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Does the Background of a Long Term Involvement in Extra Curricular Sports Affect the Physical Fitness Differences between Preadolescent Boys and Girls?

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Abstract

The purpose of this study was to investigate the differences in physical fitness between 10-12 year-old preadolescent boys and girls and whether these differences are affected by the children's background of involvement in sports. Preadolescent students (198 boys and girls) participated in the study. The basic components of physical fitness were measured by using part of the Eurofit battery test for children, including the sit and reach, the standing broad jump, the shuttle run 10×5m and the shuttle run 20m. The agility T-test, and the single-handed overhead throw were also used. A two-way analysis of Variance, conducted for each physical fitness component, indicated a sports background and gender interaction effect on standing broad Jump ($F(2,192)=3.54$, $p<.05$), on 20m shuttle run ($F(2,192)=5.02$, $p<.01$), and single-handed overhead throw ($F(2,192)=6.73$, $p<.01$). The study indicated that there were no performance differences between boys and girls, in power of upper and lower limbs, as well as in aerobic capacity, when both genders did not have a background in sports. However, the boys' performance was superior to girls' when both genders had the same background in sports and boys significantly improved their performance in these fitness components, when their background in sports increased.

Key words: *physical fitness, sports involvement, preadolescence, Eurofit test battery*

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Ερευνητική

Μπορεί το Ιστορικό της Μακρόχρονης Ενασχόλησης με τον Εξωσχολικό Αθλητισμό να Επηρεάσει τις Διαφορές στις Φυσικές Ικανότητες Μεταξύ Αγοριών και Κοριτσιών της Προεφηβικής Ηλικίας;

Μπλάτσης Πέτρος, Πλούταρχος Σαρασλανίδης, Βασίλης Μπαρκούκης, Βασιλική Μάνου, Κων/νος Τζαβίδας, Χρήστος Χ''βασιλείου, & Σταματία Πάλλα

ΤΕΦΑΑ, Αριστοτέλειο Πανεπιστήμιο

Περίληψη

Ο σκοπός της μελέτης αυτής ήταν να διερευνήσει αν υπάρχουν διαφορές στις φυσικές ικανότητες μεταξύ προ-εφήβων αγοριών και κοριτσιών 10-12 ετών και εάν οι διαφορές αυτές επηρεάζονται από το ιστορικό ενασχόλησης των παιδιών με τον αθλητισμό. Στην έρευνα συμμετείχαν 198 προ-έφηβοι μαθητές/τριες. Μετρήθηκαν οι βασικές παράμετροι των φυσικών ικανοτήτων με τη χρήση ενός μέρους της δέσμης Eurofit για παιδιά, η οποία περιλάμβανε τις εξής δοκιμασίες: δίπλωση του κορμού (ευλυγισία), άλμα σε μήκος χωρίς φόρα (ισχύς των κάτω άκρων), παλίνδρομο τρέξιμο 10×5m (ταχύτητα - ευκινησία), παλίνδρομο τρέξιμο 20m (αερόβια ικανότητα). Χρησιμοποιήθηκαν επίσης τοT-test (ευκινησία) και η ρίψη με ένα χέρι πάνω από το κεφάλι με μπαλάκι 200 gr (ισχύς άνω άκρων). Η ανάλυση διακύμανσης με δύο παράγοντες (two-way ANOVA), η οποία πραγματοποιήθηκε για κάθε παράμετρο των φυσικών ικανοτήτων χωριστά, έδειξε την ύπαρξη αλληλεπίδρασης του ιστορικού ενασχόλησης με τον αθλητισμό και του φύλου, στο άλμα σε μήκος χωρίς φόρα ($F(2,192)=3.54$, $p<.05$), στο παλίνδρομο τρέξιμο 20m ($F(2,192)=5.02$, $p<.01$), και στη ρίψη με ένα χέρι πάνω από το κεφάλι με μπαλάκι ($F(2,192)=6.73$, $p<.01$). Η μελέτη έδειξε ότι δεν υπήρχαν διαφορές μεταξύ των δύο φύλων στις παραπάνω δοκιμασίες, όταν και τα δύο φύλα δεν είχαν ιστορικό συμμετοχής στον αθλητισμό. Ωστόσο, η επίδοση των αγοριών στις παραπάνω δοκιμασίες ήταν μεγαλύτερη από αυτή των κοριτσιών, όταν και τα δύο φύλα είχαν το ίδιο ιστορικό συμμετοχής στον αθλητισμό. Επίσης, τα αγόρια βελτίωσαν την επίδοσή τους με την αύξηση του ιστορικού συμμετοχής στον αθλητισμό.

Λέξεις κλειδιά: *φυσικές ικανότητες, συμμετοχή στον αθλητισμό, προ-εφηβεία, δέσμη Eurofit*

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Introduction

Physical activity is a significant factor influencing the children'sphysical and mental development (Denker & Anderson, 2008; Ortega, Ruiz, Castillo, & Sjostrom, 2008). Physical fitness is the capacity of performing physical activity (Gallauhe, 1982). When health related aspects of physical activity are taken into consideration, physical fitness is defined as a state characterized by: (a) the ability to perform daily physical activities with vigor, and (b) the demonstration of traits and capacities that are associated with low risk of premature development of the hypokinetic diseases (i.e., those associated with physical inactivity) (Pate, 1988). A more holistic approach to the definition of physical fitness should include physical abilities as key components of physical fitness. The most frequently cited physical fitness components fall into two groups: one related to health and the other related to skills that pertain more to athletic ability. The components related to athletic ability are the physical abilities of speed, agility, balance, coordination and power (Gallahue & Ozmun, 2006). On the other hand, cardio-respiratory endurance, muscular strength and endurance, as well as flexibility are physical abilities that pertain to health related fitness (Caspersen, Powel, & Christenson, 1985).

Recent findings suggest that the children's motor skill competence is related with their physical fitness. Children with a lower level of motor skill competence demonstrate significantly poorer performance in important components of physical fitness, such as aerobic and anaerobic endurance, and muscular strength (Haga, 2008; Scott, Alof, Hultsch, & Meemann, 2007). The children's mastery of motor skills and their level of physical fitness, determines the level of their physical activity (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006).

Physical fitness is an indicator of the children's physical growth and it can be used to evaluate the effectiveness of physical education and other physical activity programs, specifically designed to improve their health related fitness level (Milanese, Bortolami, Bertucco, Verlato, & Zancanaro, 2010). Apart from physical fitness, the anthropometrical parameters are equally significant indicators, used to evaluate the children's physical growth. The body dimensions (height and weight), the body mass index (BMI), and the body composition are measurements, utilized to evaluate the children's physical growth, in relation to their physical fitness (Westersthaul, Barnekow-Bergkvist, Hedberg, & Jansson, 2003). A simultaneous assessment of children's anthropometric parameters and physical abilities could provide more accurate information about their physical development (Milanese et al., 2010).

Many studies have reported gender differences in children's fundamental motor skills and their physical fitness. They have shown that boys performed significantly better than girls in object control skills, such as throwing, catching, and kicking (Hume et al., 2008; Valentini, Spessato, & Rudisill, 2007). Most studies haven't reported gender differences in locomotor skills (running, galloping and jumping) (Goodway, Crowe, & Ward, 2003; Hume et al., 2008; Wong& Cheung, 2006). Other studies, investigating physical fitness components, have revealed that boys are better than girls in speed, strength, explosive power, and aerobic capacity (Ashoke, Sudip, Shikha, & Sudarshan 2011; Branta, Haubenstricker, & Seefeldt, 1984; Deoreo & Keogh, 1980; Katic, Bala, &Barovic, 2012; Markovic, Markovic, & Kramskoj 2011; Morris, Williams, Atwater, & Wilmore, 1983). On the other hand, girls surpass boys in balance and flexibility tasks (Deoreo, et al., 1980; Haubestricker & Seefeldt, 1986; Jensen & Fisher, 1979). These gender differences in physical fitness are small and negligible in preschool and early elementary years (6-9 years old) (Ashoke et al., 2011; Gallahue, 1982; Manios, Kafatos, & Codrington, 1999; Milanese et al., 2010; Raudsepp & Paasuke, 1995). However, they gradually increase during preadolescence (10-12 years old) and become more apparent in the adolescent stages (Branta et al., 1984; Davies & Rose, 2000; Deoreo et al., 1980).

Gender differences in fundamental motor skills have been examined on the basis of movement kinematics (Fortney, 1983; Halverson, Roberton, & Langendorfer, 1982; Milne, Seefeldt, & Reuchlein, 1976). The analysis revealed that gender differences in the running pattern are already apparent at the age of 5-6 years old and are associated with the movement of the swing leg (Fortney, 1983). Regarding the kinematics of overhand throwing, it is evident that gender differences appear already in early preschool years and they are both qualitative and quantitative (Halverson et al., 1982; Raudsepp et al., 1995).

According to the literature, gender differences in children's physical fitness are attributed to biological and environmental factors (Gabbard, 2012; Malina, 1986; Thomas, Nelson, & Church, 1991). The biological factors include the body dimensions (height, weight and BMI), the body composition (percentage of body fat) and age. During preadolescence (10-12 years old), girls progressively increase their adipose tissue, while boys develop their muscle mass to a greater extent (Hunsicker & Reiff, 1977). The skin-fold measurement differences between boys and girls become increasingly bigger, reflecting the influence of hormonal differ-

ences, that is that boys add muscle and girls add fat (Brooks & Fahey, 1984; Thomas et al., 1991). Biological characteristics, such as body dimensions and body composition, have been found to interpret a small part of gender differences in7-12-year old children's physical fitness (Slaughter, Lohman, & Misner, 1980; Thomas et al., 1991). These parameters have been found to predict an average of only 30% of their physical fitness variance (Hensley, East, & Stillwell, 1982).

It has been suggested that environmental factors are also responsible for a big part of gender differences in preadolescent children's physical fitness (Gabbard, 2012; Thomas et al., 1991). These environmental characteristics are: (a) the amount of time spent in physical education as well as the type and number of activities used in the lessons; (b) the frequency of participation in extra-curricular organized physical activities (athletic or other), their intensity and duration; (c) the amount of free time that children spend in playing games as well as the type of games they play (Archer& Lloyd, 2002; Haywood & Getchell, 2001; Samara, Sidarta, Mediana, & Noviyanti, 2012; Thomas et al., 1991). Preadolescent boys choose to participate in sports and play games that require higher intensity and duration. On the other hand, girls choose more simple activities that are less demanding and require less energy expenditure. Thomas et al. (1991) reported that physical fitness differences between boys and girls gradually increase during the preadolescent stage (10-12 years old). According to the study, these differences are mainly caused by the girls' increase of adiposity, as well as the duration and intensity of the physical activities that boys choose to participate in. However, only a small part of physical performance variance is explained by the environmental and biological characteristics measured. The researchers suggest that there are physiological and other environmental characteristics that have a direct effect on physical fitness gender differences, or interact with one another causing these differences (Thomas et al., 1991).

A review of the literature showed that there hasn't been a study investigating the effect of the preadolescents' sports involvement background (years of participation in sports) on gender physical fitness differences. In specific, there is no indication whether there are gender differences in physical fitness between preadolescents who do not have a background of involvement in sports. If these differences actually exist, this could mean that boys' advantage in physical fitness is due to biological factors. In case there are no differences, we would have to investigate whether an equal increase in sports background for both genders would either increase the gap between them or retain the original non-significant differences. In such a situation, where despite having the same sports background with girls, the boys still increased their physical fitness differences, this would imply that their biological characteristics facilitate the improvement of physical fitness to a higher level, compared with girls. It could also simply that the quality and quantity of the girls' participation in sports does not help them to improve their physical fitness sufficiently. In case that girls retain their initial non-significant physical fitness differences with boys having the same background in sports, this could indicate that gender differences are mainly caused by their reduced participation in sports and low levels of physical activity.

The purpose of this study was to investigate the following hypotheses: (a) there are physical fitness differences between preadolescent (10-12 years old) boys and girls, and (b) the sports participation background (years of involvement in sports) could have an impact on these differences. The results of this study will reveal how physical fitness differences between boys and girls increase during the preadolescent stage and in which way they are affected by the children's background in sports.

Methods

Participants and procedures

The sample consisted of 198 students (92 boys and 106 girls) who attended five different elementary schools of a northern Greece region. After informing all schools in the region about the purpose of the study, five schools accepted to participate. Fourth, fifth, and sixth class students were informed in detail by their principals and Physical Education teachers about the study. One hundred and ninety eight, out of 235students, who attended the last three elementary school grades, willingly accepted to participate and provided their parent's written consent. Their participation was anonymous and voluntary. Personal information was secured, according to the ethical principles of the Helsinki declaration. There were two inclusion criteria: (a) students had to be healthy. Those who were exempted from Physical Education were not permitted to participate in the study and (b) sixth class students should not be more than 12 years old. Even if they did participate for pedagogical reasons in the measurements carried out during the physical education lessons, their data was not included in the analysis.

Two training meetings were held, where the researchers instructed the physical educators on the testing procedures. At the beginning of the school year students initially answered a short questionnaire, giving information about their gender, their date of birth, and their years of participation in organized extracurricular sports or other health-related physical activities (Table 1). Body dimension measures (height and body mass) were conducted prior to the physical fitness tests and BMI was estimated. Two lessons were dedicated in practicing the physical fitness tests that students would have to carry out. The tests were conducted after the students experienced and learned them. They were done during the following physical education lessons. These measures included flexibility, speed, aerobic capacity, power of the upper and lower limbs, and agility tests. The students made two attempts in each test and the best result was recorded. The measures were completed in five lessons.

Table 1. Descriptive statistics of somatometric characteristics (height, body mass, and BMI), age, and background groups in sports

Variables		Boys	Girls	Overall
Height M (SD) (m)		1.47 (.07)	1.45 (.08)	
Body Mass M (SD) (kg)		42.58 (10.71)	41.3 (10.70)	
BMI M (SD)		19.68 (4.00)	19.20 (3.90)	
Sports Background Group N (%)	0	28 (30)	35 (33)	63
	1-3	33 (35)	39 (37)	72
	≥4	31 (34)	32 (30)	63
Age N (%)	10	13 (14)	21 (20)	34
	11	26 (28)	23 (22)	49
	12	53 (58)	62 (58)	115

Note. M=mean; SD=standard deviation; N=number of individuals; m= meters; kg=kilograms; BMI= Body Mass Index

Measures

Eurofit Battery: The following tests from the Eurofit Battery (Council of European Committee for Development of Sport, 1988) were used to measure the students' physical fitness components of flexibility, lower body power, running speed, agility, and aerobic capacity: (a) the Sit and reach (flexibility), (b) the Standing broad jump (lower body power), (c) the 10×5m shuttle run (running speed and agility), and (d) the 20m shuttle run (aerobic capacity). The Eurofit is a valid method to evaluate fitness components for preadolescents and adolescents (Malina & Katzmarzyk, 2006). Data was obtained using the procedures described in the Eurofitt Test Handbook (Council of European Committee for Development of Sport, 1988). A brief description of the test follows below:

Sit and reach: The sit and reach test was used to assess flexibility of the spine and posterior leg muscles. Each student had to reach as far as possible from a sitting position. Their knees were kept straight and they rested their bare feet vertically against a box 30 cm in height. To perform the test, the students leaned forward with straight arms and reached over the top surface of the box. The distance between toes and finger was measured. Positive values were recorded if the students were able to reach further than their toes, negative values were recorded if the students were unable to reach their toes, and a zero value was given when students just touched their toes. They made two attempts and the best was recorded to the nearest .10 cm.

Shuttle run 10×5m: Two lines were drawn 5 m apart. The students had to run forward as quickly as possible, pivot on the far line, and return to the starting line. This had to be repeated five times in total. The time required to complete the test was recorded to the nearest .10. After two trials the best was recorded.

Standing broad jump: The students had to stand behind the starting line. They were instructed to push off vigorously and jump as far as possible. They had to land with the feet together and stay upright. The test was repeated twice, and the best score was retained to the nearest .10 m, as the distance between toes at take-off and heels at landing or whichever body part landed nearest to the take-off spot.

Shuttle run 20m: This is a standard test of cardio-respiratory fitness, developed by Leger, Mercier, Gaboury, and Lambert (1988). In brief, 5 to 10 students started running up and down a 20 m track at an initial speed of 8.5 km/h, which gets progressively faster (.50 km/h every minute), in accordance with a pace dictated by a sound signal on an audio tape. Several shuttle runs make up each stage of the test, and students were instructed to keep pace with the signals for as long as possible. The number of stages fully completed, were recorded for each student. They had only one trial.

T-test Agility Drill: The T-Test was developed by Seminick (1990) to measure agility. Students had to reach and touch a series of cones placed in a T shape, by running and sliding. Three cones were placed 5m apart from each other on a straight line (A, B, C) and a 4th cone D was placed 10 m from the middle cone B, so that the four cones formed a T shape. They stood behind the cone D at the base of the T shape. After the signal, students had to run and touch the middle cone B. After reaching it, they side shuffled to cone A without crossing their feet. After touching this cone, they side-shuffled to their right to cone C, side-shuffled back to the middle cone, and then ran backwards to the starting position. The time to complete this test was recorded with a digital stopwatch. Each student made two attempts and the best was recorded to the nearest .10 sec. The T-Test has been established as a valid and reliable method to measure linear to lateral agility (Pauole, Madole, Garhammer, Lacourse, & Rozenek, 2000). It has been previously used to measure children's agility (Jakovljevic, Karalejic, Pajic, Macura, & Erculj, 2012).

Single-handed overhead softball throw (.200 kg ball): This is a test used to measure the upper limb power. The students were allowed to run up to a line and throw the ball with one hand over their head (javelin throw technique) without crossing the line. The best out of two trials was recorded to the nearest .10 m.

Analysis

The analyses were carried out using the statistical software package SPSS 20. Independent were the categorical variables of the children's gender, age (10-12 year-old), and their background of involvement in sports, as well as the continuous variables of their height, body mass, and BMI. According to their background in sports, participants were divided into three groups (three levels of sports involvement background): (a) children with no sports background (b) children with a background of one up to three years of participation in organized extracurricular sports and (c) children who had at least four years of participation in extracurricular sports (Table 1).

Dependent variables were the components of physical fitness. Descriptive statistics were conducted (Table 1). The Kolmogorov-Smirnov test showed a normal distribution of values for the physical fitness variables. Separate two-way ANOVAs for each physical fitness variable were conducted, using sports background and gender as fixed factors, to evaluate the differences between genders (main effect of gender) on the physical fitness variables, as well as the interaction of gender and years of sports participation in each variable (Table 2). The interaction is useful because it gives an indication of the physical fitness gender differences across all three levels of sports involvement background. The Univariate ANOVA in SPSS presents the results of the estimates of means, the pairwise comparisons and the univariate tests for the gender and for the sports background groups separately. However, the pairwise comparisons for the gender by background group interaction are unfortunately not presented in the ANOVA results (SPSS) and therefore the statistically significant differences between genders at each level of background are not evident. Therefore, separate t-tests of independent samples were conducted for all physical fitness variables with an indication of interaction, in order to identify the gender differences in each level of sports background (Table 3). In addition, separate one-way ANOVAs for each gender were conducted (Table 2), to reveal the physical fitness differences between the levels of sports background in each gender and give reason to the increased magnitude of differences between genders from one level of sports background to the other. The statistical significant criterion was $p < .05$

Results

The central tendency values for both genders' somatometric characteristics, shown in Table 1, indicate that there aren't significant differences between boys and girls in their height, body mass, and BMI. The number of students in each sports background and age group according to their gender are shown in table 1. The two-way univariate analysis of variance (ANOVA) indicated statistically significant differences between boys and girls (gender main effect) in the following physical fitness variables: (a) sit and reach($F(1,192)=4.14$, $p<.05$, partial eta squared =.02); (b) shuttle run 10×5m($F(1,192)=14.44$, $p<.001$, partial eta squared =.07); (c) standing broad jump ($F(1,192)=12.43$, $p<.001$, partial eta squared=.06); (d) 20 m shuttle run ($F(1,192)=15.90$,

Table 2. Two-way ANOVAs, estimating gender and sports background group interaction effects & One-way ANOVAs for each gender, estimating the effect of background on physical fitness variables

Variables	Back-ground Groups	Boys		Girls					
		M	SD	M	SD		F	p	η^2
Sit and Reach	0 years	9.52	6.40	12.59	6.93	*	.70	.50	.00
	1-3 years	13.26	7.37	13.68	6.38	**	-	-	-
	≥4 years	11.48	7.16	13.95	6.74	***	-	-	-
	Overall	11.52	7.11	13.41	6.64	****	4.14	.04	.02
Shuttle run 10x5m	0 years	23.00	1.87	24.10	1.71	*	1.03	.36	.01
	1-3 years	22.29	1.75	23.48	1.69	**	-	-	-
	≥4 years	22.77	1.65	23.19	1.28	***	-	-	-
	Overall	22.66	1.76	23.60	1.61	****	14.44	.00	.07
Standing broad jump	0 years	1.29	.40	1.31	.26	*	3.54	.03	.04
	1-3 years	1.45	.20	1.25	.24	**	5.21	.01	-
	≥4 years	1.53 [a]	.22	1.34	.24	***	1.33	.27	-
	Overall	1.43	.29	1.29	.25	****	12.43	.00	.06
Shuttle run 20m	0 years	22.17	15.92	22.09	12.64	*	5.02	.01	.05
	1-3 years	31.19[a]	12.09	19.42	9.56	**	8.22	.00	-
	≥4 years	31.26[a]	15.47	20.55	9.61	***	.81	.45	-
	Overall	28.43	14.93	20.97	10.69	****	15.90	.00	.08
T-Test	0 years	17.66	2.87	17.81	2.11	*	1.58	.21	.02
	1-3 years	16.51	2.08	17.59	2.10	**	-	-	-
	≥4 years	15.92	2.60	17.53	2.22	***	-	-	-
	Overall	16.67	2.59	17.64	2.13	****	8.13	.01	.04
Single – handed overhead throw	0 years	17.59	7.09	13.33	4.70	*	6.73	.00	.07
	1-3 years	19.16	4.70	13.93	5.64	**	7.21	.00	-
	≥4 years	23.22[a,b]	5.94	12.43	3.62	***	1.11	.34	-
	Overall	20.10	6.30	13.27	4.78	****	79.41	.00	.29

Note a, Differs from group with 0 years of background; b, differs from group with 1-3 years of background; * = gender and sports background interaction effect (two-way ANOVA); ** = sports background effect for boys (One-way ANOVA); *** = sports background effect for girls (One-way ANOVA); **** = Gender main effect values (differences between genders) (two-way ANOVA)

p<.001, partial eta squared=.08); (e) agility T-test (F(1,192)=8.13, p<.05, partial eta squared=.04); and (f) single-handed overhead softball throw (.200kg ball) (F(1,192)=79.41, p<.001, partial eta squared=.29) (Table 2).

The two-way univariate analysis of variance also revealed a statistically significant interaction effect of background in sports and gender on the values of the following fitness components: (a) standing broad jump (F(2,192)=3.54, p<.05, partial eta squared=.04), (b) 20m shuttle run (F(2,192)=5.02, p=<.01, partial eta squared=.05) and (c) single-handed overhead throw (F(2,192)=6.73, p<.01, partial eta squared=.07). The charts in figures (1, 2, and 3) clearly show the differences between genders in these fitness components, for each level of sports background.

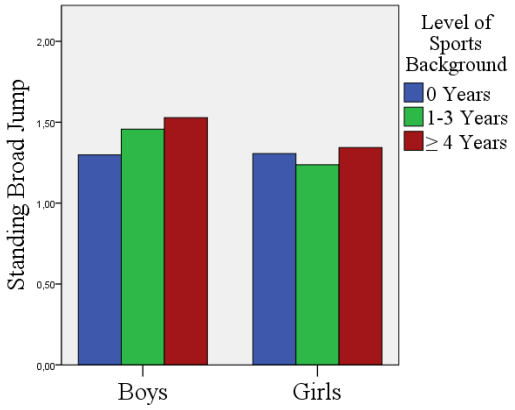

Figure 1. Level of sports background and gender interaction effect on standing broad jump

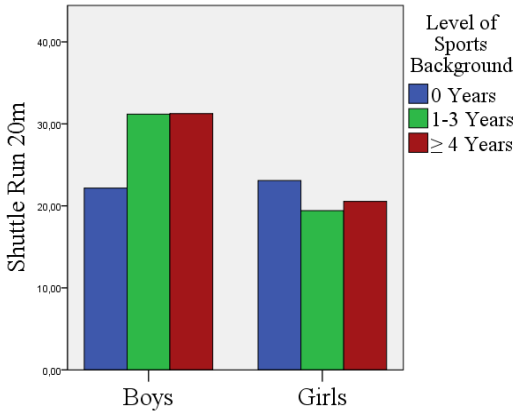

Figure 2. Level of sports background and gender interaction effect on shuttle run 20m

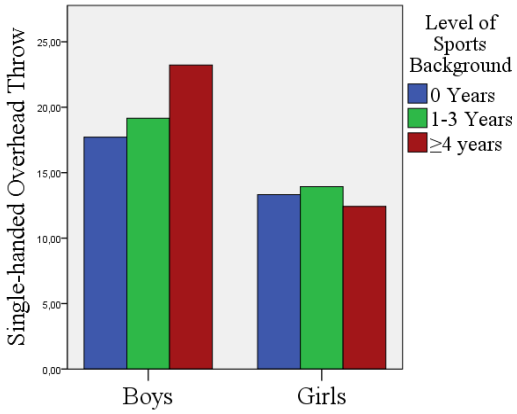

Figure 3. Level of sports background and gender interaction effect on single-handed overhead throw

The t-tests for independent samples, carried out separately for each sports background group, showed the following statistically significant differences between boys and girls, in the physical fitness variables, affected by the interaction of gender and background in sports (Table 3): (a) for the standing broad jump, the boys who had one up to three years (t(70)=3.77, p<.001) and those who had at least four years of sports participation (t(61)=3.16, p<.01), had statistically significant higher scores than girls of the same groups (Table 3), (b) for the 20 m shuttle run, the boys who had one up to three years (t(70)=4.24, p<.001) and four years (the least) of background in sports (t(61)=2.90, p<.01) had statistically significant higher scores than girls with the same background (Table 3), and (c) for the single-handed overhead throw, the boys of all three groups had statistically significant higher scores than girls belonging to the same groups (for the group which did not have a sports background t(61)=2.65, p<.05, for the group which had one up to three years of background in sports t(70)=3.94, p<.001, and for the group with at least four years of sports participation t(61)=8.75, p<.001) (Table 3).

Table 3. Independent sample t-tests in each background group, to estimate gender differences in variables with an interaction effect

Note. * Statistically significant difference; t, t value; M, Median; SD, Standard Deviation; p, level of significance.

Variables	Background	Gender	M	SD	t	df	p	95% Interval Confidence
Standing broad Jump	0 years	Boys	1.29	.40	-.19	61	.85	-.18-.15
		Girls	1.31	.26				
	1-3 years	Boys	1.45	.20	3.77*	70	.00	.09-.31
		Girls	1.25	.24				
	≥4 years	Boys	1.53	.22	3.16*	61	.00	.07-.30
		Girls	1.34	.24				
Shuttle run 20m	0 years	Boys	22.17	15.92	-1.22	61	.22	-8.12-6.27
		Girls	22.09	12.64				
	1-3 years	Boys	31.19	12.09	4.24*	70	.00	6.67-16.86
		Girls	19.42	9.56				
	≥4 years	Boys	31.26	15.47	2.90*	61	.01	4.27-17.17
		Girls	20.55	9.61				
Single – handed overhead throw	0 years	Boys	17.59	7.09	2.65*	61	.01	.99-7.07
		Girls	13.33	4.70				
	1-3 years	Boys	19.16	4.70	3.94*	70	.00	2.43-7.43
		Girls	13.93	5.64				
	≥4 years	Boys	23.22	5.94	8.75*	61	.00	8.33-13.26
		Girls	12.43	3.62				

The one-way univariate analysis of variance, carried out for each gender, revealed the following statistically significant level of background effects on the previously mentioned physical fitness variables (Table 2). For the boys' standing broad jump the sports background effect ($F(2,89)=5.21$, $p<.01$) indicated a significant difference between the group of children who had at least four years of sports participation ($M=1.53$, $SD=.22$)and the group without participation in sports ($M=1.29$, $SD=.40$) (Table 2). For the boys' shuttle run, the background effect ($F(2,91)=8.22$, $p<.001$) indicated a significant difference between both the group which had at least four years ($M=31.26$, $SD=15.47$), as well as the group which had one up to three years of sport background ($M=31.19$, $SD=12.09$) with the group of children who did not have a background in sports ($M=22.17$, $SD=15.92$) (Table 2). For the boys' single-handed overhead softball throw, the background effect ($F 2,89)=7.21$, $p=<.001$) indicated a significant difference between the group of children with four years (the least) of involvement in sports ($M=23.22$, $SD=5.94$) and the other two groups ($M=19.16$, $SD=4.70$ for the 1-3 years group and $M=17.59$, $SD=7.09$ for the group without a background in ports) (Table 2). On the contrary, there weren't significant differences between the sports background levels in the girls' physical fitness factors mentioned above. These results explain the magnitude of increase in these physical fitness differences between boys and girls, from the first level (group which had no background in sports) to the second (group that had one up to three years of background in sports) and third background level (group which had at least four years of involvement in sports).

Discussion

The purpose of this study was to investigate the differences in physical fitness between preadolescent boys and girls (10-12 years old) and whether these differences are affected by their background of participation in extracurricular organized sports (years of participation).

The results showed that boys perform better than girls in aerobic capacity, running speed, and power of lower extremities. Previous studies have shown similar results (Gantiraga, Katartzi, Komsis, & Papadopoulos, 2006; Van Praagh, Fellmann, Bedu, Falgairette, & Coudert, 1990). They also performed better in agility and this has also been previously reported (Ashoke et al., 2011; Branta et al, 1984; Deoreoet al., 1980; Katic et al., 2012; Markovic et al., 2011; Morris et al., 1983;). In agreement with previous investigations, the present study revealed that boys are better than girls in the single-handed overhead soft ball throw. It has been suggested that these differences are due to physiological and anatomical characteristics, such as the larger mid arm muscle mass and greater hip/shoulder ratio (Halverson et al., 1982; Raudsep et al., 1995; Roberton, Halverson, langerdorfer, & Williams, 1979). The present study showed that girls are better than boys in flexibility and this conclusion is also in agreement with previous studies. Researchers attribute the girls' superiority to physiological reasons (DeOreoet al., 1980; Malina, 1975).

Regarding the hypothesis, whether gender differences in physical fitness are affected by the preadolescents' background in extracurricular organized sports, the results confirmed this assumption for the basic fitness components of lower limbs (standing broad jump) and upper limbs power (single-handed overhead throw), as well as for the aerobic capacity (shuttle run 20m).In specific, the study indicated that regardless of the girls' background of involvement in sports, there was no significant increase in their lower and upper limb power, as well as their aerobic capacity (Table 2). The boys however, significantly improved their lower and upper limbs power, when they had at least four years of sports involvement. They also significantly improved their aerobic capacity, when they had at least one up to three years of involvement in sports. These results lead to the conclusion that preadolescent boys (10-12 years old) significantly improve basic components of physical fitness, while improving their background of involvement in organized extracurricular sports, but girls don't. This could be an indication that when boys increase their sports participation, their biological characteristics (progressive increase in muscle mass and less adiposity tissue), which begin to differentiate them from girls at this particular stage, initiate a more significant improvement in physical fitness, compared with girls.

The study also revealed non-significant gender differences in the power of lower limbs and in aerobic capacity for preadolescents who do not have a background of involvement in sports (Table 3). This indicates that the boys' biological characteristics, which can cause gender differences in physical fitness, might be inactivated due to the absence of a sports participation background. However, boys significantly increase their gap with girls in aerobic endurance, and in their upper and lower limbs power, when both genders have the same background of involvement in sports (Table 3). This is an indication that the girls' reduced involvement in physical activity isn't responsible for the physical fitness differences with boys. It appears that there is an inconsistency with previous studies, suggesting that the differences between preadolescent boys and girls in gross motor abilities are attributed to a higher level of the boys' participation in physical activities (Manios et al., 1999). It is possible that higher levels of physical activity alone, may not explain the gender differences in physical fitness, if the type, duration, and intensity of the activity are not taken into consideration. According to Samara et al. (2012), the type of sport and the kind of games chosen, provide children with the opportunity to improve their physical fitness. The choices they make probably contribute to the enhancement of gender differences in physical fitness. The increase in the physical fitness gap between preadolescent boys and girls, regardless of a simultaneous increase of sports participation background in both genders, might also be an indication that the boys' biological characteristics are activated when they improve their background of involvement in sports.

In conclusion, preadolescent boys and girls without a background in sports, have no differences in physical fitness. However, a sports background increase in both genders affects their differences, by increasing their gap in basic components of physical fitness. We suggest that the biological characteristics may facilitate preadolescent boys to improve their physical fitness to a greater extent, when they increase their participation in extracurricular sports. In addition, the girls' reduced physical activity participation alone is not responsible for the gap in physical fitness with boys.

The present study provides additional information about the differences in physical fitness between preadolescent boys and girls and provides an initial insight regarding how the sports participation background affects these differences. However, further investigation could be initiated to explain why the gap in physical fitness isn't reduced when both genders equally increase their involvement in sports. A study de-

signed to examine the contribution of biological characteristics, such as muscle mass and adiposity tissue, in combination with the qualitative and quantitative aspects of the physical activity (type, intensity and duration) that both genders choose, could shed light on the reasons that cause the inequality of improvement in physical fitness between boys and girls.

What does this study add to physical education?

The development of the children's psychomotor abilities, the improvement of their physical fitness, and the increase in the levels of their physical activity are the main objectives of physical education. The development of fundamental motor skills leads to their improvement in complicated athletic skills and at the bottom line it helps them to increase their participation in organized sports and finally increase their physical activity. The children's mastery of motor skills is fully dependent upon their physical fitness and vise versa. This study offers valuable information about gender differences in physical fitness levels between preadolescent boys and girls and how these differences are affected by their involvement in sports. The knowledge it offers, could be taken into consideration when physical educators set their long term objectives and plan their lessons. It could influence the choices they make in selecting the appropriate lesson content, corresponding to the different skill and fitness level between genders. Offering a qualitative lesson that fulfills the pedagogical requirements can encourage the students' participation and enhance their physical activity.

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