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Comparison of Development of Physical Fitness Parameters in different Summer School Programs

by
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The purpose of this study was to compare body composition and physical fitness development of children participating in soccer and different education programs. Nineteen adolescence children (age=12.8±0.3) participated in soccer training and eleven adolescence children (age=13.4±1) participated in multi-purpose physical education program for three weeks. Physical fitness tests were applied for determining the motor fitness, flexibility, agility, explosive power, general balance and endurance of children. Tests were applied before and after two educational programs and paired t-tests were applied between pre- and post-tests of the group. According to results, the weight of children who participated in the multi-purpose physical education program did not change significantly, whereas the weight of children in the soccer training program changed significantly ($p<0.05$). Standing-broad jump performance, 10 x 5 m speed shuttle run performance, flamingo balance test, abdominal sit-ups and medicine ball performance were significantly increased after two multi-purpose education programs ($p<0.05$). Furthermore, strength endurance of abdominal muscle group performance increased in only the soccer training group ($p<0.05$). In conclusion, both training programs had positive effects on performance. However, soccer training is more effective for development of strength and endurance of the abdominal muscle group, because soccer training is more specific for development of motor abilities.
Key words: summer school, physical activity, children, soccer training, multi-propose education

Introduction

It is clear that, despite their natural tendencies, children have become less physically active in recent decades, with children today expending approximately 600 kcal*day^{-1} less than their counterparts 50 years ago. Subsequently, 10 percent of the world's school-aged children are estimated to be carrying excess body fat. Although the health consequences of reduced energy expenditure in adults are well-documented, there is little direct evidence linking sedentariness with reduced health quality in children. Obesity is an important problem in school children, and both poor eating habits and lack of daily physical activities may lead to obesity in children with genetic predispositions (Lobstein et al., 2004; Simsek et al., 2005). To prevent obesity, physical activity of youth should be increased. Since the amount of time for school physical education has declined and curricular interventions have had limited effects, alternative non-curriculum approaches need to be tested.

In previous studies results showed that children were active during school break periods, and inexpensive interventions (new equipment, music, advertisement) further increased activity during these times. Children sitting passively in the car for the `school run', watching television for up to one-third of their waking day, participating in less and less school physical education, as other curricula pressures take precedence, and thereby giving rise to

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disconcerting evidence that our new generation of children are becoming progressively overweight, if not already obese. There is a positive relationship between TV viewing and fatness. Active travel to school offered potential to curve this relationship, but its effectiveness was impaired by traffic congestion and parental fears for child safety. Children who watched the most television during childhood had the greatest increase in body fat over time. Healthy lifestyle education designed to prevent obesity and its consequences should target television-watching habits of children. Furthermore, extracurricular school-based interventions had problems with low attendance, which might be removed if delivered through existing community organizations. Summer day camps offered potential for increasing youth activity, but research is required to determine how best to convert camp activity into increased post-camp habitual activity. (Boreham and Riddoch, 2001; Jago and Baranowski, 2004; Proctor et al., 2003; Reilly et al., 1999; Grund et al, 2001). In other results, researches showed significant physical fitness improvements during the school year, with little or no changes in the summer holidays. Children who reported less than 30 minutes of daily participation in physical activity demonstrated lower prevalence rates for overweight and obesity, as well as superior fitness performance. The detrimental effect of the summer break on the progress of physical fitness was less in children who participated in physical activity in the school year than in those who did not. Longitudinal modeling using generalized estimating equations demonstrated that physical activity is a major contributing factor for obesity over time, masking the singular effect of various fitness parameters (Christodoulos et al., 2006).

Sallis et al. (1997) evaluated a health-related physical education program for fourth and fifth grade students, designed to increase physical activity during physical education classes and outside of school. They found that students spent more minutes per week being physically active in specialist-led (40 min) and teacher-led (33 min) physical education classes than in control classes (18 min; $p < 0.001$). After 2 years, girls in the specialist-led condition were superior to girls in the control condition on abdominal strength and endurance ($p<0.001$) and cardio respiratory endurance ($p < 0.001$). There were no effects on the study due to physical activity outside of school. Deforche et al. (2003) assessed different aspects of physical fitness and physical activity in obese and non-obese Flemish youth. They found that obese subjects had inferior performances on all tests requiring propulsion or lifting of the body mass (standing-broad jump, sit-ups, bent-arm hang, speed shuttle run, and endurance shuttle run), compared with their non-obese counterparts ($p < 0.001$). In contrast, the obese subjects showed greater strength on handgrip ($p < 0.001$). Both groups had similar levels of leisure-time physical activity; however, non-obese boys had a higher sport index than their obese counterparts ($p < 0.05$). Recent health guidelines suggesting that children should accumulate 60 min of moderate-intensity physical activity every day, supplemented by regular activities that promote strength, flexibility and bone strength appear to be justified. Future developments should include the implementation of large-scale, longitudinal studies spanning childhood and young adulthood, the further refinement of tools for measuring physical activity accurately in young people, and research into the relative strength of association between fitness, activity and health in children. Düger et al. (1999) researched the relationship between motor abilities and demographic characteristics, such as age and sex, in healthy children aged 4± 11 years. There are some studies about motor development of children (Salis et al. 1997), however, there was no research about the effects of different training programs for children. The purpose of this study was to compare body composition and physical fitness development of children that participated in soccer training and multi-purpose training programs.

Materials and Methods

Participants

The research was conducted in the summer time of 2009 in Eskisehir. The multi-purpose education program was performed by the physical education and sports department in Eskisehir. The soccer summer school was carried out by the Eskisehir soccer team, which competes in the first division of Turkish Super League. Nineteen adolescence chil-

Table 1

Descriptive Information of Subjects

	Age (year) M±SD	Height (cm) M±SD
Soccer Training	12.8±0.3	146.9±6.2
Multi-Purpose Physical Education Program	13.4±1	164.1±7

dren participated in soccer training and 11 adolescence children participated in the multi-purpose physical education program for three weeks.

Instruments and Procedure

Education Programs

Trainings were four times a week for soccer training and five times a week for multi-purpose physical education training programs. Soccer training includes training drills for soccer. Multi-purpose physical education programs included soccer, volleyball, basketball, gymnastics and educational games for different days. All training drills for soccer training and multi-purpose physical education programs were based on games for sportive activities because of the age of children.

Physical Fitness and Body Composition Parameters

All tests were applied before the start of the training periods and after the 3 weeks training period. All tests were applied two times for reliability. Age, body weight, height, % body fat and body mass index were measured. Body fat percentage was calculated with Dogu Formula, which was developed for the Turkish population.

Body Fat %= 2.662566 x 0.5819738 x X1+0.2770687 x X2

X1= Abdominal skinfold (mm)

X2= Thigh skinfold (mm) Hamimoglu and Kaya (2008).

Bruininks Oseretsky tests of motor proficiency were used to assess the both gross and fine motor skills. These tests are running speed and agility, balance/walking, forward heel-toe on walking a line, bilateral coordination, tapping-foot and finger on same side synchronized, strength/standing broad jump, response speed, visual motor control/cutting out a circle with preferred hand, upper-limb speed and dexterity placing pennies in two boxes with both hands (Wrotniak et al., 2006; Duger et al., 1999). As it explained above some items from Bruininks Oseretsky tests of motor proficiency were used in this study.

Physical Fitness tests were applied for determining the motor proficiency, flexibility, agility, explosive power, general balance and strength endurance of the abdominal muscle group of children. Flexibility was measured by sit and reach test. Subjects stood on one foot until they couldn't maintain balance. Time duration in seconds was noted for evaluating balance. Flamingo balance test was applied for determining general balance. 10 x 5 m speed shuttle run test was applied for determining speed and agility. Sit-ups tested which mechanism for regulation of excitation duration was applied for evaluating the trunk, gluteus maximus and quadriceps muscles for repetitive strength and endurance. Children performed sit-ups continuously for 30 seconds and registered the number of repetitions performed.) Standing-broad jump tesed which mechanism for regulation of excitation intensity was applied for determining explosive strength. The child jumps with both feet from the start line and lands as far from the line as possible. The length of the jump is recorded in centimeters. The task is performed two times. These tests are reliable and valid instruments for measuring physical fitness in children and are a commonly used battery of tests in Europe (Bala, 1999; Deforche et al., 2003). A two kilogram medicine ball was used for determining explosive strength in the upper and lower body of adolescents.

Height was measured to the nearest 0.1 cm using a stadiometer (Holtain Ltd) with the subject wearing sports clothing and no shoes. BMI was calculated from height and weight measurements. Skin fold thickness was measured with Holtain Caliper.

Data Analyses

Body composition and physical fitness tests were applied before and after two training programs and statistical analyses were applied between two measurements. Normality test was applied to the data. If the data passed the normality test, a paired T test was used for determining the effects of different training programs. Effect size (ES) was calculated for each comparison using Cohen's delta to evaluate the size of mean differences. Effect sizes >0.8 represent large differences (Cohen, 1988) and were used to acknowledge physical fitness level differences. SPSS 18 PASW program was used for the statistical analyses.

Results

The weight (kg) of children who participated in the multi-purpose physical education program (M pre=63.5, SD=11; M post=63.3, SD=11) did not change significantly; however; the weight of children who participated in the soccer training program (M pre=39.5, SD=8.8; M post=39.9, SD=9) demonstrated significant differences ($p<0.01$). The distance (m) in the standing-broad jump in children who participated in the multi-purpose physical education pro-

Table 2

Pre- and Post-Evaluation of Physical Fitness Parameters of Two Education Groups

Measurements	Soccer Training				Multi-Purpose Physical Education			
	Pre M±SD	Post M±SD	P	ES	Pre M±SD	Post M±SD	P	ES
Weight (kg)	39.5±8.8	39.9±9	**	.02	63.5±11	63.3±11	NS	
Body Mass Index	23.5±3.4	23.3±3.3	NS		18.3±3.5	18.4±3.6	NS	.
Standing Broad Jump (cm)	1.45±0.3	1.53±0.2	*	.2	1.53±0.2	1.64±0.1	**	.3
10*5 m speed shuttle run (sn)	16.63±1.4	17.19±1.5	*	.2	16.11±0.9	16.22±1	*	.05
Flamingo balance test(sc)	19.5±10.6	32.5±16.6	*	.4	59.32±11.2	141.7±17.4	*	.9
Abdominal sit-ups (strength endurance of a abdominal muscle group)	21±11.8	28±6.8	**	.3	34±9.2	39±7.9	NS	
Medicine ball performance(m)	4.5±1	4.9±0.9	**	.2	3.04±0.6	3.59±0.8	*	.4
Sit and Reach (cm)	20.9±7.1	26.3±8.1	*	.3	21.2±6.8	23.6±6.3	**	.2
Sit-up	34.4±2.1	36.9±1.8	**	.5	21.3±11.8	27.6±6.9	*	.3

*: p<0.05, **: <0.01

gram (M pre=1.53, SD=0.16; M post=1.64, SD=0.15) showed significant differences (p<0.01), whereas children who participated in the soccer training program (M pre=1.45, SD=0.26; M post=1.53, SD=0.25) demonstrated only moderately significant differences (p<0.05). The 10 x 5 m speed shuttle run performance showed multi-purpose physical education children (M pre=16.11, SD=0.9; M post=16.22, SD=1) had moderately significant differences (p<0.05), which corresponded similarly to the soccer training group (M pre=16.63, SD=1.4; M post=17.19, SD=1.5), also revealing moderately significant differences (p<0.05). With respect to flamingo balance test, multi-purpose physical education children (M pre=59.32, SD=11.2; M post=141.7, SD=17.4) demonstrated moderately significant differences (p<0.05), as did the soccer training group (M pre=19.5, SD=10.6; M post=32.5, SD=16.6) which also had moderately significant differences (p<0.05). In the abdominal sit-ups test, multi-purpose physical education children (M pre=34, SD=9.2; M post=39, SD=7.9) showed no significant differences; however; the soccer training group (M pre=21, SD=11.8; M post=28, SD=6.8) was significantly different at p<0.01. In evaluating medicine ball performance, multi-purpose physical education children (M pre=3.04, SD=0.6; M post=3.59, SD=0.8) demonstrated moderate significant differences (p<0.05), whereas, the soccer training group (M pre=4.5, SD=1; M post=4.9, SD=0.9) recorded significant differences (p<0.01). With respect to sit and reach test, multi-purpose physical education children (M pre=21.2, SD=6.8; M post=23.6, SD=6.3) demonstrated significant differences (p<0.01); however; the soccer training group (M pre=20.9, SD=7.1; M post=26.3, SD=8.1) indicated only moderately significant differences (p<0.05). Lastly, in evaluating the sit-up test (multi-purpose physical education children (M pre=21.3, SD=11.8; M post=27.6, SD=6.9) performed with significant differences (p<0.05); while the soccer training group (M pre=34.4, SD=2.1; M post 36.9, SD=1.8) indicated only moderately significant differences (p<0.01).

Discussion

The purpose of this study was to compare body composition and physical fitness development of children between children participating in soccer training and multi-purpose physical education programs. Pre-training values and after training values were evaluated.

Hippel et al. (2007) determined whether school or extracurricular environments contribute more to overweight children. They compared children's gains in body mass index (BMI) when school is in session (during the kindergarten and first-grade school years) with their gains in BMI when school is out (during summer vacation). Although a school's diet and exercise policies may be less than ideal, it appears that early school environments contribute less to being overweight than do extracurricular environments. Therefore, it's appear that sport activities in summer are beneficial to the maintenance of physical fitness of adolescents.

Kain et al. (2004) assessed the impact of a 6 months nutritional education and physical activity intervention on primary school children, through changes in adiposity and physical fitness. It was concluded that the physical fitness parameters (20m

shuttle run test and lower back flexibility) increased significantly.

Eisenmann and Malina (2003) examined the age and sex-associated variation in neuromuscular capacities of young male adolescent distance runners. According to results, sit-ups (M=50, SD=11.6) and sit and reach performance (M=26.7, SD=7.6) tests of 12-14 years old long distance runners showed similar findings to the sit and reach performance of soccer (M=26.3, SD=8.1) and multi-purpose education program (M=23.6, SD=6.3) participants, and better sit-ups performance than both soccer (M=36.9, SD=1.8) and multi-purpose education programs (M=27.6, SD=6.9) . These results indicated that similarity in flexibility may be a result of developmental properties in youth. Therefore, there is no difference between specific soccer training, multipurpose education program and long distance runners who had 4 years sport background. However; having higher sit up performance in long distance runners than soccer training and multi-purpose education programs is reasonably acceptable because of the 4 years sport-specific training background.

Falk et al. (2001) examined the tracking of field-assessed fitness components in boys and girls from the second to sixth grades. According to the results of Falk et al. (2001), the distance of standing broad jump (M=1.63, SD=1.8) demonstrated similarity with standing broad jump of participants in soccer (M=1.53, SD=0.2) and multi-purpose education programs (M=1.64, SD=0.1). However, the discrepancy in medicine ball throwing distance between these two studies is clearly accountable in light of Falk et al. using a 1 kg ball (M=6.5, SD=1.2) and our study (soccer: M=4.9, SD=0.9; multi-purpose program: M=3.59, SD=0.8) implementing a 2 kg ball.

It is clear that many children may benefit by increasing their physical activity and by reducing the amount of time watching TV or videos and playing video games. In particular, two activities accessible to most children, aerobics/dancing and walking, also appeared beneficial (Berkey et al., 2003). Christodoulos et al. (2006) found that children showed significant physical fitness improvements during the school year, with little or no changes in the summer holidays. Children who reported less than 30 minutes of daily participation in physical activity demonstrated lower prevalence rates for overweight and obesity, as well as superior fitness performance. Recent health guidelines suggesting that children should accumulate 60 min of moderate-intensity physical activity every day, supplemented by regular activities that promote strength and flexibility, and bone strength, appear to be justified (Deforche et al., 2003). In this research, children participated in sport activities for 3 hours a day (5 days/week), and results showed that ideal weight guidelines and enhanced fitness performance developed after sport activities. The results of this study and the study of Christodoulos et al. (2006) and Deforche et al. (2003) are supported by each other. Sallis et al. (1997) found that students spent more minutes per week being physically active in specialist-led (40 min) and teacher-led (33 min) physical education classes than in control classes (18 min; $p < 0.001$). After 2 years, girls in the specialist-led condition were superior to girls in the control condition on abdominal strength and endurance ($p<0.001$) and cardio-respiratory endurance ($p < 0.001$). There were no effects on unscheduled physical activity outside of school. The results of this study confirm that children participate in physical activities much better with specialist-led programs. In this current study, strength endurance of the abdominal muscle group is also increased. Furthermore, physical fitness performance of soccer and multi-purpose groups increased after 3 weeks of educational and training programs. The most significant improvement occurred with the abdominal sit-ups (strength endurance of abdominal muscle group), medicine ball performance (m) and sit-ups in soccer training groups These findings show that because the nature of soccer is more related to endurance, strength and speed, the greatest development was seen in tests that measure parameters comparing multi-purpose education programs. On the other hand, the greatest improvement was seen in flexibility and jumping performance in soccer training groups. This is thought to be a result of specific characteristics of basketball, volleyball, handball and gymnastics in the multi-purpose education program. Therefore, the mixed affect of these disciplines improved jumping and flexibility performance in the multi-purpose group, relative to the soccer players.

Conclusion

In conclusion, both training programs had positive effects on performance. While soccer training was more effective for development of strength and endurance of the abdominal muscle group, multi-purpose physical education programs were more effective for development of jumping and flexibility. This is thought to be a result of soccer training being

more specific for development of motor abilities, such as speed, endurance and strength, whereas multi-purpose physical education has general effects on motor performance. It is suggested that both education programs are affective for improving physical fitness. However, if the aim is to improve flexibility and jumping performance, complex physical education programs are suggested. If the aim is to improve general motor performance, such as strength, endurance and speed, then soccer-specific training is suggested.

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