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The Relationship between Anthropometric Properties and Physical Performance Levels of 9-12 Years Old Taekwondoists[1]

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Abstract

The aim of this study was to investigate the relationship between physical fitness levels of performance and anthropometric characteristics of male athletes aged 9-12 years who regularly participate in taekwondo. Sixty licensed taekwondoist volunteers participated in the study. The average age, height, and weight of the athletes participating in the study were 10.41±1.16 years, 144.16±15.19 cm and 39.66±12.27 kg, respectively. The participants in the study practiced taekwondo two hours twice a week for 2.5 years. Physical fitness levels of the taekwondoists were measured using the Eurofit Physical Fitness Test Battery protocol. Measurements taken include height, weight, skin fold thickness, and body height and circumference. The Durning-Womersley formula was used to calculate body mass and the Siri formula was used to calculate body fat percentage. The measurements were evaluated using the SPSS statistical program and Pearson correlation analysis was performed to investigate the relationship between the variables. The results demonstrated a significant negative correlation between 10x5m push up run, balance, disc hitting and flexibility parameters and anthropometric characteristics. Long jump, right and left grip force, 30 sec sit-up test, Bent arm pull-up test hanging values and the anthropometric properties were found to be positively correlated. In conclusion, anthropometric characteristics of 9-12 year old male taekwondoists were found to have positive and negative effects on performance related physical fitness levels.

Keywords: Taekwondo, Physical fitness, Anthropometric characteristics

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Introduction

Studies show sporting activities should be started in early in order for children to be successful in sports. Consequently, developed countries focus on childhood sporting activities. Furthermore, children's workouts have their own unique characteristics. Therefore, pre-school and primary school age children should undergo a number of tests to obtain necessary information about motor skills, general physical parameters and physical development (Güler & Ark., 2008). Although there are some unique features in each age group, very different features are depicted between the ages of 8-11. In this age group, development and personality formation can be positively affected by sports. The use of Eurofit Tests in children of different age groups is essential in determining general health and nutritional status and understanding exercise and sporting habits. This provides physical education teachers and coaches with information about the structural and functional characteristics of children, as well as developing national norms and defining national policies on children in Physical Education and Sports (Akgün, 1989, Çelebi, 2000, Uzuncan, 1991, Loğoğlu, 2002, Zorba et al, 1995, Demir, 2001, Prime Ministry, 1989, Ministry of National Education, 1997). Physical and physiological tests of children are used to evaluate the effects of regular physical activity on growth, development and health, and to examine the trainability of children during adolescence. The long-term trends of children in growth, maturation and physical fitness models and their acute responses to exercise of varying degrees can also be determined through these tests (Docherty, 1996). The impact of regular exercise on the development of children and young people has been the subject of research for many years (Baltacı, 1998). Taekwondo, a fighting sport, which is popular and widely accepted by the youth in Turkey, is of importance in terms of its effect on the motor skill development of children (Şahin et al., 2012). Moreover, previous experimental studies in Turkey provided evidence of the educational benefits of taekwondo practices in multiple intelligence development of the students (Türkmen, 2013).

The aim of this study was to investigate the relationship between physical fitness levels of performance and anthropometric characteristics of male athletes aged 9-12 years who regularly participate in taekwondo.

Material and Methods

Sixty licensed male athletes age 9-12, active in Taekwondo, volunteered to participate in the study. This group practiced taekwondo regularly for two hours a twice a week for 2.5 years. Measuring forms were prepared and the measurement values were recorded. Body length was measured with a height scale of 0.01 kg in Taekwondo outfits and bare feet, while the ages of the individuals forming the sample were determined as years. The body mass index (BMI) was determined by body weight (kg) / height2 (m) (Zorba and Ziyagil, 1995). Eurofit Physical Fitness Test Battery protocol utilized the following tests: Flamingo Balance Test, Disks Touch Test, Flexibility test, 30 sec sit-up test, Hand Grip Strength Test, Long jump test,Bent arm pull-up test, 10x5m push up run Test and 20 m shuttle run . For anthropometric measurements, biceps, calf, and thigh circumferences were recorded in centimeters (cm) as well as, femur, bust, full arm, and hand length. Body densities were calculated using skin fold thicknesses (biceps, triceps, suprailiac, subscapula) and the Durning-Wormersley formula. Body fat percentage was calculated according to the Siri formula. Calculation of body mass required for the Siri formula was calculated using the Durning-Womersley formula.

Durning -Womersley Body Density (BD) formula:

BD = 1.1553 - 0.0643 x X (Male Child)

BD = Body Density Log X = (bi + tr + ss + si)

Siri Formula: % Fat= (4.95 / BD - 4.50) x 100

(bi = biceps skin fold thickness, tr = triceps skin fold thickness, sc = subscapular skin fold thickness, si = suprailiac skin fold thickness.)

SPSS 21.0 software program was used in the analysis of the data. Pearson correlation analysis was used to determine the relationship between descriptive statistics, physical fitness levels and anthropometric characteristics in the distribution of data and the level of significance was determined as p <0.05

Findings

Table 1. The Relationship between Motor Performance and Anthropometric Properties

Variables		Biceps circumference in flexion	Calf circumference	Femur circumference	Arm span length	Bust Length	Arm length	Hand length	Leg Length
10x5m push up run	r	-,432**	-,291*	-,284*	-,362**	-,499**	-,372**	-,340**	-,357**
Balance test	r	-,235	-,064	-,144	-,273*	-,283*	-,313*	-,238	-,328*
Disk touching test	r	-,372**	-,197	-,257*	-,313*	-,344**	-,330*	-,259*	-,340**
Flexibility test	r	-,083	-,131	-,167	-,215	-,005	-,212	-,256*	-,110
Long jump test	r	,423**	,224	,263*	,400**	,536**	,390**	,378**	,432**
Hand grip strength - Right	r	,650**	,470**	,623**	,672**	,669**	,678**	,684**	,642**
Hand grip strength- Left	r	,664**	,545**	,660**	,630**	,650**	,618**	,609**	,577**
30 sec sit-up test	r	,470**	,221	,331**	,524**	,652**	,530**	,482**	,589**
Bent arm pull-up test	r	,542**	,305*	,409**	,603**	,673**	,649**	,645**	,629**
20 m shuttle run	r	,140	,091	,021	,140	,253	,156	,164	,196

**P<0,01   * P<0,05

Table 1 illustrates a negative correlation between anthropometric values and long jump, right-left hand gripping force, 30 sec sit-up testes, Bent arm pull-up test hanging performance and negative correlation between 10x5m push up run , balance, disk touching performance and anthropometric values. It was determined that there was no significant relationship between 20 m crunches test and other variables.

Table 2. Correlation of Body Composition with Motor Performance

Variables		Fat Percentage	Weight	Fat Mass	Fat free mass	Body mass index
10x5m push up run	r	,060	-,374**	-,187	-,428**	-,061
Balance test	r	,112	-,303*	-,119	-,361**	-,113
Disk touching test	r	,059	-,300*	-,137	-,350**	-,042
Flexibility test	r	-,194	-,154	-,229	-,107	-,156
Long jump test	r	-,182	,395**	,099	,497**	,002
Hand grip strength - Right	r	,192	,699**	,490**	,734**	,299*
Hand grip strength- Left	r	,212	,712**	,512**	,742**	,382**
30 sec sit-up test	r	-,038	,358**	,180	,409**	,024
Bent arm pull-up test	r	-,024	,594**	,339**	,660**	,095
20 m shuttle run	r	-,097	-,073	-,080	-,063	-,173

**P<0.01   *P<0.05

Table 2, shows a negative correlation between 10x5m push up run, balance, disk touching performance and body weight and lean body mass. Conversely, there was a positive correlation between long jump and 30 sec sit-up test performance and body weight and fat free mass. In addition, a positive correlation was found in other measured values except for the percentage of fat in the right and left hand grip strength. A significant relationship was found between body weight, body fat mass and body fat free mass in the Bent arm pull-up test hang test.

Discussion and Conclusion

In this study, the physical fitness levels of 9-12 age group Taekwondoists living in Erzincan were correlated with their anthropometric characteristics. Results showed a significant negative correlation between 10x5m push up run, balance, disc hitting and flexibility

parameters and anthropometric characteristics. Long jump, right and left grip force, 30 sec sit-up test and the Bent arm pull-up test hang test were found to be positively correlated with the anthropometric features. The relationship between anthropometric features and 20 m crunches running test results was not statistically significant.

Changes in body structures and performance during growth and maturation in children and young people have been studied. It has been noted that growth can lead to different developments in levels of performance. (Bale et al. 1992, Malina and Bouchard 1991, Pekel et al 2006)

The relationship between development and motor performance is generally dependent on anthropometric factors and performance is considered as an important factor (Özer K. 1993, Pekel et al., 2006).

Performance and strength are directly related to height, weight, arm and leg length, and other body members, flexibility and joint mobility and reaction time (Bostanci et al., 2004). In speed and coordination tests, 10x5m push up run tests and in all anthropometric parameters, a negative correlation was found in weight and lean mass values, which are body composition parameters. In a study on rugby players, researchers found a weak relationship between body fat and non-directional running speed (r = 0.21) (Sheppard and Young, 2006). From these results, it can be said that the anthropometric measurements on the negative side may adversely affect the speed and coordination test. The relationship between development and motor performance is generally dependent on anthropometric factors and it is considered to be an important factor in performance (Özer, 1993). In this study, right-handed grip force, 30 sec sit-up test and Bent arm pull-up test, as well as the increase in anthropometric and body composition measurement values in the positive direction explains the increase in motor skills in the positive direction. When the correlations between right and left hand grip strength and anthropometric features were examined in children, positive correlations were found in all parameters of length measurement values. In the body composition measurement values, a significant correlation was found in the positive direction in all but the fat percentage parameter. As the measurement levels increase, the performance of hand grip strength right-left also increases. Examining the relationship between the results of the 30 sec sit-up test carried out to determine abdominal force, endurance results anthropometric features and body composition values, positive values were found in other parameters except calf value, fat percentage, fat mass, body mass index values. In the Bent arm pull-up test , a positive correlation was found at p <0.001 for all anthropometric values whereas, for body composition values, a significant correlation was found in weight, fat mass and fat free mass values.

Ostojic et al. (2006) found a strong correlation between body composition and explosive power. Tharp et al. (1984) have stated that anaerobic power is related to age, body weight and most importantly fat free mass. In this study, it was determined that there was a positive correlation between weight and fat body mass values between standing long jump (explosive-anaerobic power) test and body composition values. When the correlations between anthropometric characteristics were examined, positive relationships were found especially between bust length, leg length and arm span length values. This length measurement value increases while the long jump performance is also increasing.

Polat and Saygın (2003) in adolescent athletes, and Berg et al. (1995) in advanced adolescent athletes, reported that flexibility significantly decreased with increasing age. In this study, it

was determined that there is a decrease in the negative direction in the measurements of length and body composition. These studies in literature support our findings.

The flamingo balance test suggests that the relationship between flare length, bust length, full limb length, and leg length is negative and that anthropometric measurements in aging does not protect body balance because it makes it difficult for children to control their limbs. In the disc touch test, all anthropometric values except calf value were determined to have a negative correlation. While these length measurement values are increasing, disk touch performance is also adversely affected. There was no statistically significant difference in the 20 m shuttle run test results.

This study conveys that anthropometric and body composition measurements in this study group affected their performance in a negative and positive direction. These results are consistent with other studies. Comparatively, strong correlations were observed between anthropometric values and body composition values during the growth and development period. This supports establishing norms for future studies in other sports, resulting in discussion and conclusions that will enrich physical development in children.

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Conflicts of Interest

The authors have no conflicts of interest to acknowledge.

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