TDTC	AFIFAGP	-1.000	0.611	-4.87	2.87
1min Push-up	EYSA	TDTC	-2.000	0.363	-6.32	2.32
		AFIFAGP	-7.743*	0.001	-12.07	-3.42
	TDTC	AFIFAGP	-5.743*	0.009	-10.07	-1.42
35 meter Run	EYSA	TDTC	0.06608	0.544	-0.1483	0.2804
		AFIFAGP	-0.24223*	0.027	-0.4566	-0.0279
	TDTC	AFIFAGP	-0.30831*	0.005	-0.5227	-0.0939
Illinois Agility	EYSA	TDTC	-0.04081	0.759	-0.3025	0.2209
		AFIFAGP	-0.08216	0.537	-0.3439	0.1796
	TDTC	AFIFAGP	-0.04135	0.756	-0.3031	0.2204

*. The mean difference is significant at the 0.05 level.

Conclusion

Based on the result of the study the researchers can come to the following conclusions:

- The players have an ideal BMI in all academies as compared with the normal range of 18.5-24.9 kg/m^2 of BMI.
- The significant difference was not observed between all academies in the height of the players.
- TDTC and AFIFAGP youth football players have a higher weight than EYSA.
- EYSA has the lower BMI than TDTC and AFIFAGP football players.
- The significant difference was observed in waist, thigh, calf, hip circumference, leg length and sitting height except, in arm span.
- TDTC youth football player has the highest waist, and thigh circumference than AFIFAGP and EYSA youth football players.
- EYSA youth football player has the lowest calf circumference, but has the highest hip circumference than TDTC and AFIFAGP.
- An insignificance difference was observed between EYSA, TDTC and AFIFAGP in arm span.
- Leg Length of youth football players significance differences was observed between EYSA and TDTC
- Siting height of youth football players' significance differences was observed between EYSA with TDTC and AFIFAGP.
- A significance difference was not observed between youth sport academies in body fat %, 1.5 mile run, 1 min sit-up and Illinois agility tests,
- EYSA has the lowest performance in sit and reach test.
- Abdominal and back muscle strength and endurance was not showing a significant difference between those academies.
- AFIFAGP has the highest performance of speed and upper body strength and endurance than EYSA and TDTC.
- In speed test a significance differences was shows between AFIFAGP with EYSA and TDTC.
- The players have balanced performance of agility in all academies.

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Interest of Conflicts: There is no any Interest of Conflicts

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