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Orignal article

The Relationship Between Anthropometry and Jumping Performance in Handball

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Summary. *Background:* Anthropometric measurements are done for various purposes such as monitoring the growth and development of athletes, determining motor performance, physical activity and body composition changes and nutritional interventions. *Aim:* The aim of this study is to determine the relationship between anthropometry and jumping performances in 11-12-year-old girls handball players. *Materials and Methods:* 62 female handball players voluntarily participated in the study. Athlete's height, body weight, body mass index (BMI), body fat ratio and measurements of whole arm, forearm, whole leg, thigh lengths, and elbow, waist, hip, calf, knee, ankle and wrist circumference were measured; reach length, single foot (right-left), double-feet vertical jumping and long jumping test by standing. The data were analyzed in SPSS 20 statistical program and Pearson correlation test was applied in statistical analysis, the significance value was determined as $p < 0.05$. *Results:* There were correlations between athletes' double-feet vertical jumping, all leg and thigh lengths and left-foot vertical jumping and thigh lengths positively; standing long-jumping and height, body weight and body fat ratio negatively; double-feet vertical jumping and body weight, body fat ratio negatively; left-foot vertical jumping and body fat ratio negatively ($p<0.05$). *Conclusions:* In conclusion, it was stated that leg length, body weight, body fat ratio may have an effect on jumping performance in 11-12-year-old female handball players.

Key words: Jumping, anthropometry, handball, nutrition

Introduction

Anthropometry is the interface between anatomy and movement (1). Anthropometric measurements are done for various purposes such as monitoring the growth and development of athletes, determining motor performance, physical activity and body composition changes and nutritional interventions (2). Growth and maturation status of young athletes should be monitored with the nutritional assessments; and necessary precautions should be taken if weight gain, loss or changes in body composition are seen (3). It is all-important to make anthropometric measurements and lead them accordingly for development of physical and motor skills, mental and social abilities in children (4).

Physical properties and body composition are known to be the basis for top athletic performance level (5). Anthropometric measurements are important to predict physical and physiological performances (6). The physical condition, body composition, technical and tactical capacities of the athletes according to the sports affect their performance (7).

Every sports branch has unique needs, that is why every athlete must have his/her own anthropometric features and a body composition for self-sport discipline (8). Nevertheless, the most effective criterions in determining the performance in sports are height and body weight. Height and body weight are included in the anthropometric prerequisites for the selection of athletes and development of their performance (9,10).

Understanding the physical proper-ties of successful athletes can be a model for talent selection. For this, physical properties such as length, perimeter etc. making measurements are of the essence (11).
Handball is a fast and dynamic sport that requires good physical strength. Handball performance can be affected by skill, tactical understanding and physical abilities, depending on the anthropometric features and the age of the player (12). Anthropometric and physiological examinations to be applied will contribute to the selection of the athlete and the training model, and to create a vision for targeted success (13). Astrand et al. (1986) stated that considering the speed, shot height and angle in handball, it would be advantageous for the athlete to be taller. Handball players appear to have an above average body weight, on the other hand their body fat percentage is below average (14). For good performance in handball, the ability to jump, fall, turn and twist vertically and horizontally are also important in body deceptions, as well as physical properties like firing speed and firing force (15). For this reason, it is crucial to approach anthropometry and jumping ability together, which are very important especially in handball. The aim of this study is to determine the relationship between anthropometry and jumping performances in 11-12-year-old female handball players.

Materials and Methods

This study was conducted with 62 handball female athletes in different sports clubs in Ankara, who had at least 2 years of sports history and participated in official competitions in their age group. Students' families and sports clubs were given detailed information about the study and their approval was applied.
The length of athletes was measured with 0.01 m. on the sensitive scale, and Body Mass Index (kg/m2), body fat ratio (%) were measured with a body analyzer, branded Tanita (BC-418). An anthropometric set of Holtain branded was used for length and perimeter measurements of elbow, waist, hip, calf, knee, foot and wrist circumference.
In the standing long-jumping test, athletes jumped 2 times from the starting point to the front with two-feet forward, the farthest distance to the jump recorded as centimeter.
Single-double foot vertical jumping test was measured with Takei jumping meter, athletes were tied to the abdominal region and the arms were freely jumped from one and two feet vertically to fall into a certain area. Two trials were made and the best high value was recorded as centimeter.
SPSS 20 software was used to analyze the data and Pearson correlation test was used ($p < 0.05$).

Results

In the present study, it was found that there were statistically significantly negative correlations between standing long-jumping and height, body weight, body fat ratio; double-feet vertical jumping and body weight, body fat ratio; left foot vertical jumping and body fat ratio ($p < 0.05$).
A significant positive correlation was found between whole leg and thigh lengths with double-feet vertical jumping; left foot vertical jumping and thigh lengths ($p < 0.05$).

Discussion

In the present study, the results of relationships between anthropometry and jumping performances in 11-12 year old female handball players discussed below.

Białoskórska et al. (2016) stated that there was a significant correlation between the vertical jumping skills and body compositions of volleyball players, and the vertical jumping height was found to be positively correlated with the body mass percentage and the body mass index negatively. Strong correlations were reported by Silvestre et al. (2006), between body composition and vertical jumping, and Ostojic et al. (2006) between body composition and anaerobic power. Crawford (1996) said that body size plays an important role in sports performance, and people with larger body sizes have more strength and maximum anaerobic power. Aslan et al. (2011) found that there was a correlation between body weight and standing long-jumping. Aouichaoui et al. (2014) reported a

Table 1. Athlete's physical properties and the measurements of jumping, length and perimeter

n- 62		Min.	Max.	Mean	SD
Physical Properties	Height (cm)	128,00	173,50	150,53	12,47
	Body Weight (kg)	24,70	68,90	45,14	11,95
	BMI (kg/m²)	15,50	34,60	21,65	5,17
	Body fat ratio	16,20	37,90	24,06	6,16
Jumping Measurements (cm)	Standing long-jumping	93,00	202,00	143,36	21,52
	Double-feet jumping	7,00	50,00	25,40	10,61
	Right-foot jumping	2,00	40,00	17,84	8,33
	Left-foot jumping	2,00	40,00	15,20	9,94
	Reaching length	164,00	225,00	193,04	15,85
Length Measurements (cm)	Whole arm	52,00	81,00	65,80	7,14
	Forearm	21,00	39,00	28,52	4,33
	Whole leg	39,00	101,00	83,00	15,27
	Thigh	37,00	78,00	49,36	9,54
Circumferential Measurements (cm)	Elbow	19,00	27,00	22,24	1,98
	Waist	52,00	97,00	72,92	9,56
	Hip	54,00	106,00	86,64	11,54
	Calf	36,00	59,00	47,22	6,11
	Knee	23,00	42,00	33,44	3,96
	Wrist	13,00	24,00	16,08	2,71
	Ankle	13,00	28,00	22,76	4,36

Table 2. Relationship between jumping and physical features of athletes

n- 62		Height (cm)	Body weight (kg)	BMI (kg/m²)	Body fat ratio (%)
Standing long-jumping (cm)	r	**-0,410***	**-0,486***	-0,152	**-0.456***
	p	0.021	0.022	0.067	0.032
Double-feet jumping (cm)	r	0,240	**-0,356***	0,113	**0,571***
	p	0.243	0.021	0.072	0.031
Right foot jumping (cm)	r	-0,098	-0,272	-0,049	0,000
	p	0.561	0.341	0.122	0.071
Left foot jumping (cm)	r	0,183	-0.015	0,137	**-0.450***
	p	0,231	0.034	0.944	0.032

p<0.05*

Table 3. Relationship between jumping and length and perimeter measurements of athletes

		Length				Circumference						
n- 62		**Whole arm(cm)**	**Forearm (cm)**	**Whole leg (cm)**	**Thigh (cm)**	**Elbow (cm)**	**Waist (cm)**	**Hip (cm)**	**Calf (cm)**	**Knee (cm)**	**Wrist (cm)**	**Ankle (cm)**
Standing long-jumping (cm)	r	0,104	-0,065	0,087	0,259	-0,095	-0,162	0,094	0,045	-0,04	0,067	-0,017
	p	0,622	0,756	0,678	0,212	0,652	0,438	0,654	0,831	0,849	0,749	0,934
Double-feet jumping (cm)	r	0,318	0,159	**,409***	**,414***	-0,057	0,003	0,044	0,017	0,037	-0,173	0,147
	p	0,121	0,447	0,043	0,04	0,786	0,988	0,833	0,936	0,862	0,407	0,484
Right foot jumping (cm)	r	0,074	-0,177	0,123	0,1	-0,316	-0,095	-0,218	-0,289	-0,256	-0,415	-0,052
	p	0,725	0,399	0,558	0,634	0,124	0,653	0,295	0,162	0,217	0,069	0,806
Left foot jumping (cm)	r	0,316	0,049	0,25	**,424***	-0,055	0,112	0,034	-0,107	0,098	-0,197	0,084
	p	0,124	0,817	0,227	0,035	0,795	0,593	0,873	0,611	0,642	0,346	0,688

p<0.05*

negative correlation between vertical jumping performance and body weight, height and body mass index in their study on athletes in prepuberte period. Copić et al. (2014) in their study on athletes, determined that if an athlete has the higher the body fat rate, the vertical jump height will lower. In this study, there were statistically significant correlations between double-feet vertical jumping, all leg and thigh lengths and left-foot vertical jumping and thigh lengths positively; standing long-jumping and height, body weight and body fat ratio negatively; double-feet vertical jumping and body weight, body fat ratio negatively; left-foot vertical jumping and body fat ratio negatively ($p<0.05$).

Yıldırım and Özdemir (2010) reported in their study that height, body fat percentage, chest circumference, waist circumference, thigh circumference, calf circumference, thigh length, calf length, leg strength and flexibility were significantly effective on vertical jumping distance on elite handball players. Kılınç et al. (2007) stated that athletes with high vertical jumping performance had higher shoulder and hip widths along with all circumferential measurements. And also they found that, especially in the features affecting the vertical jumping, the shoulder, waist and hip circumference of the thigh front and back group muscles are effective as well.

Thigh and calf length is forming the whole leg length and will make the legs longer for the body. This leads the center of gravity to be above, which would be an advantage for vertical and horizontal jumping. In parallel with the contribution of the calf length to the anaerobic power, it is thought to increase the firing force and make a significant impact on jumping (15). Aouadi et al. (2012), found that there was a significant correlation between the height, lower limb length and jumping performance of volleyball players and Kruger et al. (2014) reported a strong relationship between anthropometric data and sprint, jumping, anaerobic and endurance performances.

As a result, present study supports current study results. In this study, it was found that anthropometry affects the jumping performance of handball players. In young handball players, determining these features at an early age is very important for the targeted performance, health, nutritional needs and interventions in order to determine.

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