

## Enhanced Body Composition and Physical Fitness in Prepubescent Soccer Players

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### ABSTRACT

The purpose of this study is to examine the effect of soccer activities on body composition and physical fitness among prepubertal boys. A total of 38 prepubescent male soccer players (mean age,  $12.1 \pm 0.13$  years) were compared with 41 participants in control group (mean age,  $12.4 \pm 0.06$  years). The body composition was measured using the bio-electrical impedance analysis (BIA) method (Tanita Corp., Tokyo, Japan). 30m sprint ( $T_{30}$ ), agility T-Test, and Sit-And-Reach (S&R) Tests were performed from different motor fitness test batteries. Student's unpaired t-test revealed that soccer and control groups were similar in age, height, body mass, BMI and lean body mass (LBM), but the control group had higher percentage of body fat (%BF) than the soccer group ( $p < 0.05$ ). Also, pearson correlation analysis showed a significant moderate positive correlation between %BF and  $T_{30}$  ( $r = 0.62$ ;  $p = 0.00$ ), and a significant lower positive correlation between agility T-Test and S&R test ( $r = 0.35$ ;  $p = 0.00$ ,  $r = 0.42$ ;  $p = 0.00$ ), respectively. No significant correlation was observed between LBM, and  $T_{30}$ , agility T-Test, and S&R test ( $r = -0.08$ ;  $p = 0.49$ ,  $r = -0.16$ ;  $p = 0.15$ ,  $r = -0.16$ ;  $p = 0.15$ ), respectively. In conclusion, soccer activities are associated with better physical fitness and lower BF among prepubescent boys.

**Keywords:** body fat percentage, lean body mass, BMI, performance, regular training

### INTRODUCTION

In order to develop a physically active and healthy lifestyle, participation in sports and engagement in physical activities have critical importance in children between 6 and 12 years of age (Hofferth and Sandberg, 2001). The benefits of sports in enhancing physical activity were reported in previous studies (Kjønniksen et al., 2009; Wickel and Eisenmann, 2007; Yarım, 2014). Improved physical fitness is seen in prepubertal children who have continued physical activity for a long time (Vicente-Rodriguez et al., 2003). It is well known that physical fitness is negatively associated to body composition in children (Deforche et al., 2003; Brunet et al., 2007; Ara et al., 2004; Hussey et al., 2007). An excess of body fat and high values of body mass index can be defined as obesity in the literature (Freedman et al., 2007). During the past decades, the prevalence of childhood obesity has increased dramatically all around the world (Lifshitz et al., 2006). Consequently, to prevent the increasing prevalence of obesity, the health promoting programs should target physical fitness activities (Brunet et al., 2007; Nobre et al., 2017).

Regular physical activity during childhood and adolescence is known to have many positive effects on physiological and psychological parameters (Sallis et al., 2000; Strong et al., 2005; Ortega et al., 2008). For example, Ara et al., (2004) found that better physical fitness and lower body fat percentage in prepubertal boys who participate regular physical exercises (at least 3 hours per week). Kotzamanidis (2006) suggested that plyometric training enhanced running speed in prepubertal boys. At least 60 minutes or moderate to intensive physical

exercises are advised in order to improvement better physical and physiological characteristic in children and adolescents (Borrod et al., 2014).

Soccer/football is the most common and popular sport in the world among both women, men, and children. Stølen et al., (2005) indicated that soccer training consists of technic and tactical, biomechanical, mental and physiological activities. Strength, flexibility (Lehance et al., 2009), speed, and acceleration abilities are important for physical performance in soccer players (Baker and Nance, 1999). It is reported that child and adolescent soccer players at 9, 11, 12, and 14 years of age have significantly lower body fat ratios than reference population (Moreno et al. 2004). Studies also show that athletes engaged in team-sports have shown better physical fitness parameters than their lower skilled counterparts (Gabbett et al., 2009; Gabbett and Georgieff, 2007).

## **PURPOSE OF THE STUDY**

The majority of the training program-based pediatric research focus to improvement cardiorespiratory health (Cepero et al., 2011). But at the same time, studies, for example Santos et al. (2011), showed that improvements in muscular strength, running speed, and agility have important effects on health like cardiorespiratory fitness. On the other hand, according to Johnson et al. (2000), recommended only aerobic fitness in order to decrease fat mass in children. Therefore, the interventions should be focus to prevent or reduce the prevalence of the obesity in prepubertal children (Ara et al., 2004). The aim of this present study is to examine the effects of soccer training on body composition and physical fitness among prepubescent boys.

## **METHODS AND MATERIALS**

The experimental design of this study is a Cross- Sectional Study. All tests were carried out in a single season at the same time of the day (9–11 AM). The participants were allowed to rest for 60 minutes after the anthropometric analysis, and then physical fitness testing started. Before the tests, parents were asked to read and sign an informed consent document. The study was conducted in accordance with the Helsinki Declaration. Seventy-nine healthy boys between 11 and 14 years of age involved in the study. They were grouped on their physical characteristics as soccer group (SG) (n = 38) and control group (CG) (n = 41). SG those who is a part of a soccer training group at a primary training center. The mean training time three days a week was  $1.15 \pm 0.9$  h (except for school sports), and the mean training experience at the beginning of the study was  $1.4 \pm 1.6$  years. The remaining 41 children, who participate only 1 weekly session of 45 minutes in the physical education classes.

### **Data Collection Tool**

Subjects' body heights were roughly measured by using an electronic measuring scale. The bio-electrical impedance analysis (BIA) method (Tanita Corp., Tokyo, Japan) was used to measure children's body compositions. Three single tests of physical fitness were used in this study. Speed, agility, and flexibility were assessed via 30-m sprint test, agility T-Test, and sit-and-reach test, respectively. At the beginning of the testing session, a standard warm-up was performed before the test. This warm-up lasted about 10 minutes and consisted of light walking, running and dynamic stretching exercises. After that all children were informed about tests procedures verbally and visually, and they were allowed to one practice trail for each test. In all measurements, the children made maximum of 2 repetitions with full rests in-between. The best trail was recorded for further analysis.

Statistical analysis of the values obtained from the study was performed using the IBM SPSS (version 23) analysis program. Means, standard deviation, and the 95% confidence interval values of the data were calculated. Data normality was verified and confirmed by the Skewness and Kurtosis Tests. Students' unpaired t-tests were used to evaluate group differences between parameters. To determine the relationship between physical fitness and body composition, Pearson correlation analysis was performed. The 95% confidence interval for each variable was calculated. The significance level was set at  $p < 0.05$ .

## **FINDINGS**

Age, anthropometric characteristics, and body composition of children are shown in **Table 1**. Except BF%, age, height, body mass, BMI, and LBM were similar in SG and CG. SG had lower BF% than the SG ( $p < 0.05$ ). Similarly, the SG had better performances in S&R, T<sub>30</sub>, and T-test agility performances ( $p < 0.05$ ) (**Table 2**).

**Table 1.** Subject's age and anthropometric variables of the study groups

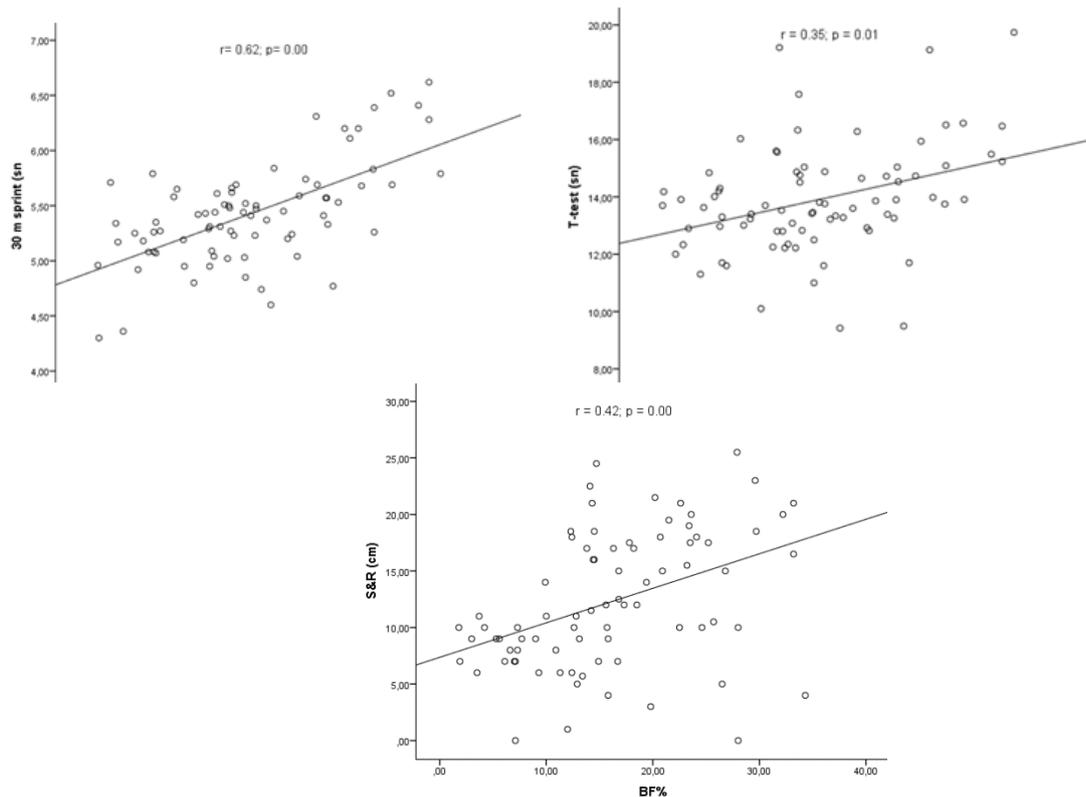
	Soccer (n= 38)		Control (n= 41)		P
	Mean ± SD	[95% CI]	Mean ± SD	[95% CI]	
Age (years)	12.1±0.13	[11.8-12.3]	12.4±0.09	[12.2-12.6]	NS
Height (cm)	151.5±1.79	[148-154.8]	151.5±0.04	[149.3-153.8]	NS
Body mass (kg)	43.4±1.91	[39.6-47]	45.4±1.56	[42.3-48.5]	NS
BMI (kg/m <sup>2</sup> )	18.5±0.45	[17.6-19.4]	19.6±0.52	[18.6-20.7]	NS
BF (%)	11.1 ±0.01	[9.08-13.1]	21 ±1.01	[19-23.1]	0.00*
LBM (kg)	37.9±1.31	[35.2-40.5]	35.1±0.77	[33.7-36.7]	NS

Abbr: SD, standard deviation; CI, 95% confidence intervals; NS, nonsignificant.

**Table 2.** Physical Fitness Measurements of the study groups

	Soccer (n= 38)		Control (n= 41)		P
	Mean ± SD	[95% CI]	Mean ± SD	[95% CI]	
S&R Test (cm)	15.8±0.84	[14.1-17.6]	8.5±0.66	[7.21-9.79]	0.00*
T <sub>30</sub> (sn)	5.18±0.06	[5.06-5.29]	5.65±0.06	[5.52-5.78]	0.00*
T-test (sn)	13±0.25	[12.5-13.5]	14.8±0.27	[14.3-15.3]	0.00*

Abbr: SD, standard deviation; CI, 95% confidence intervals; T<sub>30</sub>, time in 30 m (s); SD, standard deviation; S&R, Sit and Reach Test; NS, nonsignificant.

**Figure 1.** Correlations between BF and sprint, agility and flexibility in all participant

Pearson correlation analysis showed a significant moderate positive correlation between BF% and T<sub>30</sub> ( $r = 0.62$ ;  $p = 0.00$ ), and a significant lower positive correlation between agility T-Test and S&R test ( $r = 0.35$ ;  $p = 0.00$ ,  $r = 0.42$ ;  $p = 0.00$ ), respectively. No significant correlation was detected between LBM, and T<sub>30</sub>, agility T-Test, and S&R test ( $r = -0.08$ ;  $p = 0.49$ ,  $r = -0.16$ ;  $p = 0.15$ ,  $r = -0.16$ ;  $p = 0.15$ ), respectively (Figure 1).

## DISCUSSION AND CONCLUSION

This study analyzed the effects of soccer training for 3.45 h/week for at least 1 year on body composition and physical fitness in prepubescent boys. The results of this present study showed that practicing soccer training is related with lower percentage of body fat, better running speed, agility, and flexibility performance in prepubertal boys.

There are wide range of studies reporting that physical activity level is a good indicator of better body composition and physical fitness capacity (Çetin et al., 2018; Janssen et al., 2010; Granacher and Borde, 2017; Polat and Gunay, 2016; Vanttinen et al., 2011; Ara et al., 2004; Ara et al., 2007).

For example, Granacher and Borde (2017), examined the physical fitness and body composition among prepubertal children. They reported that participants in the elite sports class had a lower BMI (22%), lower body fat mass (14%), and more relative skeletal muscle mass (6%) than those of the control group. In addition, in the same study, significantly better performances were detected in running speed, agility, flexibility, and lower extremity power in the sport-specific training group. Ara et al. (2007) reported that athletically active boys had better results in flexibility, and bent arm hang tests than their counterparts in the age between 7 and 12 years. Similarly, as previously reported by Vanttinen et al. (2011) in their study conducted with 39 children (age between 11 to 15 years), they detected that young soccer players had better results in speed, agility, and percentage of body fat than their peers. Furthermore, the authors noted that soccer practices have positive effects on physiological characteristics in children.

According to a study conducted in overweight children and adolescents by Martín-García et al. (2017), vigorous physical activity intervention had positive effects on body fat and BMI parameters. Another study was conducted by Moreno et al., (2004) in 239 children between 9 and 14.9 years of age, who played soccer in a local league. The results were parallel with this present study. They reported that no differences were detected in terms of BMI in the soccer and reference groups, and soccer group had lower BF% than in the reference group. The authors also recommended that soccer can be proposed as a physical activity practice in order to prevent obesity.

Previous studies reported that overweight and obese children showed lower physical fitness levels than non-obese children (Deforche et al., 2003; Brunet et al., 2007; Ara et al., 2004; Hussey et al., 2007). Because of fat tissue is an extra load for subjects, the overweight and obese children have shown lower performance in all motor tests (Ara et al., 2004). Hussey et al. (2007), showed that a significant negative relations between physical fitness and body compositions in boys and girls, those have high BMI, and waist circumference. Similarly, Brunet et al. (2007), found negative correlations between BMI, WC and the fitness tests in children between 7 and 10 years of age. In agreement with these observations, this present study showed that negative correlation between BF and physical fitness tests in prepubertal boys. BF was significantly correlated with running speed, agility, and flexibility performance.

In conclusion, three days a week for 1.5 hours of soccer activity for at least 1 year has positive effects on the percentage of body fat and physical fitness parameters among soccer prepubescent boys than control subjects at the same age and pubertal stage. Soccer activities can be favorable as a physical activity practice in order to improve physical fitness performance and reduce body fat percentage among prepubescent boys.

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