

Health-related fitness in preschool children: Difference between organized and unorganized physical activity

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Abstract

The aim of this research was to determine the differences in health-related fitness between preschool children involved in organized and unorganized physical activities. This study was performed on a sample of 220 healthy preschool children that were divided into two groups, organized physical activity group (N=99) and unorganized physical activity group (N=121). Beside the set of anthropometric variables children were tested for Standing broad jump, Classic sit-and-reach test, Bent arm hang, Sit-ups in 30 seconds and Handgrip strength test. The t-test applied to determine differences between anthropometric characteristic revealed differences for almost all variables ($p \leq 0.05$). Moreover, the organized physical activity group showed better results in all fitness variables compared to unorganized group ($p \leq 0.01$). It can be concluded that the developmental gymnastics program has influence on improvement of health-related fitness in preschool children.

Keywords motor abilities • children • differences • assessment

Introduction

The main health-related fitness components in youth are cardiorespiratory fitness, musculoskeletal fitness and motor fitness (Ortega, Ruiz, Castillo, & Sjöström, 2008). Having in mind that physical fitness is important for the current and future health in youth, (Ruiz et al., 2009) reliable and valid measures of fitness are crucial for longitudinal studies. Muscular strength and flexibility, are fitness components that are largely responsible for a children's good postural status. One study found that reduced hamstring flexibility is a risk factor for the hamstring muscle injuries (Witvrouw et al., 2001). Therefore, it is of vital importance to measure and improve health-related fitness in children. However, the development of fitness in children is influenced by individual differences during maturation. For example, in a sample of children of the same age, some children are higher and heavier, and have greater power and greater $VO_2\max$ than those who are late in maturing (Malina & Katzmarzyk, 2006).

Beside physical fitness, physical activity is very important for children because of the associated benefits to physical, social and psychological health (Strong et al., 2005). It was stated that children with better motor skill proficiency have 10% - 20% bigger chance of participating in vigorous physical activity (Ali, Pigou, Clarke, & McLachlan, 2016). Accordingly, previous research identified positive effect on health outcomes in youth population (Roth, 2010; Bun-

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gum, 1997; Butcher, 1983).

Recently, several publications have appeared documenting the effect of different physical activity programs on physical fitness in preschool and school children. Obradović et al. (2009) found significant difference between soccer players and control group in fat mass and bone mineral density. Krneta et al. (2014) found significant impact of additional exercise program on explosive strength (Standing broad jump) and flexibility (Seated straddle stretch) in preschool boys. More recently, Jakšić, (2016) tried to define and analyze the effects of developmental gymnastics model on cognitive, motor and morphological development of preschool children. The aforementioned author concluded that certain morphological characteristics have improved, and that certain motoric and intellectual abilities of children from the experimental group have also improved in comparison with the control group.

Extracurricular physical activities at kindergartens and organized physical activities in the community provide important opportunities for children to be physically active and contribute to helping attain recommended physical activity levels. Blagojević et al. (2017) stated that participation in organized school program produces greater improvement in physical fitness than traditional physical education lessons in primary school children. Moreover, participation in organized school program that included invasion games produced greater improvement in physical fitness than traditional physical education lessons in primary school children (Valentine, Madić, & Sporiš, 2017). However, according to Bélanger et al., (2009) it cannot be stated that participation in organized physical activities in childhood protect against declining physical activity levels during adolescence. Moreover, it is unclear if there are differences between organized and unorganized physical activities in preschool children. Therefore, the aim of this paper was to determine the differences in health-related fitness between preschool children involved in organized and unorganized physical activities. We hypothesized that children engaged in organized physical activities would have better results for health-related fitness than children involved in unorganized activities.

Method

Participants

This study was performed on a sample of 220 healthy preschool children that were divided into two groups. Organized physical activity group (N=99) consisted of children attending kindergartens, who attended developmental gymnastics classes. Unorganized physical activity group (N=121) was randomly chosen from the cluster of kindergartens and were not involved in organized training. The average age of the children in the organized group was 5.4 ± 0.8 , whereas the children of the unorganized group had 4.9 ± 0.9 years. Written informed consents for the participation in the study were obtained from the parents of all children. All measurements and treatments were performed in accordance with the ethical standards laid down in the Declaration of Helsinki.

Procedures

The set of anthropometric variables and the set of motor variables obtained by the use of the following measurements and tests, were analyzed at the beginning of October. Body height was measured with a fixed measured using anthropometry according to Martin (GPM Anthropometer 100; DKSH Switzerland Ltd., Zurich, Switzerland; ± 0.1 cm;), and body mass with a digital balance (BC1000, Tanita, Japan; ± 0.1 kg;). We used waist and hip circumferences for the assessment of subcutaneous adipose tissue and skinfolds of upper arm (triceps skinfold) (0.2mm), back (subscapular skinfold) (0.2mm) and abdominal skinfold (0.2mm). All of the anthropometrical measurements were conducted in accordance with IBP standard.

Fitness tests were used from several test batteries and reliability and factor validity was confirmed for this age group (Bala, Katić, & Krneta, 2011). The following test battery was used in motor fitness assessment:

Standing broad jump. The child jumps with both feet from the reversed side of Reuter bounce board onto a carpet, which is marked in cm. The result is the length of the jump in cm.

Classic sit-and-reach test. The test was administered using a wooden box of 30.5 cm x 30.5 cm x 30.5 cm with a ruler at the top (the score 23 cm corresponded to the tangent of the feet; accuracy 0.1 cm). At the beginning of the test, each child stood in front of the box, sat with his/ her hips flexed, knees

extended and both hands on the top of the ruler. The hands with the fingers extended were placed parallel to the shoulders width, to avoid the influence of the scapular flexibility. The knees were fixed in extension with the help of the tester. From this position, the child had to bend the trunk forward slowly and progressively (no rebounds) in order to reach the greatest possible distance. In the maximum flexion position, the participant had to remain still for at least two seconds. The best out of two trials was recorded for further statistical analysis.

Bent arm hang. The child under-grips the bar and holds the pull-up as long as he/she can (chin above the bar). The result is the time of the hold measured in tenths of a second.

Sit-ups in 30 sec. The child lies on his/her back with his/her knees bent and arms crossed on the opposite shoulders. He/she rises into a seated position and returns into the starting position. The instructor's assistant holds the child's feet. The result is the number of correctly executed raises to the seated position (no longer than 30 seconds).

Handgrip strength. The equipment used in this study include a baseline pneumatic squeeze bulb dynamometer (Baseline, USA). The participants received thorough instructions after which they were also allowed to practice the tests. Subjects received verbal encouragement during the tests. Each participant was positioned in a standard position as recommended by the American Society of Hand Therapists. Two successive bilateral power grip strength measurements were recorded. The dominant hand was assessed first. To prevent fatigue occurring, a 15-second rest period between each measurement was given. The dynamometer was supported slightly by the examiner to prevent any accidental falls.

Organized physical activity group participated in developmental gymnastics at least 6 months. Program of developmental gymnastics for preschool children includes 60-90 minutes training, 2-3 times a week. These trainings are conducted from September to June of the next year. During the public appearances

and competition periods the number of training is often increased to four a week. The sample of this research consisted only of the children who are involved in one of presented programs of organized exercising for at least one year continuously. Children who didn't participate in at least 70% of program were excluded for further analysis. Unorganized physical activity group consisted of participants who have fulfilled the recommendations of the WHO (Tudor-Locke et al., 2011). Children were included in the study if they had at least 60 minutes of moderate-to vigorous-intensity physical activity daily. Children who do not fulfill these recommendations were excluded for this research.

Statistical analysis

Statistical procedures included descriptive statistics and independent t test for determining the differences between the children involved in organized and unorganized PA in fitness components. Normal distribution of variables was tested by Kolmogorov-Smirnov test. We have used the t-test for the assessment of differences between two groups of participants for anthropometric variables. For the assessment of differences between every health-related fitness characteristic for both groups t-test was also applied. The level of statistical significance was $p \leq 0.05$. For the needs of this research statistical programme SPSS (Statistical Package for the Social Sciences 18.0) was used.

Results

The analysis of differences in anthropometric variables of two groups of 4-6-year-old children is shown in Table 1. There were no significant differences for BMI and Subscapular Skinfold Thickness (Table 1). On the contrary, all other anthropometric variables showed significant differences between organized and unorganized physical activity.

Table 1. Differences in anthropometric variables between two groups

Variable	Unorganized PA	Organized PA	p
Body height (cm)	1159.23± 81.30	1196.70± 73.60	≤0.01
Body Mass (kg)	21.79± 4.39	22.98± 3.57	≤0.05
BMI	16.06±1.67	15.97±1.33	≥0.05
Waist circumferences	548.52±48.10	546.98±44.14	≤0.05
Hip circumferences	623.17±56.478	609.65±46.30	≤0.05
Abdominal skinfold thickness	75.38±39.45	65.05±31.04	≤0.05
Subscapular Skinfold Thickness	57.52 ± 20.13	56.48±16.94	≥0.05
Triceps Skinfold Thickness	101.81± 29.33	93.88±25.16	≤0.05

Based on results, statistically significant differences ($p \leq 0.01$) between groups for all fitness variables were determined. The organized physical

activity group showed better results in all fitness variables compared to unorganized group.

Table 2. Difference in fitness tests between two groups

Variable	Unorganized PA	Organized PA	p
Standing broad jump (cm)	106.93± 20.50	123.29± 20.18	≤0.01
Sit and reach (cm)	28.91± 4.81	32.17± 4.48	≤0.01
Bent arm hang (s)	6.32±6.84	22.37±18.75	≤0.01
Sit ups (freq.)	8.25±5.28	13.51±4.19	≤0.01
Handgrip strength (psi)	3.99±1.73	4.82±1.28	≤0.01

Discussion

Appropriate practice of physical activity assists children to develop healthy musculoskeletal tissues, develop a healthy cardiovascular system, develop neuromuscular awareness, maintain a healthy body weight. From the results of our study it can be seen that for all examined variables organized physical activity group have higher values than children not involved in any kind of organized training. It means that children involved in developmental gymnastics have lower values of body mass circumferences and amount of subcutaneous adipose tissue compared with children of the same age not involved in organized physical activity. These results are expected due to structure of gymnastics, acrobatics, games and all the other elements of developmental gymnastics. Accordingly, decrease of body mass and subcutaneous adipose tissue in all body segments take a special place because of better status of motor abilities as well as specific morphological structure these children have later in life.

One important advantage of organized physical activity in contrast to unorganized is the involvement of coaches which makes this physical activity guided

and highly structured (Mahoney & Cairns, 2000; Mahoney, Larson, Eccles, & Lord, 2005). Moreover, according to Felfe, Lechner, & Steinmayr (2016) not only that organized physical activity imposes structure on children's life but also puts children in contact with coaches and competent peers that may act as role models.

We found statistically significant differences between groups in morphological characteristics as well in fitness tests. The explanation of such significance could be found in the content of developmental gymnastics that require intensive physical efforts. Nowadays, there is a great demand for determination of physical activity impact on health in children. We know that correlation between motor skill proficiency and physical activity levels among preschoolers is strong (Williams et al., 2008). However, according to Timmons, Proudfoot, MacDonald, Bray, & Cairney (2012) the causal relation between motor skill proficiency and physical activity is unclear. The aforementioned authors mention two important questions; either are preschoolers more active because of better motor skills or they have better motor skills because they are more active. Risk of obesity and inactivity are evident

even in children aged 3 to 6 years, which could have implications for subsequent ages. Therefore, it is important to promote physical activity beginning with the preschool children.

Conclusion

It can be concluded that the program of developmental gymnastics had influence on morphological status and fitness of preschool children. Comparative analysis of morphological characteristics and fitness components of preschool children involved in developmental gymnastics and children not involved in any kind of organized training showed statistically significant difference in quality of morphological status defined by lower volume, body mass and subcutaneous adipose tissue and better health related fitness. According to our results organized physical activities are recommended for better quality of health-related fitness of preschool children but also for all the other anthropological dimensions of pre-school and younger-school aged children.

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