Relationship between anthropometric parameters and speed performance: A kinanthropometric research

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Abstract

The purpose in this study; determined of relationship between anthropometric parameters and speed performance. In this purpose; 118 sedentary university students age 21.2 ± 2.1 year, body weight 62.2 ± 10.7 kg and height 168.2 ± 8.1 cm participated in this study voluntarily. 30 m speed performance with stature (shoulder, chest, trunk, waist, hip, thigh, knee, calf and ankle) and (height, fathoms, upper arm, fore arm, all arms, trunk, thigh, leg and all leg) girths was measured. Statistical analysis was made in SPSS 22.0 packed program for Windows. Data from the measured of arithmetic means, standard deviation, lowest and highest values was found. Relationship between anthropometric parameters and speed performance was tested by Pearson's Correlation. According to Data from the measured; there were significant relationship in between speed values of workgroups and body weight, shoulder girths, chest girths, trunk girths, waist girths ($p<0.01$), leg girths ($p<0.05$) and there were significant relationship in between speed values of workgroup and height, fathoms length, fore arm length, all arm length, trunk length, leg length ($p<0.01$), thigh length ($p<0.05$). It can be said increases in speed values, if girths and length values increase.

Keywords: Anthropometric parameters, speed and sedentary, kinanthropometry.

INTRODUCTION

Anthropometry is a phrase made of combinations of the words antros and metris (human and measurement). In a general sense, it is a systematic technique classifying objective characteristics of human body by certain measurement methods and principles based on their dimensions and structural characteristics. Today, anthropometry is adopted as a single support in body type and structural characteristic matters (19).Anthropometric techniques may be used for different purposes such as evaluating differences related to the physics between the effects on physical characteristics of training and sports branches (19).

Kinanthropometry can be defined as a scientific field (19) explaining the relationship between human structure and function quantitatively or a discipline (19) researching the relationship between human structure and behavior or examining the effect of human measurement and morphological structure on behavior by considering morphological

differences (17,19). It has been considered for many years that a proper body type plays an important role in sportive performance (16,26).

Even in ancient times, studies were performed for examining physical structure of people and according to the results of these, people were classified structurally. Today, the relationship between the physical structure and functions are examined and studies related to the determination of sportive performance are conducted continuously(22).Anthropometric measurements and somatotype has become important for determining skills from the first studies until today(12).Significant developments in all sports branches are a product of the evaluation of fundamental and specific anthropometric and kinesiology characters of athletes(11).Studies have revealed that there are significant differences in physical structures of athletes in different sport branches(2,8,14,20,24,28,29,32).

Measurement of anthropometric characteristics and body composition and revealing their

relationship with performance is one of the matters that are focused on during the recent years. In many sports branches, it is considered that anthropometric characteristics are one of the most important factors showing whether an athlete could be a competitor at the highest level in that sport (5,9). Making the morphological characteristics numerical and their examination gives important information about the effect of body structure on performance (5,9).

Based on all of these information; in this study were aimed to determine that the relationship between anthropometric parameters with speed, which is a bio motor skill.

MATERIAL & METHOD

One hundred-eighteen sedentary university students who are their gender 60 female and 58 male, their age 21.2 ± 2.1 year, their body weight 61.2 ± 10.7 kg, and their height 168.2 ± 8.1 cm participated in this study voluntarily. Anthropometric measurements (circumference and length) and 30 m sprint test was performed in the research group.

Height of the research group was measured in cm by a nonflexible measuring tape of 0.1 cm sensitivity barefoot and by enabling anatomic posture, and their weight was measured in kg wearing shorts and t-shirt by an electronic scale of 100 gr sensitivity.

Anthropometric Measurements: Anthropometric measurements were made based on techniques suggested by International Biological Program (IBP)(Harvey, 1974) and "International Society for the Advancement of Kinanthropometry (ISAK)(23).

Stature (shoulder, chest, trunk, waist, hip, thigh, knee, calf and ankle) and length measurements (height, overarm, upper arm, fore arm, all arms, trunk, thigh, leg and whole leg) was made by an nonflexible measurement tape of 0.1 cm sensitivity.

All of the research group was performed a lumbering up protocol that included jogging 10 minutes and stretching exercise 10 minutes before 30 meter sprint test.

30 meter sprint test: Each volunteer in the research group ran in a tiled floor sports saloon in an area determined as 30 m with starting stand and maximum rigor. Running period was recorded in seconds by a Casio brand digital chronometer. This test was repeated three times by each volunteer and the best repeat test result was recorded.

Statistical analysis was made by SPSS 22.0 for Windows package program. Arithmetic mean, standard deviation, the lowest and highest values were determined. The relationship between anthropometric parameters and speed performance was tested by "Pearson Correlation". Margin of error (α) was regarded as p<0.05 and p<0.01.

RESULTS

Physical characteristics and anthropometric measurement values of the research group and other findings in the study are presented in the following tables.

Table 1. Physical characteristics of the women in research group.

Parameters	n	Minimum	Maximum	Mean	SD
Age (year)	60	18.0	28.0	21.1	2.0
Height (cm)	60	148.0	173.0	162.3	5.5
Body Weight (kg)	60	41.50	75.8	55.6	7.1

Table 2. Circumference measurement values of the women in research group.

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Shoulder	60	83.0	102	93.5	4.3
Chest	60	75.0	90.0	82.9	4.1
Trunk	60	57.0	89.0	66.0	5.1
Girth	60	58.0	87.0	72.9	6.8
Hip	60	79.0	104.0	90.5	5.4
Thigh	60	41.0	96.0	49.9	7.3
Knee	60	29.0	38.0	33.8	2.1
Calf	60	20.0	39.0	32.9	3.1
Ankle	60	18.5	24.0	21.1	1.4

Table 3. Length measurement values of the women in research group.

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Overarm	60	73.0	177.5	162.4	13.5
Upper Arm	60	30.0	40.0	36.3	1.9
Fore Arm	60	33.5	47.0	42.9	2.1
Whole Arm	60	70.5	86.0	79.1	3.4
Trunk	60	38.5	50.0	42.3	2.4
Thigh	60	36.0	49.5	40.9	2.7
Calf	60	31.0	45.0	37.8	2.8
Whole Leg	60	69.0	91.0	78.4	4.7

Table 4. Sprint test values of the women in research group.

Parameters (sec)	n	Minimum	Maximum	Mean	SD
Speed Period	118	4.91	6.31	5.55	0.30

Table 5. Relationship between speed values and circumference and length measurements on women.

Variables		Speed Period	Variables		Speed Period
Body Weight	r	.304*	Height	r	.149
	p	.018		p	.255
	n	118		n	118
Shoulder Circumference	r	.190	Overarm Length	r	-.004
	p	.146		p	.975
	n	118		n	118
Chest Circumference	r	.152	Upper Arm Length	r	.082
	p	.248		p	.536
	n	118		n	118
Trunk Circumference	r	.348*	Forearm Length	r	.127
	p	.010		p	.332
	n	118		n	118
Girth Circumference	r	.363**	Whole Arm Length	r	.297*
	p	.004		p	.021
	n	118		n	118
Hip Circumference	r	.369**	Trunk Length	r	.263*
	p	.004		p	.042
	n	118		n	118
Thigh Circumference	r	.020	Thigh Length	r	-.018
	p	.879		p	.094
	n	118		n	118
Knee Circumference	r	.270*	Calf Length	r	.218
	p	.037		p	.095
	n	118		n	118
Calf Circumference	r	.293*	Whole Leg Length	r	.071
	p	.023		p	.591
	n	118		n	118
Ankle Circumference	r	.282*			
	p	.029			
	n	118			

*p<0.05; **p<0.01

On women, it was established that there was a medium positive relationship between trunk circumference, girth circumference, hip circumference values and sprint period values (0.01). Besides, there was a weak positive significant relationship between knee circumference, calf circumference, ankle circumference, whole arm length, trunk length values and sprint period values (0.05).

On men, it was found that there were a no significant relationship anthropometric parameter values and sprint period values (0.05).

Without gender gap, according to statistical analysis findings; it was determined that there was a strong negative relationship shoulder circumference, chest circumference, height, forearm length, trunk length values and sprint period values (0.01) besides there was a medium negative significant relationship body weight, chest circumference, whole arm length, whole leg length values and sprint period values (0.05). Moreover, it was found that there was a weak negative significant relationship girth circumference, calf length, overarm length values and sprint period values (0.01); in addition, there was a weak significant relationship calf circumference, thigh circumference values and sprint period values (0.05).

Table 6. Physical characteristics of the men in research group.

Parameters	n	Minimum	Maximum	Mean	SD
Age (year)	58	18.0	30.0	21.2	2.1
Height (cm)	58	158.5	190.0	174.3	5.4
Body Weight (kg)	58	51.4	92.90	68.9	9.7

Table 7. Circumference measurement values of the men in research group.

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Shoulder	58	92.0	130.0	108.5	6.5
Chest	58	76	107.0	88.4	6.2
Trunk	58	63.0	98.0	75.7	6.5
Girth	58	64.0	99.0	79.6	7.0
Hip	58	79.0	105.0	91.5	5.4
Thigh	58	40.0	83.0	50.9	6.2
Knee	58	30.5	41.0	35.2	2.0
Calf	58	25.0	43.0	34.9	3.1
Ankle	58	17.5	31.0	22.6	2.1

Table 8. Length measurement values of the men in research group.

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Overarm	58	82.0	192.5	174.9	18.6
Upper Arm	58	32.0	44.0	38.4	2.3
Fore Arm	58	40.0	52.5	47.3	2.2
Whole Arm	58	75.0	95.5	85.5	4.2
Trunk	58	39.5	53.0	47.1	3.1
Thigh	58	38.0	50.0	42.5	2.8
Calf	58	35.0	46.5	40.3	2.6
Whole Leg	58	71.0	91.0	82.5	4.2

Table 9. Sprint test values of the men in research group.

Parameters (sec)	n	Minimum	Maximum	Mean	SD
Speed Period	58	4.10	5.56	4.51	0.25

Table 10. Relationship between speed values and circumference and length measurements on men.

Variables		Speed Period	Variables		Speed Period
Body Weight	r	.213	Height	r	.049
	p	.109		p	.715
	n	58		n	58
Shoulder Circumference	r	.101	Overarm Length	r	.217
	p	.451		p	.101
	n	58		n	58
Chest Circumference	r	.019	Upper Arm Length	r	.077
	p	.888		p	.567
	n	58		n	58
Trunk Circumference	r	.005	Forearm Length	r	.051
	p	.973		p	.702
	n	58		n	60
Girth Circumference	r	.122	Whole Arm Length	r	-.016
	p	.362		p	.904
	n	58		n	58
Hip Circumference	r	.174	Trunk Length	r	.088
	p	.192		p	.509
	n	58		n	58
Thigh Circumference	r	-.046	Thigh Length	r	.061
	p	.731		p	.651
	n	58		n	58
Knee Circumference	r	.165	Calf Length	r	.163
	p	.214		p	.221
	n	58		n	58
Calf Circumference	r	.031	Whole Leg Length	r	.216
	p	.815		p	.104
	n	58		n	58
Ankle Circumference	r	.026			
	p	.849			
	n	58			

*p<0.05; **p<0.01

Table 11. Physical characteristics of the research group.

Parameters	n	Minimum	Maximum	Mean	SD
Age (year)	118	18.0	30.0	21.2	2.1
Height (cm)	118	148.0	190.0	168.2	8.1
Body Weight (kg)	118	41.50	92.90	61.2	10.7

Table 12. Circumference Measurement Values of the Research Group

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Shoulder	118	83.0	130.0	100.9	9.3
Chest	118	75.0	107.0	85.63	6.0
Trunk	118	57.0	98.0	70.8	7.7
Girth	118	58.0	99.0	76.2	7.6
Hip	118	79.0	105.0	91.0	5.4
Thigh	118	40.0	96.0	50.4	6.8
Knee	118	29.0	41.0	34.5	2.2
Calf	118	20.0	43.0	33.9	3.3
Ankle	118	17.5	31.0	21.8	1.9

Table 13. Length measurement values of the research group.

Parameters (cm)	n	Minimum	Maximum	Mean	SD
Overarm	118	73.0	192.5	168.6	17.3
Upper Arm	118	30.0	66.0	37.6	3.5
Fore Arm	118	33.5	52.5	45.1	3.1
Whole Arm	118	46.0	95.5	82.1	6.1
Trunk	118	38.5	53.0	44.6	3.7
Thigh	118	36.0	50.0	41.7	2.8
Calf	118	31.0	46.5	39.0	3.0
Whole Leg	118	69.0	91.0	80.4	4.9

Table 14. Sprint test values of the research group.

Parameters (sec)	n	Minimum	Maximum	Mean	SD
Speed Period	118	4.10	6.31	5.04	0.60

Table 15. Relationship between research groups' speed values and circumference and length measurements.

Variables		Speed Period	Variables		Speed Period
Body Weight	r	-.451**	Height	r	-.618**
	p	.000		p	.000
	n	60		n	60
Shoulder Circumference	r	-.672**	Overarm Length	r	-.269**
	p	.000		p	.003
	n	60		n	60
Chest Circumference	r	-.383**	Upper Arm Length	r	-.156
	p	.000		p	.091
	n	60		n	60
Trunk Circumference	r	-.507**	Forearm Length	r	-.587**
	p	.000		p	.000
	n	60		n	60
Girth Circumference	r	-.282**	Whole Arm Length	r	-.446**
	p	.002		p	.000
	n	60		n	60
Hip Circumference	r	.049	Trunk Length	r	-.519**
	p	.596		p	.000
	n	60		n	60
Thigh Circumference	r	-.066	Thigh Length	r	-.230*
	p	.477		p	.012
	n	60		n	60
Knee Circumference	r	-.176	Calf Length	r	-.290**
	p	.057		p	.001
	n	60		n	60
Calf Circumference	r	-.193*	Whole Leg Length	r	-.310**
	p	.036		p	.001
	n	60		n	60
Ankle Circumference	r	-.162			
	p	.080			
	n	60			

*p<0.05. **p<0.01

DISCUSSION

A study conducted on Physical education and sport high School students by Bozlar has found that the general age average of students was 20.52±0.55 year. The average weight of students was

71.028±1.84 kg, and the average height of students was 174.38±1.39 cm (6).

A similar study conducted on university students by Yaprak has found that the age average of students was 22.84±2.42 year, the average weight of students was 62.27±880 kg, and the average height of students was 169.42±7.21 cm (34).

The another similar study conducted on university students by Bostancı et al. has found that the general age average of students was 22.27 ± 2.20 year. The average weight of students was 66.77 ± 8.12 kg, and the average height of students was 172.36 ± 6.14 cm (4).

A different study conducted on university students by Yorulmaz et al. has found that the general age average of students was 19.84±1.33 year.The average weight of students was 68.42±8.23 kg, and the average height of students was 170.38±8.19 cm (35).

The another different study conducted on KTÜ Giresun Education Faculty students by Kalkavan et al. has found that the general age average of students was 22.2year, the average weight of students was 67.8 kg, and the average height of students was 1.67 m (13).

The end of this study, physical education and sport high School students has found that the general age average of students was 21.2 ± 2.1 year. The average weight of students was 61.2 ± 10.7 kg, and the average height of students was 168.2 ± 8.1 cm. In addition to that Female physical education and sport high School students has found that the general age average of students was 21.1 ± 2.0 year. The average body weight of students was 55.6 ± 7.1 kg. and the average height of students was 162.3 ± 5.5 cm. and male physical education and sport high School students has found that the general age average of students was 21.2 ± 2.1 year. The average weight of students was 68.9 ± 9.7 kg, and the average height of students was 174.3 ± 5.4 cm. The results are parallel to others study in related body of literature.

Number of studies scrutinizing the relationship between anthropometric characteristics and speed performance is low considerably. Therefore, the discussion was made directly only along with the studies investigating the relationship between anthropometric characteristics and speed performance indirectly.

Physical structure is only one of the factors affecting performance and success. Physical structure combines with strength, power, flexibility, speed, resistance and swiftness, which are among motor characteristics necessary for the sports branch, and influences the success of the athlete positively(30).

In addition to such factors for success in sports performance or sports, anthropometric characteristics also have a role. In general, when these attributes which are determined genetically are evaluated well, they are provided for performance in a certain sports branch(33).

It is known that each sport has unique characteristics. It is also known that these attributes of athletes with special physical structure appropriate to the branch are effective for success. Knowing physical characteristics of successful athletes in skill selection could be a model. For this reason, it is important to take measurements of length. Circumference, etc., among physical attributes(7,27).

Especially performance and strength generation is directly related to height, body weight, arm and leg lengths, joint mobility, and flexibility levels(1).

Determination of anthropometric profile facilitates determination of training process and skills of the players. When anthropometric body measurements are taken as the basis by using standard methods, athletes display high degree performance(21).

Several studies have assessed the anthropometric, physiological, psychological, and motor skill attributes of individual sports(3,9,15,18,25,31).

The statistical analysis results of this study have corroborated in the other studies in related body of literature.

In conclusion; it was found that there was a significant relationship between the speed values of the study group and body weight, shoulder, chest, trunk, waist circumference (p<0.01) and calf circumference (p<0.05).And there was a significant relationship between the speed values of the study group and height, fathom length, forearm length, whole arm length, trunk length, calf length (p<0.01) and thigh length (p<0.05). Based on these results; it can be stated that when circumference and length measurements increase, speed performance could increase as well.

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