DOI 10.26773/jaspe.200103

Journal of Anthropology of Sport and Physical Education

ORIGINAL SCIENTIFIC PAPER

Assessment of The Relationships between Physical and Motor Features of Young Wrestlers from Turkey

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Abstract

Physical development, fitness and motor skills are the most important components in determining the performance and success of wrestlers, with wrestling largely dependent on overall body strength and relatively short match times. The aim of the present study is to evaluate the relationships between the physical and motor characteristics of young wrestlers in Sivas, Turkey. The study conducted on 86 male freestyle wrestlers aged 10 to 21 years representing urban and rural areas. The sample was analyzed by age groups; 10 to 14 years olds, 15 to 17 years olds and 18 to 21 years olds due to the skill level of the United World Wrestling (UWW) sport categories. Anthropometric measurements (height, weight, skin folds and body composition) as well as motor tests (speed, flexibility and durability) were performed and the data were analyzed using the Statistical Package for Social Science (SPSS) version 23. The results showed that physical properties were correlated significantly with motor features and affected them significantly. According to standardized regression coefficients (β), particularly muscle mass and free fat mass values were presented significant relationships on the anthropometric characters for all of age groups. As a conclusion, wrestlers from all age groups have presented with high level of fat mass, muscle mass and fat free mass where motor and physical properties are highly correlated among the wresting athletes in accordance with the special traning methods.

Keywords: *Wrestling, Physical Properties, Motor Characters, Sivas, Turkey*

Introduction

During the last century, increasing the value attached to sport in the world, and especially in Turkey, has led to young people exercising in different areas. The role of climate and environmental conditions can not be denied among the reasons why people prefer sports. However, the physical structure, performance, motor characteristics and body composition of the individual are also important. Furthermore, recognizing skillful and intelligent athletes are currently one of the most important and striking issues in sport. In other words, the identification, training and evaluation of talented athletes discovered early on prepare them for their future success (Jafari, Damirchi, Mirzaei, & Nobari, 2016). One of the sports that should start at an early age is wrestling. Wrestling is one of the oldest combat sports and dates back to 708 BC to the ancient Greek Olympic Games. Today, there are two types of wrestling on the international platform known as Greco-Roman wrestling and freestyle wrestling. Greco-Roman wrestlers can use the upper body only for attack, and it is forbidden to hold them under the waist. However, in freestyle wrestling they are allowed to use their entire body during the competition (Chaabene et al., 2016).

Any sport that be exercised and match within a short peri-

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od of time, requires high level of total body strength (Cicioğlu, Kürkçü, Eroğlu, & Yüksek, 2007). In this branch where physical and motor features are very prominent, it is important to know how these characteristics affect each other, and to control choice of skills and exercise planning (Bulğay, & Çetin, 2018). Wrestling can be defined as a fight of two wrestlers to gain superiority through technique, skills, strength and intelligence in accordance with the rules of the International Wrestling Federation (FILA) (Aslan, Karakollukçu, Gül, & Fişne, 2013). In wrestling, games require very fast movements in a short time, matches consist of 2 periods with 3 minutes (Demirkan, Kutlu, Koz, Özal, & Favre, 2014). Wrestling is one of the most challenging sport that requires anaerobic power due to the high stress on metabolic systems, where the anaerobic energy supplies the short, quick, and explosive all-out burst of maximal power and strength (Lansky, 1999; Cengiz & Demirhan, 2013; Jafari et al., 2016; Nikooie, Cheraghi, & Mohamadipour, 2017). The wrestler athletes can achieve success, when various features are integrated such as; the high strength of the body, physical fitness, mentall ability, flexibility, high speed and reaction timethat athlete can make quick defensive or attack (Özer, Şahin, Karakulak, & Aslan, 2017; Cicioğlu et al., 2007; Pryimakov, 2015; Jafari et al., 2016).

Considering of the basic studies in the field of wrestling in the world, Zaccagni (2012) studied on anthropometric characters and body composition of Italian national wrestlers aged of 18 to 33 years. As a conclusion, females competed at above the predicted class for their minimum weight while males were competed at a weight class below the minimum predicted weight. Mirzaei, Curby, Rahmani-Nia, & Moghadasi (2009) samples were consist from physical features of elite Iranian junior freestyle wrestlers and cadet wrestlers. In conclusion, Iranian junior wrestlers' physical characters were similar with elite wrestlers from other countries. Ohya et al. (2015) researched on physical fitness profile of Japanese elit male wrestlers, compared to weight classes. According to Ohya et al. (2015), motor characters were correlated with physical characters and affect each other. On wrestling, there were effect both anaerobic and aerobic powers. Ramirez-Velez et al. (2014) studied on anthropometric characteristics and physical performance of Colombian elite male wrestlers, aged of 27.9 ± 6.7 years. As a conclusion, it was provided an information for tactical and training about Colombian elite male wrestlers. Sterkowicz-Przybycień, Sterkowicz, & Żarów (2011) researched on somatotype and body composition of Polish wrestlers, compared to weight category. In conclusion, physical structe and body composition of wrestlers change by the weight categories and the heavier wrestlers' characteristic type was endomorph-mesomorph, while lighter wrestlers' type was balanced mesomorph. Considering the studies in Turkey, Vardar, Tezel, Öztürk, & Kaya (2007) samples were consist from body composition and anaerobic performance of elite young wrestlers aged between 15 to 19 years. According to Vardar et al. (2007), there was no relation between anaerobic variables and fat mass (%). Demirkan, Koz, Kutlu, & Favre, (2015) studied on physical and physiological profiles in elite and amateur young wrestlers aged between 15 to 17 years. The results of this study show that for the wrestlers to be in the elite category, there must be training experience, aerobic endurance, and anaerobic power. Aslan et al. (2013) researched on physical and motor characters of young wrestlers aged of 13-15 years. In conclusion, the anaerobic power and aerobic endurance values of wrestlers were found to positively change with the effect of training within a year.

Throughout the history, Turks have given special importance to the wrestling sport and Sivas province located at the eastern part of the Central Anatolia has an important place providing many Olympic and World champions. Various studies have focused on the just physical characters of the wrestlers; however, the present study focuses on both physical and motor characteristics of the wrestlers. We evaluated the young freestle wrestlers ages 10 and 21 years with the following aims: (1) to describe the anthropometric and motor characters of wrestlers, and (2) to assessment of the relationships between physical and motor features of young wrestlers from Sivas, Turkey.

Methods

Subjects

This work was carried out in January-February 2018 period in Sivas. In the present study, 86 male free-style wrestlers between the ages 10 and 21 years from Sivas province, representing rural environments was attended. Study was carried out under the permission of local boards of Directorate of Youth and Sports of Sivas Province family consent was taken from each individual under 18 years of age, over 18 years of aged individuals' personal consent was taken. Sample were analysed by age groups; 10-14 (schoolboys), 15-17 (cadets) and 18-21 (juniors) years due to the proficiency levels of United World Wrestling (UWW) sport categories. Each group were training 4 days per week and average 12 hours with wrestling trainer.

Ethics approval and consent to participate

The Sivas survey was conducted with the permission of the Directorate of Youth and Sports of Sivas Province and local sport clubs. Ethical approval was taken from Sivas Cumhuriyet University Ethical Commission (60263016-050.06-12/10/2017), and consent was taken from each child' parents before participating.

Measurements

According to the standard anthropometric protocols (Lohman, 1988; Weiner & Lourie, 1969), height (cm), weight (kg), biepicondylar humerus (cm) and femur breadths (mm), triceps, subscapular, supraspinale and medial calf skinfolds (mm), flexed and tensed arm girth and calf girth (cm) were measured. Height (H) to the nearest mm with Martin type anthopometer, weight (W) to the nearest 100g by Tanita (SC-330s), breadth was measured to the nearest mm by digital caliper, skinfolds were measured to the nearest mm with Holtain type skinfold, and circumferences were measured by non-elastic tape.

Body Composition Analyses, such as, Fat Percentage (F%), Fat Mass (FM), Fat Free Mass (FFM), Muscle Mass (MM) and Body Mass Index (kg/m2) (BMI) were conducted using Body Composition Analyzer (Tanita SC-330).

Motor properties, upper extremity strength, speed, flexibility and durability characteristics have been determined. Plate tapping test - speed of the limb movement, standing broad jump test - measures explosive leg power, handgrip test with dynamometer (Takei-Japan) - measures static arm strength, sit-ups in 30 seconds - measures trunk strength, and standing medicine ball test - measures arm strength were applied (Pescatelo, 2000).

Statistics

The data were analysed using Statistical Package for Social Science (SPSS) version 23. Kolmogorov-Smirnov test was used to find out whether the data had a normal distribution and looked at the skewness and kurtosis and it was found that the data have a normal distribution. The descriptive statistics (mean and standard deviation) was conducted, student t-test (independent sample test) was used to understand the relationship between variables, and Pearson correlation analysis and multiple linear regressions were applied.

Results

Descriptive statistics and independent sample t-test results, Pearson correlation analysis and multiple linear regression results are given in Tables (1-9).

It has been seen that the data (the physical characteristics of young wrestlers) are placed within the normal distribution boundaries, when looked at based on the central and dispersion parameters the values of the skewness and the kurtosis. Physical characteristics of young wrestlers by age groups (schoolboys-cadet) showed that there is a significant difference between weight, height, upper arm length, suprailiac, supraspinale, supscapular, biceps, triceps and calf skinfolds, bust height, upper leg length, biceps girth (tensed and flexed), calf girth, fat percentage and mass, free fat mass, muscle mass and body mass index values ($p< 0.05$). Furthermore, there is a significant differance all of values between the cadets and juniors in Table 1.

Table 1. Descriptive statistics on physical features by age group

	Schoolboys (n=41)		Cadets (n=21)		Juniors (n=24)		Skewness	Kurtosis
	Mean	SD	Mean	SD	Mean	SD		
Weight (kg)	51.12	18.26	72.2**	15.43	80.00**	11.88	-.066	.628
Height (cm)	154.50	13.03	168.04**	4.41	170.45**	6.74	-.893	.458
Upper Arm Length (cm)	374.96	45.03	407.81**	24.78	421.30**	23.43	-.841	.819
Suprailiac Skinfold (mm)	5.71	4.80	6.48**	4.68	5.56**	4.72	-.178	-.963
Supraspinale Skinfold (mm)	8.91	3.27	10.24**	0.21	9.89**	1.71	-.573	.874
Subscapular Skinfold (mm)	9.57	2.38	10.23**	0.15	10.27**	0.19	-.870	.073
Bust Height (cm)	838.91	71.65	900.57**	27.29	896.13**	39.45	-.934	.302
Upper Leg Length (cm)	500.63	53.70	572.07**	49.75	539.43**	33.85	-.161	.309
Biceps Girth (Tensed) (cm)	25.29	4.25	28.52**	3.82	31.58**	3.65	-.087	-.125
Biceps Girth (Flexed)	29.42	5.12	34.43**	4.34	35.44**	3.69	-.263	-.342
Biceps Skinfold (mm)	2.11	3.45	1.02**	2.14	0.66**	0.46	.170	.189
Triceps Skinfold (mm)	8.01	4.00	9.27**	2.77	8.73**	3.44	-1.748	1.074
Calf Skinfold (mm)	7.24	4.40	6.20**	4.64	2.07**	3.28	.133	-1.979
Calf Girth (cm)	32.29	4.41	35.27**	3.96	36.29**	2.89	-.142	-.018
Fat %	17.26	5.95	16.51**	6.61	15.90**	5.50	-.007	.100
Fat Mass	10.51	6.64	14.40**	6.79	13.01**	5.74	1.073	.692
Free Fat Mass	46.11	12.75	61.17**	9.28	66.92**	8.30	-.387	-.561
Muscle Mass	43.70	12.15	58.05**	8.80	63.36**	7.97	-.378	-.554
Body Mass Index	20.93	3.84	25.61**	5.29	27.51**	2.32	.239	-.295

Note: *<0.05; ** p<0.001 difference between successive age groups using student t-test

It has been seen that the data (the motor features of young wrestlers) are placed within the normal distribution boundaries, when looked at based on the central and dispersion parameters the values of the skewness and the kurtosis. The results showed a significant difference in plate tapping test, standing broad jump test, handgrip test (right and left), sit-ups in thirty seconds and standing medicine ball values in motor features between the schoolboys and cadets (Table 2). Also, in motor tests between the cadets and juniors, there is a significant differance all of values.

Table 2. Descriptive statistics on motor features by age groups

	Schoolboys (n=41)		Cadets (n=21)		Juniors (n=24)		Skewness	Kurtosis
	Mean	SD	Mean	SD	Mean	SD		
Plate Tapping Test	13.40	2.99	11.06**	1.69	10.82**	1.30	1.851	.575
Standing Broad Jump Test (cm)	194.99	20.29	226.17**	16.93	242.69**	19.83	-.159	-.801
Right Handgrip Test	28.41	10.89	45.10**	8.16	46.73**	3.15	-.457	-.598
Left Handgrip Test	27.04	11.33	41.43**	8.65	45.47**	4.66	-.478	-.697
Sit-ups in thirty seconds	26.08	5.88	32.31**	5.76	37.29**	3.99	-.231	-.477
Standing Medicine Ball Test (m)	5.22	1.81	7.81**	1.96	9.52**	1.16	-.200	-1.029

Note: *<0.05; ** p<0.001 difference between successive age groups using student t-test

According to the results of correlation analysis, significant relationships weight, height, upper arm length, suprailiac, supspinale, supscapular, biceps, triceps and calf skinfolds, büst height, upper leg length, biceps girth (tensed-flexed) and calf girth with plate tapping test, standing broad jump test, hand grip test (right-left), sit-ups in thirty seconds test and stand-

ing medicine ball test were observed. Similarly, F%, FM, FFM, MM and BMI values with these performance values are significantly correlated. However, there are high correlation coefficients between weight, height, biceps girth, FFM, MM and BMI, and handgrip test and standing medicine ball test (Table 3) measures.

Table 3. Relationship coefficients between physical and motor features (pearson correlation analysis)

Correlations		PTT	SBJT	RHT	LHT	STST	SMBT
Weight	r	-.560**	.447**	.764**	.757**	.573**	.809**
	p	.000	.000	.000	.000	.000	.000
Height	r	-.578**	.468**	.727**	.738**	.572**	.703**
	p	.000	.000	.000	.000	.000	.000
Upper Arm Length	r	-.349**	.320**	.500**	.509**	.433**	.580**
	p	.000	.000	.000	.000	.000	.000
Suprailiac Sf.	r	-.154**	-.201**	.120**	.130**	.037**	.177**
	p	.000	.000	.000	.000	.005	.000
Supraspinale Sf.	r	-.214**	.107**	.208**	.250**	.212**	.265**
	p	.000	.000	.000	.000	.000	.000
Subscapular Sf.	r	-.297**	-.025	.159**	.202**	.105**	.220**
	p	.000	.000	.000	.000	.000	.000
Bust Height	r	-.573**	.441**	.679**	.693**	.525**	.641**
	p	.000	.000	.000	.000	.000	.000
Upper Leg Length	r	-.518**	.357**	.622**	.591**	.435**	.580**
	p	.000	.000	.000	.000	.000	.000
Biceps Girth (T)	r	-.579**	.500**	.690**	.759**	.507**	.693**
	p	.000	.000	.000	.000	.000	.000
Biceps Girth (F)	r	-.618**	.466**	.693**	.752**	.528**	.672**
	p	.000	.000	.000	.000	.000	.000
Biceps Sf.	r	.139**	-.333**	-.318**	-.317**	-.185**	-.343**
	p	.000	.000	.000	.000	.000	.000
Triceps Sf.	r	-.203**	.047**	.229**	.202**	.076**	.114**
	p	.000	.000	.000	.000	.000	.000
Calf Sf.	r	.141**	-.465**	-.293**	-.286**	-.473**	-.384**
	p	.000	.000	.000	.000	.000	.000
Calf Girth	r	-.473**	.310**	.606**	.595**	.421**	.589**
	p	.000	.000	.000	.000	.000	.000
Fat %	r	.026*	-.310**	-.064**	.014	-.101**	.041**
	p	.049	.000	.000	.302	.000	.002
Fat Mass	r	-.307**	.032*	.438**	.447**	.235**	.463**
	p	.000	.017	.000	.000	.000	.000
Free Fat Mass	r	-.597**	.560**	.815**	.806**	.641**	.833**
	p	.000	.000	.000	.000	.000	.000
Muscle Mass	r	-.595**	.559**	.814**	.805**	.638**	.830**
	p	.000	.000	.000	.000	.000	.000
Body Mass Index	r	-.521**	.358**	.678**	.669**	.494**	.734**
	p	.000	.000	.000	.000	.000	.000

Note: PTT - Plate tapping test; SBJT - Standing broad jump test; RHT - Right handgrip test; LHT - Left handgirp test; STST - Sit-ups in thirty second test; SMBT - Standing medicine ball test, Sf - Skinfold; **- Correlation is significant at the 0.01 level (2-tailed); * - Correlation is significant at the 0.05 level (2-tailed).

Regression analysis results are given in Table 4, the selected physical properties give a statistically significant relationship with the plate tapping test in the schoolboys, cadets and juniors. The plate tapping test explains 64% of the total variance on the schoolboys, while this rate is 87% in the cadets and 84% in juniors. According to standardized regression coefficient (β), the importance of variables on plate tapping test for the schoolboys is MM, FFM and BMI, respectively. While these values on the cadets are BMI, MM and FM, and FM, F% and tensed arm girth on juniors, respectively. Weight and height are not included because of high correlation, these are excluded variables.

Table 4. Regression analysis of the plate tapping test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.802 R2=.643	F=197.14 p=.000		R=.937 R2=.878	F=634.57 p=.000		R=.920 R2=.846	F=548.83 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Weight	-.425	-2.673	.008				-1.634	-28.005	.000
Height	-1.631	-15.123	.000	2.14	11.554	.000	.641	7.273	.000
Upper Arm Length	-.025	-1.430	.153	-.080	-3.482	.001	-.664	-14.687	.000
Suprailiac Sf.	.036	1.274	.203	.126	6.359	.000	1.200	53.133	.000
Supraspinale Sf.	-.020	-1.000	.317	.434	21.648	.000	-.243	-16.143	.000
Subscapular Sf.	-.069	-3.744	.000	-.150	-3.984	.000	.995	34.208	.000
Bust Height	-.246	-5.902	.000	.507	22.047	.000	-1.027	-27.139	.000
Upper Leg Length	-.064	-1.760	.079	-.030	-.603	.547	-1.678	-31.991	.000
Tensed Arm Girth	.420	7.579	.000	.087	1.019	.309	-3.919	-53.494	.000
Flexed Arm Girth	-.260	-4.772	.000	.480	8.893	.000	3.023	43.325	.000
Biceps Sf.	-.006	-.277	.782	.172	4.340	.000	.272	17.836	.000
Triceps Sf.	-.007	-.363	.717	-.064	-2.901	.004	.724	32.396	.000
Calf Sf.	-.223	-11.638	.000	.473	15.998	.000	1.283	41.395	.000
Calf Girth	.181	5.678	.000	.491	15.277	.000	-.196	-7.178	.000
Fat Percentage	.765	14.477	.000	.269	19.581	.000	-6.404	-25.618	.000
Fat Mass	.545	6.581	.000	-4.711	-13.869	.000	7.389	26.054	.000
Free Fat Mass	-5.194	-7.725	.000				-2.732	-7.275	.000
Muscle Mass	7.499	12.083	.000	-5.94	-12.828	.000	2.114	5.642	.000
Body Mass Index	-1.898	-16.151	.000	7.73	10.05	.000	-.405	-4.761	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

The selected physical properties give a statistically significant relationship with the standing broad jump test in the schoolboys, cadets and juniors. The standing broad jump test explains 78% of the total variance on the schoolboys, while this rate is 88% in the cadets and 92% in juniors (Table 5).

Table 5. Regression analysis of the standing broad jump test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.888 R2=.789	F=408.99 p=.000		R=.941 R2=.885	F=683.13 p=.000		R=.963 R2=.927	F=1275.26 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Weight	-.024	-.197	.844				.485	12.103	.000
Height	-1.132	-13.647	.000	-1.705	-9.509	.000	-.263	-4.345	.000
Upper Arm Length	-.164	-12.098	.000	-.539	-24.177	.000	-.209	-6.733	.000
Suprailiac Sf.	.135	6.258	.000	-.816	-42.445	.000	-.900	-57.992	.000
Supraspinale Sf.	.016	1.012	.311	.169	8.678	.000	.186	18.031	.000
Subscapular Sf.	-.018	-1.235	.217	-.429	-11.784	.000	-.422	-21.141	.000
Bust Height	.303	9.455	.000	-.690	-30.998	.000	.642	24.682	.000
Upper Leg Length	.119	4.241	.000	.472	9.936	.000	.891	24.721	.000
Tensed Arm Girth	-.342	-8.028	.000	.902	10.861	.000	1.170	23.253	.000
Flexed Arm Girth	-.650	-15.482	.000	-.246	-4.714	.000	-1.156	-24.108	.000

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Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.888 R2=.789	F=408.99 p=.000		R=.941 R2=.885	F=683.13 p=.000		R=.963 R2=.927	F=1275.26 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Biceps Sf.	-.156	-9.008	.000	-.058	-1.508	.132	.089	8.490	.000
Triceps Sf.	.154	10.468	.000	-.126	-5.924	.000	.185	12.04	.000
Calf Sf.	-.313	-21.304	.000	.035	1.217	.224	-.353	-16.573	.000
Calf Girth	.285	11.664	.000	-.926	-29.749	.000	-.699	-37.179	.000
Fat Percentage	-.213	-5.238	.000	-.079	-5.928	.000	10.3	59.984	.000
Fat Mass	.275	4.323	.000	4.733	14.395	.000	-9.875	-50.692	.000
Free Fat Mass	9.181	17.759	.000				-.193	-.749	.454
Muscle Mass	-6.409	-13.430	.000	6.553	14.619	.000	3.508	13.631	.000
Body Mass Index	-1.385	-15.327	.000	-8.852	-11.889	.000	-1.024	-17.548	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

According to Table 6; the selected anthropological measurements give a statistically significant relationship with the right handgrip test in the schoolboys, cadets and juniors. The right handgrip test explains 87% of the total variance on the schoolboys, while this rate is 97% in the cadets and 92% in juniors. According to standardized regression coefficient (β), the importance of variables on right handgrip test for the schoolboys are MM, FFM and weight, respectively. While these values on the cadets are BMI, MM and FM; and F%, FM and FFM on the juniors.

Table 6. Regression analysis of the right handgrip test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.938 R2=.879	F=793.44 p=.000		R=.985 R2=.970	F=2893.76 p=.000		R=.959 R2=.920	F=1144.27 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Weight	1.311	14.159	.000				-1,466	-34.785	.000
Height	.618	9.834	.000	-1.056	-11.581	.000	2.571	40.407	.000
Upper Arm Length	.001	.074	.941	-.024	-2.131	.033	-.172	-5.266	.000
Suprailiac Sf.	-.216	-13.194	.000	-.358	-36.590	.000	.295	18.088	.000
Supraspinale Sf.	.033	2.793	.005	-.129	-13.027	.000	-.418	-38.497	.000
Subscapular Sf.	-.242	-22.498	.000	-.367	-19.833	.000	.515	24.532	.000
Bust Height	.073	3.002	.003	-.187	-16.523	.000	-1.147	-41.973	.000
Upper Leg Length	.124	5.877	.000	-.577	-23.874	.000	-1.343	-35.45	.000
Tensed Arm Girth	-.084	-2.596	.010	2.030	48.039	.000	-1.354	-25.589	.000
Flexed Arm Girth	-.203	-6.386	.000	-.276	-10.402	.000	1.294	25.683	.000
Biceps Sf.	-.287	-21.824	.000	1.152	59.059	.000	.709	64.321	.000
Triceps Sf.	.179	16.029	.000	.030	2.732	.006	-.040	-2.467	.014
Calf Sf.	-.220	-19.732	.000	.107	7.323	.000	.471	21.037	.000
Calf Girth	-.220	-11.845	.000	-.406	-25.616	.000	.098	4.948	.000
Fat Percentage	.066	2.133	.033	-.704	-104.11	.000	-4.414	-24.45	.000
Fat Mass	-.162	-3.359	.001	3.068	18.343	.000	3.617	17.659	.000
Free Fat Mass	1.569	4.005	.000				-3.244	-11.96	.000
Muscle Mass	-2.413	-6.673	.000	3.915	17.173	.000	2.423	8.955	.000
Body Mass Index	.329	4.799	.000	-5.571	-14.711	.000	.785	12.789	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

The selected anthropological measurements were significant for the left handgrip test in the schoolboys, cadets and juniors. The left handgrip test explains 92% of the total variance on schoolboys, while this rate is 94% in the cadets and 87% in juniors. According to standardized regression coefficient (β), the importance of variables on left handgrip test test for schoolboys is FFM, MM and flexed arm girth, respectively. While these values on the cadets are BMI, FM and MM; and F%, FM and FFM on the juniors (Table 7).

Table 7. Regression analysis of the left handgrip test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.964 R2=.929	F=1420.04 p=.000		R=.972 R2=.945	F=1511.24 p=.000		R=.935 R2=.874	F=695.02 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Weight	-.057	-.799	.424				-,964	-18.288	.000
Height	.105	2.178	.030	-1.185	-9.516	.000	.546	6.860	.000
Upper Arm Length	.054	6.838	.000	-.054	-3.513	.000	-.886	-21.693	.000
Suprailiac Sf.	-.066	-5.222	.000	-.239	-17.86	.000	-.091	-4.477	.000
Supraspinale Sf.	-.002	-.229	.819	-.136	-10.058	.000	-.047	-3.470	.001
Subscapular Sf.	-.132	-15.933	.000	-.582	-23.033	.000	.713	27.151	.000
Bust Height	-.217	-11.636	.000	.124	8.045	.000	.501	14.669	.000
Upper Leg Length	-.207	-12.712	.000	-.595	-18.028	.000	.189	3.982	.000
Tensed Arm Girth	.412	16.587	.000	1.333	23.108	.000	-.342	-5.168	.000
Flexed Arm Girth	-.614	-25.128	.000	.168	4.618	.000	.371	5.892	.000
Biceps Sf.	-.130	-12.883	.000	.854	32.042	.000	.138	10.041	.000
Triceps Sf.	.168	19.552	.000	-.199	-13.46	.000	.211	10.441	.000
Calf Sf.	-.144	-16.854	.000	-.453	-22.755	.000	-.016	-.575	.566
Calf Girth	-.203	-14.26	.000	-.496	-22.953	.000	-.480	-19.44	.000
Fat Percentage	.161	6.810	.000	-.528	-57.182	.000	6.22	27.542	.000
Fat Mass	.055	1.489	.137	5.094	22.307	.000	-5.441	-21.236	.000
Free Fat Mass	3.729	12.390	.000				3.151	9.287	.000
Muscle Mass	-1.887	-6.792	.000	3.935	12.640	.000	-.875	-2.584	.010
Body Mass Index	-.445	-8.457	.000	-7.183	-13.892	.000	-.595	-7.755	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

According to the regression analysis results (Table 8) the selected physical properties showed significant relationship with the sit-ups in thirty seconds test in the schoolboys, cadets and juniors. The sit-ups in thirty seconds test explain 70% of the total variance on schoolboys, while this rate is 82% in the cadets and 95% in juniors.

Table 8. Regression analysis of the sit-ups in thirty seconds test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.840 R2=.706	F=262.88 p=.000		R=.909 R2=.825	F=417.84 p=.000		R=.979 R2=.958	F=2276.40 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Weight	.584	4.046	.000				-.215	-7.064	.000
Height	-.974	-9.953	.000	-4.640	-20.959	.000	.214	4.658	.000
Upper Arm Length	-.017	-1.086	.278	-.432	-15.710	.000	.666	28.204	.000
Suprailiac Sf.	-.153	-5.987	.000	-.063	-2.669	.008	-.247	-20.897	.000
Supraspinale Sf.	.075	4.140	.000	-.096	-4.016	.000	.652	82.842	.000
Subscapular Sf.	-.125	-7.460	.000	-1.695	-37.723	.000	-1.671	-109.923	.000
Bust Height	.606	16.058	.000	-.527	-19.179	.000	.246	12.435	.000
Upper Leg Length	.514	15.581	.000	.425	7.245	.000	3.102	113.185	.000
Tensed Arm Girth	-.220	-4.362	.000	2.625	25.591	.000	2.287	59.745	.000
Flexed Arm Girth	.230	4.636	.000	-1.284	-19.901	.000	-1.547	-42.417	.000
Biceps Sf.	.140	6.832	.000	1.584	33.449	.000	-.500	-62.655	.000
Triceps Sf.	-.123	-7.074	.000	-.875	-33.238	.000	.115	9.808	.000
Calf Sf.	-.390	-22.457	.000	-.566	-15.995	.000	-1.46	-90.185	.000
Calf Girth	.133	4.595	.000	-.187	-4.862	.000	-.294	-20.580	.000

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Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.840 R2=.706	F=262.88 p=.000		R=.909 R2=.825	F=417.84 p=.000		R=.979 R2=.958	F=2276.40 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**t**	**p**
Fat Percentage	.110	2.289	.022	-.254	-15.460	.000	3.614	27.665	.000
Fat Mass	-.182	-2.423	.015	11.716	28.864	.000	-3.556	-23.995	.000
Free Fat Mass	5.011	8.213	.000				6.173	31.453	.000
Muscle Mass	-4.488	-7.969	.000	12.721	22.988	.000	-6.691	-34.177	.000
Body Mass Index	-.393	-3.688	.000	-21.290	-23.163	.000	.237	5.335	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

The selected anthropological measurements showed significant relationship with the standing medicine ball test in the schoolboys, cadets and juniors. The standing medicine ball test explains 87% of the total variance on schoolboys, while this rate is 97% in cadets and 97% in juniors. According to standardized regression coefficient (β), the importance of variables on standing medicine ball test test for schoolboys is FFM, MM and weight, respectively. While these values on the cadets are BMI, MM, FM and FFM on the juniors, respectively (Table 9).

Table 9. Regression analysis of the standing medicine ball test by age group

Age Group	Schoolboys (n=41)			Cadets (n=21)			Juniors (n=24)		
	R=.937 R2=.878	F=787.83 p=.000		R=.989 R2=.979	F=4090.72 p=.000		R=.986 R2=.973	F=3626.69 p=.000	
	Beta	**t**	**p**	**Beta**	**t**	**p**	**Beta**	**T**	**p**
Weight	.868	9.344	.000				1.98	81.341	.000
Height	.691	10.956	.000	3.057	39.68	.000	.163	4.425	.000
Upper Arm Length	.032	3.095	.002	-.523	-54.61	.000	-.253	-13.418	.000
Suprailiac Sf.	-.140	-8.536	.000	-.383	-46.356	.000	-.907	-96.188	.000
Supraspinale Sf.	.113	9.711	.000	-.114	-13.657	.000	.380	60.464	.000
Subscapular Sf.	-.099	-9.200	.000	-.085	-5.440	.000	-.875	-72.109	.000
Bust Height	-.298	-12.231	.000	-.490	-51.185	.000	.081	5.126	.000
Upper Leg Length	-.031	-1.455	.146	-.027	-1.325	.185	1.542	70.450	.000
Tensed Arm Girth	-.140	-4.325	.000	-.279	-7.824	.000	2.063	67.502	.000
Flexed Arm Girth	-.306	-9.589	.000	.298	13.265	.000	-.745	-25.582	.000
Biceps Sf.	-.184	-13.961	.000	-.425	-25.768	.000	-.241	-37.861	.000
Triceps Sf.	-.007	-.662	.508	-.053	-5.773	.000	.075	8.045	.000
Calf Sf.	-.165	-14.718	.000	-.182	-14.789	.000	-1.787	-138.241	.000
Calf Girth	.043	2.333	.020	-.491	-36.680	.000	-.574	-50.315	.000
Fat Percentage	-.059	-1.923	.055	-.096	-16.860	.000	-1.502	-14.403	.000
Fat Mass	-.336	-6.936	.000	-3.272	-23.161	.000	1.936	16.363	.000
Free Fat Mass	1.787	4.547	.000				3.354	21.399	.000
Muscle Mass	-1.745	-4.811	.000	-6.508	-33.789	.000	-3.547	-22.692	.000
Body Mass Index	.377	5.494	.000	10.952	34.235	.000	-.728	-20.530	.000

Note: R – multiple regression coefficient, R2 – dependent variable measuring power, F – value of F-test, p – significance level, Beta – value of beta coefficient, t – value of t-test

Discussion

By evaluating the data obtained from the present study, it was found that the selected physical properties were significantly correlated with all of the motor features and affected them significantly. Özer et al. (2017) studied on young amateur wrestlers -the athletes who regularly train for a year (13 to 14 years). In the present study, height and weight values are 158.2 cm and 56.3 kg, while Özer et al. (2017) found that 162.9 cm and 57.4 kg., respectively. F%, FM, FFM and BMI values were lower than our result. Their results were 12.01%, 7.70, 49.95 and 21.21 respectively. Furthermore, motor features of the cadet wrestlers (standing broad jump, handgrip test and standing medicine ball throw test) are higher than Özer et al. study. Aslan et al. (2013) found a different result with the present study by physical and motor features. Their work area was amateur wrestlers who regularly train in Sivas between the ages of 13 and 15. Their height and weight values were similar with our result, 160.4 cm and 53.7kg, respectively. The present study' motor features (standing broad jump, handgrip test, sit-ups in 30 seconds and standing medicine ball throw) are higher than Aslan et al. (2013) study. According to Taşkıran

(2014), comparing with our result, some anthropometric characters of U.S. National Freestyle Wrestling Team (24 ages) were higher than our result (height and weight values). Then, their body fat value (9.45%) were lower than our wrestlers' body fat value (juniors). However, their handgrip test score (50.38) is higher than our result. Similarly, Zaccagni' (2012) samples (Italian National wrestlers aged of 18 to 33 years) show that F%, FM and FFM values were lower than our result: their results were 10.1, 7.7 and 65.5, respectively. Vardar et al. (2007) samples (Turkish cadet and juniors national team wrestlers) show that their body fat percentage and mass values were lower than our result (9.7% and 7.9). These results (including our results) demonstrated to percent body fat above the minimum recommended by the ACSM (5% for males). According to Yoon (2002), the body fat (%) should be ranges from 3-13 in well-trained wrestlers.

The correlation analysis results demonstrate that there were positive or negative correlation coefficients between many of the physical properties and motor properties. According to Pearson correlation analysis, the all of motor features are increase except plate tapping, when the physical characters rised together with age. There is a high correlation coefficient between weight, height, biceps girth, fat free mass, muscle mass and body mass index, and handgrip test and standing medicine ball test which are indicators of upper extremity explosive force. According to Özer et al. (2017), handgrip forces and standing medicine ball power are rising, when body mass increased. Cvetković, Marić, & Marelić (2005) studied 16 to 20 years old young wrestlers who are preparing for the European and World Championships in Croatia. They argued that body height and body weight were high and positive correlated with throwing medicine ball.

The wrestling has anaerobic and aerobic energy systems, like many other sports (Karnincic, Tocilj, Uljevic, & Erceg, 2009; Mirzaei, Moghaddam, & Abadi, 2017). While the anaerobic system provides maximum power explosion during the match or training, the aerobic system is effective in the effort and improvement of the athletes during the match. Markovic & Jaric (2007) reported that body weight positively affects force and anaerobic power. These motor features are affected by the physical characters (Ohya et al., 2015; Zaccagni, 2015). However, some researchers, such as Horswill (1992) and Mirzaei et al. (2009) say that only anaerobic power is effective, when studied on Elite Iranian junior freestyle wrestlers. While Ohya et al. (2015) (studied on light, middle, and heavy weight-class groups of Japanese elite male wrestlers) argue that both anaerobic and aerobic powers is effective. Yoon (2002) claims that aerobic capacity is also one of the important factors to be successful in wresting sport. The present study results showed that body weight, muscle mass and fat free mass affects on anaerobic power, such as standing broad jump test and standing medicine ball test.

Compared to the other sports, Tharp, Johnson, & Thorland (1984) reported that anaerobic power is related to age, body weight and most importantly, lean body mass on athletes. According to Ostojic, Majic, & Dikic (2006) there is a strong correlation between body composition and anaerobic power on basketball players, and Silvestre, West, Maresh, & Kraemer (2006) reported that there were significant correlations between body composition, vertical jump and anaerobic power on football players. The physical characteristics of the all of wrestler groups were determined to have a significant effect on plate tapping test, standing broad jump, hand-grip (right and left), sit-ups in thirty seconds and standing medicine ball characteristics, when the results of multiple linear regression analysis are examined. In the study of Cvetković et al (2005), they found that standing medicine ball test and handgrip (right-left) test were also significantly affect on body height and weight. According to standardized regression coefficient (β), especially, muscle mass, body mass index and fat free mass values are significantly relationship on physical characters in all age groups. This may be caused by the development of the muscle groups (body density). As a result of this, the high muscular endurance allows a good stability in attack or defense positions (Mirzaei, Curby, Barbas, & Lotfi, 2011). Furthermore, fat free mass and body composition are indicator and predictor of muscle mass and could increase an individual's production of speed, strength and power. This situation is related to sporty performance (Stojanović, Bešić, Stojanović, Lilić, & Zadražnik, 2018). According to Demirkan et al. (2015) handgrip strength (left), flexibility of the low back and hamstring were one of the most important factors to predicting wrestling success.

In conclusion, the present study results showed that wrestlers from all age groups have presented with high level of fat mass, muscle mass and fat free mass where motor and physical properties are highly correlated among the wresting athletes in accordance with the special traning methods. In order to be successful, not only anaerobic power but also aerobic power should be given importance. Also, trainers should help wrestlers in training.

Acknowledgements
The authors appreciate all the wrestlers and coaches who cooperated with us.

Conflict of Interest
The authors declare that there are no conflicts of interest.

Received: 6 June 2019 **| Accepted:** 16 September 2019 | **Published:** 10 January 2020

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