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ANALYSIS OF SOME PERFORMANCE PARAMETERS OF FENCER ACCORDING TO GENDER AND AGE

ANALIZA NEKATERIH PARAMETROV USPEŠNOSTI SABLJAČEV GLEDE NA SPOL IN STAROST

ABSTRACT

The aim of this research was to examine the differences in agility, flexibility, aerobic capacity, vertical jump and vertical anaerobic power according to age and sex in children and young fencers.

76 children and young fencing athletes from 9-17 years (girl:30 and boy:46) who camped in Dardanos campus of Çanakkale Onsekiz Mart University participated in the research. The measurements and tests were conducted by the Sports Science and Athlete Health Research and Application Center. Length and weight measurements, BMI calculation, T-test for agility, Yo-Yo IR1 test and shuttle running test for aerobic capacity, maxVO_2 calculation equations, vertical jump test, anaerobic vertical power calculation, sit and reach test for flexibility were used in the study. ANOVA to determine the difference between age groups, t test for gender comparison was used. The level of significance was accepted as $p < 0,05$.

As a result of the research, maxVO_2, elasticity, vertical jump and anaerobic vertical power parameters were found significant different between age groups ($p<0,05$). Accordingly, it was found that the flexibility of girls was significantly higher than boys ($p<0,05$). However, there was no found significant difference between girls and boys in VO_2max, vertical jump, anaerobic vertical power and T test parameters ($p>0,05$).

Vertical jump distance, vertical power, maxVO_2, and agility are similar in boys and girls. Flexibility in girls is better than boys. Differences in performance can be seen among age groups.

Key words: Fencing, aerobic capacity, agility, flexibility, vertical jump.

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IZVLEČEK

Cilj raziskave je bil preučiti razlike v agilnosti, fleksibilnosti, aerobni sposobnosti, vertikalnem skoku in vertikalni anaerobni moči glede na starost in spol pri otrocih in adolescentih sabljačih.

V raziskavi je sodelovalo 76 otrok in adolescentov sabljačev, starih od 9 do 17 let (30 deklet in 46 fantov), ki so bili nastanjeni v kampusu Dardanos turške univerze Çanakkale Onsekiz Mart Universitesi. Meritve in teste je izvajal Center za športno znanost in raziskave zdravja športnikov. V raziskavi so bili izvedeni: meritve višine in teže, izračun BMI, t-test agilnosti, test Yo-Yo IR1, test teka s spremembami smeri za aerobično sposobnost, enačbe za izračun VO2max, test vertikalnega skoka, izračun anaerobične vertikalne moči ter test fleksibilnosti 'sit-and-reach'. Opravljena sta bila tudi analiza ANOVA za ugotavljanje razlik med starostnimi skupinami ter t-test za primerjavo med spoloma. Nivo značilnosti je bil $p < 0,05$.

Rezultati raziskave so pokazali statistično značilne razlike med starostnimi skupinami ($p < 0,05$) pri parametrih: VO2max, elastičnost, vertikalni skok in anaerobična vertikalna moč. Poleg tega so rezultati pokazali značilno večjo fleksibilnost pri dekletih v primerjavi s fanti ($p < 0,05$). Nobene statistično značilne razlike pa ni bilo med dekleti in fanti v parametrih: VO2max, vertikalen skok, anaerobična vertikalna moč in t-test ($p > 0,05$).

Razdalja pri vertikalnem skoku, vertikalna moč, VO2max in agilnost so bili pri dekletih in fantih podobni. Pri dekletih je bila fleksibilnost boljša kot pri fantih. Med starostnimi skupinami so bile opažene razlike v uspešnosti.

Ključne besede: sabljanje, aerobne sposobnost, agilnost, fleksibilnost, vertikalen skok

INTRODUCTION AND AIM

Fencing is a high intensity interval sport based on expertly combining certain technical skills, tactical decision-making ability and physical performance (Wazir, Mostaert, Pion, & Lenoir, 2018). In addition to tactical skills, fencing comprises repeated movement sequences of explosive movements and low intensity activities or rest periods (Turner et al., 2013) As a result, it is understood from research that like other sports branches, aerobic, anaerobic capacity, movement technique, lower body flexibility and agility play an important role apart from tactical and technical skills. When the literature is investigated, data about Turkish fencers appears to be mainly related to reaction, attention and cognitive functions (Duvan, Toros, & Şenel, 2010; Kalkan & Zekioğlu, 2017; Kartal, Dereceli, & Kartal, 2016; Pulur, Ceylan, & Karaçam, 2017; Toros & Duvan, 2011). As fencing is a sports branch involving technical and tactical skills, in addition to performance parameters requiring reaction and attention, development of these parameters will provide a better sporting performance.

Though reaction time and dimensional perspective are considered the most important determinants of fencing skills, it is important to consider the contribution of other parameters to performance. Though there are fencers with performance below the anaerobic threshold, lactic anaerobic capacity is known to be activated to a moderate degree to support energy requirements during movements (Bottoms, Sinclair, Gabrysz, Szmatlan-Gabrysz, & Price, 2011; Enzo, 2005; Roi & Pittaiuga, 1997; Turner et al., 2014, 2013)oxygen consumption, heart rate and finger tip blood lactate samples were taken throughout a series of simulated fencing fights. The fencing fights consisted of 3 x 3 minutes of fencing, with 1 minute rest between each bout. The results demonstrated peak oxygen uptake (47±5 ml·kg·min-1. Fencing is a complicated game requiring performance characteristics. Assessment of these characteristics are important to define ability and to develop ability. Multidimensional test series are used and provide results in different sports. Additionally, obtaining more data from different tests of fencers will contribute to performance development, training content and skill selection in children.

In fencing, especially in women, there are studies that have identified greater hip elasticity during the lunge move [Sinclair & Bottoms, 2013; Sinclair & Bottoms, 2015). In addition to flexibility, other performance components may vary by sex and age. In previous studies, differences in gender and age groups defined in different sports were determined (Sinclair et al.,2012; Katis, Kellis & Lees, 2015) .The definition of differences or similarities for fencing athletes would contribute to coaches and researchers.

The aim of this research was to examine the differences in agility, flexibility, aerobic capacity, vertical jump and vertical anaerobic power according to age and sex in children and young fencers.

METHOD

Research Group

A total of 76 (30 females, 46 males) child fencers aged from 9-17 years attending a camp in Çanakkale Onsekiz Mart University Dardanos campus participated in the research. The research measurements and tests were completed by the Sports Sciences and Sport Health Research and Application Center. The research measured height and weight, calculated BMI and used the T-test

for agility, the yo-yo IR1 test for aerobic capacity of 12-17-year olds and the shuttle run test for aerobic capacity of 9-11-year olds, the vertical jump test, anaerobic vertical power equation and sit-reach test for flexibility.

Body height and body weight measurement and BMI calculation: Body weight was measured with Radwag scale with 0.1 kg sensitivity. Body height was measured with Radwag digital height meter with 0.01 cm sensitivity. The following formula was used to calculate body mass index. Body mass index (BMI) = body weight/height^2.

T-test: Four cones are placed on the prepared route shaped like a T. When the test begins, the subject runs straight from cone A to reach cone B as fast as possible, touches the cone and runs sideways left to cone C. After touching cone C they run sideways to the right to reach cone D. After this they run sideways left to reach cone B and after touching it run backwards to cone A and complete the test. A photocell is used to measure and record the values for the subject.

Shuttle run test: The test was performed on ÇOMU Dardanos campus football field (synthetic ground). In accordance with the test protocol, a sound signal is given by an LG loudr brand high-power sound system. Shuttle run test was used only for 9-11 years old children. Subjects run 20 meters to touch a line with their feet before the next signal. The test continues until the subject makes two errors. The equation VO_2max=31.025+(3.238 x velocity)-(3.248 × age)+(0.1536 × age × velocity) was used (Ramsbottom, Brewer, & Williams, 1988).

Yo-yo intermittent recovery test level 1: The test was performed on ÇOMU Dardanos campus football field (synthetic ground). The yo-yo intermittent recovery test is complex and difficult for below 11 years old children, thus, this test was used for above 11 years children. The test protocol uses a 20-meter distance and 5 m resting distances behind the start line are marked with cones. The subjects were given a sound signal with an LG loudr brand high-power sound system. Subjects are required to be within the start and finish lines before each signal. The test is designed to include 8 subjects at a time. The speed is increased in stages according to the test protocol. Each signal caught by the subject is recorded and if the signal is not caught it is recorded as an error. The test is ended after the subject makes two errors. The VO2 max formula developed by Bangsbo et al. (2008) was used (VO2max= (mL/min/kg) = IR1 distance (m) X 0.0084 + 36.4).

Vertical jump test: Before the test, subjects mark the highest point they can reach on the wall. The subject is requested to jump and reach for the highest point possible. The difference between the highest point reached and the highest point of the jump is recorded in cm. Two jumps are made with the best result recorded.

Flexibility measurements: A sit-reach table was used. The subject sits with bare feet against the flat surface of the sit-reach table. They lean forward and without bending the knees reach their hands forward as far as possible. Values are recorded in cm. Two attempts were made with the best value recorded (Beam & Adams, 2010).

Calculation of anaerobic vertical power: This was calculated using the jump distance obtained from the vertical jump test and the weight of the subject with the Lewis equation: Power (kgm/s) = √ 4.9 (body weight) x √ (vertical jump ( )) (Beam & Adams, 2010).

Analysis of data: The data obtained were analyzed with a statistical program. Two-way comparisons of independent groups used the t test, while comparison between groups used the one-way analysis of variance (ANOVA). Results were accepted as significant at $p<0.05$ level.

RESULTS

Table 1. Demographic data of participants according to age group

	Age Group	N		±
Height (cm)	14-17	21	170.76	8.02
	12-13	27	158.44	8.04
	9-11	28	147.21	7.78
	Total	76	157.71	12.26
Weight (kg)	14-17	21	58.08	7.92
	12-13	27	47.72	10.73
	9-11	28	38.6	8.78
	Total	76	47.23	12.05
BMI	14-17	21	19.9	2.22
	12-13	27	18.79	2.51
	9-11	28	17.65	2.84
	Total	76	18.68	2.69

The data related to demographic characteristics of participants according to age group are shown in Table 1.

Table 2. Performance test results and p values according to age groups

	Age group	N		±	f	p
VO2max (ml/kg/min)	14-17	20	39.55	1.25	86.250	**.000**
	12-13	25	35.45	8.12		
	9-11	24	19.54	3.84		
	Total	69	31.10	10.19		
Flexibility (cm)	14-17	21	11.45	8.65	5.381	**.007**
	12-13	27	4.74	7.85		
	9-11	28	4.80	7.44		
	Total	76	6.61	8.38		
Vertical jump (cm)	14-17	21	35.66	5.17	13.082	**.000**
	12-13	27	28.62	7.45		
	9-11	28	25.64	7.37		
	Total	76	29.47	7.90		
Anaerobic vertical power (Watt)	14-17	21	76.49	11.87	33.560	**.000**
	12-13	27	56.67	17.72		
	9-11	28	42.82	11.88		
	Total	76	57.04	19.46		
T test (s)	14-17	21	11.52	.67	2.824	.066
	12-13	27	11.04	3.31		
	9-11	28	12.35	.87		
	Total	76	11.66	2.12		

The one-way analysis of variance (ANOVA) results with the aim of comparing performance test results according to the age of subjects are shown in Table 2. Accordingly, there were statistically significant differences observed between the groups for VO_2max, flexibility, vertical jump, and anaerobic vertical power parameters ($p<0.05$).

When the source of the differences between the groups are investigated, there were differences VO_2 max and vertical anaerobic power between the 14-17 and 12-13 groups, 14-17 and 9-11 group and the 12-13 and 9-11 group. For flexibility and vertical jump parameters there were differences between the 14-17 and 9-11 groups and the 14-17 and 12-13 groups. The T-test results did not have any significant differences between groups.

Table 3. Demographic data according to gender

	Gender	N		±
Age (year)	Female	30	13.10	2.13
	Male	46	11.84	1.82
Height (cm)	Female	30	158.53	10.11
	Male	46	157.17	13.56
Weight (kg)	Female	30	47.82	11.02
	Male	46	46.84	12.78
BMI	Female	30	18.80	2.77
	Male	46	18.60	2.66

The data related to demographic characteristics of participants according to gender are shown in Table 3.

Table 4. Performance test results and p values according to gender

	Gender	N		±	t	p
VO_2max (ml/kg/min)	Female	28	30.88	11.11	-.151	.881
	Male	41	31.26	9.64		
Flexibility (cm)	Female	30	12.23	7.62	5.579	**.000**
	Male	46	2.95	6.71		
Vertical jump (cm)	Female	30	30.16	7.53	.615	.541
	Male	46	29.02	8.17		
Anaerobic vertical power (Watt)	Female	30	58.50	18.33	.523	.603
	Male	46	56.10	20.30		
T test (s)	Female	30	12.05	.92	1.323	.190
	Male	46	11.40	2.61		

The t test results for independent groups performed with the aim of comparing performance test results according to gender are shown in Table 4. Accordingly, the flexibility of girls (12.23±7.62) was found to be significantly higher than boys (2.95±6.71) ($p<0.05$). Contrary to this, there was no significant difference between the genders in terms of VO_2max, vertical jump, anaerobic vertical power and t test parameters ($p>0.05$).

DISCUSSION AND RESULTS

This research aimed to investigate some performance characteristics of fencers according to age and gender. A study by Sözen et al. (2016) aiming to direct primary school children (9-11 years) to sports branches based on their sports-specific skill levels by identifying sport fitness found mean height was 1.36±0.08 m for girls and was 1.35±0.06 m for boys, mean body weight was 30.52±5.43 kg for girls and was 31.48±5.30 kg for boys and mean body mass index was 17.60±1.87 kg/m^2 for girls and 17.40±1.95 kg/m^2 old for boys. These results are similar to the results for the same age group in our study (9-11 years). This situation shows that in this age group children have similar physical characteristics and that sports branch has not begun to create a distinguishing effect in this age group.

It appeared the 14-17-year group had better values for the parameters of VO_2max, flexibility, vertical jump and anaerobic vertical power parameters compared to the other groups ($p<0.05$). As the ages and age-linked physical characteristics of children increase, endurance capacity increased which appears to have increased maxVO_2 values, vertical jump distance, anaerobic vertical power and flexibility. Considering physical size, this situation is considered to be related to the maturity levels of the older age group. Additionally, when foreign research is investigated, our subjects appear weak when compared with the flexibility parameters of 11-16 year old national fencers in the study by Wazir et al. (2018). Apart from tactical and technical skills, as in other sports branches aerobic, anaerobic capacity, movement technique, lower body flexibility and agility play an important role, as understood from other research. In our research there was no significant difference between the groups for the agility test. The reason for this, in spite of the different ages, is considered to be that fencing training supports agility and reduces the effect of age difference. Additionally, the 12-13-year age group had better mean agility, though this was not significant compared to the other age groups.

When differences between genders are investigated, the flexibility of girls (12.23±7.62) was observed to be significantly high compared to boys (2.95±6.71) ($p<0.05$). It is known that girls have better flexibility than boys and our research results confirm this is the case for fencers. A study by Koçak and Kartal (2003) found the mean sit-reach results for primary school children was 20.3±5.58 cm for boys and 21.9±6.0 cm for girls. These results are similar to our study results in terms of girls having better mean flexibility compared to boys. Additionally, there were no significant differences between the fencers participating in our research in terms of VO_2max, vertical jump, anaerobic vertical power and agility according to gender ($p>0.05$).

There was no significant difference between the heights of girls and boys. The analysis results show that the mean vertical jump was 30.16±7.53 cm for females and 29.02±8.17 cm for males. This shows that boys and girls have similar vertical jump power. When age groups are examined, the mean jump was 25.64±7.37 cm in the 9-11 age group, 28.62±7.45 in the 12-13 age group and 35.66±5.17 cm in the 14-17 age group. There was an age-linked increase in vertical jumps in the age groups. A study by Sözen et al. (2016) about the 9-11 age group found the mean vertical jump for girls was 22.45±6 cm and for boys was 25.11±7 cm. These results are similar to the results for the same age group (9-11 years) in our study. This situation shows that children in this age group have limited vertical anaerobic power differences and these children display similar performance for vertical jump skills. The study by Sözen et al. (2016) found the mean vertical jump for female national fencers was 49.33±6.42 cm. This result is different to the result for girls in a similar age group (14-17 years) in our study. This difference is considered to be due to the higher training

levels of national sportspeople. When the literature is investigated, there are very limited studies about performance in the branch of fencing.

The literature related to the age groups included in our study is mainly about physical activity. Research by Hands et al. (2009) about 1585 14-year old children stated there was no significant difference between boys and girls in terms of motor performance. Hands found no significant correlation between motor performance and physical activity; however, they recorded a significant correlation between physical fitness and motor performance. Research by Fisher et al. (2005) including 394 children found no significant difference between boys and girls in terms of motor performance, but identified that girls were significantly more sedentary than boys. Additionally, they stated there was a positive significant correlation between physical activity and motor performance.

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