

NON-FORMAL PHYSICAL EDUCATION OF CHILDREN: INCREASE FACTOR OF PHYSICAL ACTIVITY AND PHYSICAL FITNESS

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ABSTRACT

Background. Studies on physical activity, which is positively associated with physical fitness, reveal that children's activity is not sufficient (BHFNC, 2010; Chen, Zheng, Yi, & Yao, 2014; Currie et al., 2012), and their physical fitness deteriorates (Volbekienė & Kavaliauskas, 2002; Мирошниченко & Астраханцев, 2005; Синявский, Власов, & Сергеев, 2009). Non-formal physical education (NFPE) is one of the means to increase children's physical activity and physical fitness. The aim of this study was to determine the influence of NFPE on the physical fitness of 6th grade pupils.

Methods. The research was conducted in May, 2013; 356 six-graders (48.0% of girls) from four Klaipėda city comprehensive schools participated in the research. As many as 56.5% of children (48.3% of girls) participated in NFPE in school and out of school. The participants completed five physical fitness tests.

Results. Independent *t* test revealed that the results of boys who attended the NFPE group of cardiorespiratory fitness, $t(180) = -2.093, p = .038$; upper body muscular strength and endurance, $t(182) = 2.413, p = .017$; abdominal muscular strength and endurance, $t(186) = 3.282, p = .001$; explosive leg power, $t(183) = 1.967, p = .049$, and girls' results of abdominal muscular strength and endurance, $t(172) = 2.687, p = .008$ were significantly higher than those in the NFPE non attended group.

Conclusion. Non-formal physical education is a meaningful educational form for increasing children's, particularly boys', health related physical fitness; therefore it is purposeful to encourage children to participate in physical activities in school and after classes.

Keywords: non-formal physical education, physical fitness, testing.

INTRODUCTION

Physical activity is important to the overall health and well-being of everyone, including all school-age children. The benefits of physical activity are well-documented and involve the mitigation of many health risks, including those for developing Type 2 diabetes (Costanian, Bennett, Hwalla, Assaad, & Sibai, 2014; Rottensteiner et al., 2014), high blood pressure and high blood cholesterol (Carpio-Rivera, Moncada-Jiménez, Salazar-Rojas, & Solera-Herrera, 2016; Heshmat et al., 2016). Physical activity also contributes to the building and maintenance of healthy bones and muscles (Sioen et al., 2015), to improve positive

mental health (Hiltn, Erikon, & Kramer, 2008; Nguyen – Michel, Unger, Hamilton, & Spruijt-Metz, 2006; Wang et al., 2010), and health-related physical fitness (HRPF) (De Baere, Philippaert, De Martelaer, & Lefevre, 2016; Malacko & Pejčić, 2009).

HRPF components are cardiorespiratory fitness, muscular strength and endurance, flexibility and body composition (Gallahue & Ozmun, 2006; Volbekienė & Kavaliauskas, 2007). One of the most important components is cardiorespiratory fitness. Its training improves cardiac function and peripheral blood flow and enhances the capacity

of the muscle fibres to generate greater amounts of adenosine triphosphate (Kenney, Wilmore, & Cosill, 2012; Skernevicius, Milasius, Raslanas, & Dadelienė, 2011). Minimal levels of muscular fitness are needed to perform activities of daily living, to maintain functional independence as one ages, and to partake in active leisure-time pursuits without undue stress or fatigue (Heyward, 2010).

Empirical research estimated that sixth graders' (12–13-year-old children) daily physical activity is not sufficient (BHFNC, 2010; Chen et al., 2014; Currie et al., 2012; Schneider, Dunn, & Cooper, 2009) and their physical fitness diminishes (Volbekienė, & Kavaliauskas, 2002; Мирошниченко & Астраханцев, 2005; Синявский et al., 2009).

Lessons of physical education are the primary form of the activity children receive at school, but only several countries require daily physical education. Further, physical education programs provide only up to 8–11% of children's daily physical activity. One of the strategies to increase activity is to promote it within the non-formal physical education (Beets, Beighle, & Erwin, 2009). California Department of Education (2009) and Carrel et al. (2011) denote that these activities may be the only place where children can regularly engage in physical activity and to seek to increase their physical fitness.

In different countries different words are used to describe more or less the same activities: extracurricular education, after school education, or extra school education. In this study we will use the term of non-formal physical education (NFPE).

The effectiveness of NFPE usually is measured by analyzing NFPE impact on physical activity (Gortmaker et al., 2012; Lubans & Morgan, 2008), while some literature sources focused on the influence of NFPE on 13-year-old children's health-related physical fitness.

Research by data Carrel et al. (2011), Da Silva, Fisberg, de Sousa Pires, Nassar, and Sottovia (2013) demonstrate that NFPE curriculum in school can improve body composition. Drake et al. (2012) conducted telephone surveys with 1718 high school students and their parents. The scientists estimated that team sport participation had the strongest and most consistent inverse association with weight status. Ara et al. (2006) analysed the effect of NFPE on physical fitness during growth in early pubertal males and found that children who attended NFPE and were physically active at least 3 h per week

during 3 years maintained their physical fitness during growth, while it deteriorated in physically inactive children.

Hypothesis: most of six-graders do not participate in NFPE and HRPF is insufficient. Children who participate in NFPE at least once a week have higher indices of HRPF than those who do not participate in NFPE.

The aim of this study was to determine the influence of NFPE on the physical fitness of 6th grade pupils.

METHODS

Participants. Research participants were 356 six-graders (48.0% girls) from four Klaipeda city comprehensive schools; 56.5% of children (48.3% girls) participated in NFPE at least once a week. Duration of each training session was 1–2 hours. In this research NFPE was defined as a purposeful physical education, organized in school or out of school after the regular school day.

Statistically significantly more boys participated in sports than girls $t(370) = 3.062, p = .002$. The duration of attendance was 2.89 ($SD = 2.29$) years. With regard to gender the attendance duration did not differ significantly, $t(370) = -1.582, p = .114$. The average age of the participants was 13.00 ($SD = 0.26$) years.

Methods. The research was conducted in May, 2013. All physical fitness tests as well as height and weight measurements participants were taken during physical education lessons (one test/measurement per one lesson).

Consistent with recommendations (Volbekienė & Kavaliauskas, 2002; Heyward, 2010) health-related physical fitness components, which are body composition, flexibility, muscular strength and endurance, and cardiorespiratory fitness, of all study participants were assessed by the physical fitness tests described below.

Height was measured using roller height meter (Seca, Model 206, Germany). The height meter was mounted on the wall and the participants stood erect, barefooted, and looked straight ahead. Before being measured or weighed, pupils were asked to remove their shoes and outer clothing, such as jackets. Height was measured to the nearest half centimetre. *Weight* was measured to the nearest 0.1 kilogram using a calibrated scale (Seca, Model 709, Germany) that was zero balanced before each pupil was weighed. *Body mass index* of the participants

Table 1. Distribution of sixth grade pupils' participation and non-participation in NFPE

The distribution of participants		Girls (%)	Boys (%)	Total (%)	
<i>Non-attending NFPE</i>		51.7	36.3	43.7	
<i>Attending NFPE</i>	In school		19.7	19.7	19.7
	Out of school	Totally	28.8	44.0	36.6
		Dance	12.4	1.6	6.7
		Swimming	3.9	7.8	5.9
		Football	0.6	8.8	4.9
		Dual sports	1.1	8.3	4.9
		Basketball	1.1	7.8	4.6
		Other	9.7	9.7	9.6

was calculated from their respective height and weight using the relation = weight/height².

Sit and reach (lower back flexibility). The sit and reach was scored at the most distant point (in cm) of reaching on a ruler with the fingertips. A sit and reach box was a specially constructed box with the measuring scale where 23 cm was at the level of the feet. Each participant was given two trials and the best result was chosen. The pupil removed his/her shoes before sitting at the test apparatus with the knees fully extended.

Sit ups in 30 seconds (abdominal muscle strength and endurance). The sit ups test was scored as the number of sit-ups performed within a 30 s period. The adolescent lay down on a mat with knees bent at right angles and hands behind the head. The ankles were firmly held by a partner for support and maintaining the count. The pupil's elbows touched the knees during the execution of the test.

Flexed-arm hang (upper body strength and endurance). Flexed-arm hang was scored as the total time in seconds. The participant climbed the ladder to a height so that the chin was at the level with the bar. They grasped the overhead bar using an overhand grip (palms facing away from body), with the hands at shoulder width apart. On the command, "ready, go" the pupil removed their feet from the ladder, and timing started. The pupil had to attempt to hold this position as long as possible. Timing was stopped when the pupil's chin fell below the level of the bar or the head tilted backward to enable the chin to stay at the level with the bar.

Standing long jump (explosive leg power). Standing long jump was scored as the longest distance jump in centimetres. The participant stood behind a line marked on the ground with feet slightly apart. A two foot take-off and landing was used, with swinging of the arms and bending

of the knees to provide forward drive. The pupil attempted to jump as far as possible, landing on both feet without falling backwards. Two attempts were allowed.

One mile walk/run (cardiorespiratory fitness). One mile walk/run was measured in minutes. The participants were instructed to try to keep a steady speed and finish running as fast as possible. Walking was permitted when the pupil could not continue running.

Data analysis. Descriptive statistics were calculated (including means (*M*) and standard deviation (*SD*)) for each physical fitness component. One – Sample *T* test was used to examine the mean difference between the sample and the known value of the population mean. Independent *t* test was used to examine test differences between two independent (NFPE attended and non-attended) groups. For all the tests, statistical significance was set at $p < .05$. All statistical analyses were performed with the Statistical Package for Social Sciences (SPSS) (version 20.0 for Windows).

Research ethics. All the participants of the research were introduced to research aim and the agreements of them and their parents/guardians were received.

RESULTS

Descriptive statistics were used to describe the basic features ((the means (*M*) and standard deviation (*SD*)) of the data in a study. Table 2 presents HRPF results of NFPE attending and non-attending groups, and Lithuanian sixth graders' HRPF results.

One – Sample *T* test shows that indices of the explosive leg power, $t(81) = 0.661$, $p = .510$ and abdominal muscular strength and endurance, $t(84) = 0.230$, $p = .819$ among girls, attending NFPE, and of Lithuanian sixth grade girls did

Table 2. Health-related physical fitness (HRPF) results (mean, standard deviation)

Components of health-related physical fitness	Girls				The results of Lithuanian girls' HRPF (2002)	Boys				The results of Lithuanian boys' HRPF (2002)
	NFPE attending group (n = 82)		NFPE non-attending group (n = 86)			NFPE attending group (n = 120)		NFPE non-attending group (n = 68)		
	M	SD	M	SD		M	SD	M	SD	
Cardiorespiratory fitness (1 mile walk/run (s))	651.8	79.2	659.2	79.4	-	579.0 ^{ac}	110.4	614.4	108.7	-
Upper body strength and endurance (Flexed-arm hang(s))	8.18	8.49	8.49	9.87	11.5 ^{ab}	15.85 ^c	13.68	11.3	9.64	19.6 ^{ab}
Abdominal muscle strength and endurance (Sit ups in 30 seconds (n/30s))	23.31 ^c	4.25	21.72	3.52	23.20 ^b	26.05 ^c	4.47	23.65	5.39	25.54 ^b
Explosive leg power Standing long jump(cm))	156.37	26.73	152.16	21.86	154.41	175.57 ^c	24.26	168.15	25.15	171.86
Lower back flexibility (Sit and reach (cm))	22.91 ^a	6.81	22.40 ^b	7.20	20.69	17.77	6.30	17.06	6.45	17.34
BMI (kg/m ²)	19.70	3.09	19.49	3.74	18.7	19.14 ^a	3.18	19.79 ^b	3.59	18.1

Notes. M = mean; SD = standard deviation; NFPE – non-formal physical education.

^a – Significant differences between NFPE attending group and Lithuanian sixth grade pupils.

^b – Significant differences between NFPE non-attending group and Lithuanian sixth grade pupils.

^c – Significant differences between NFPE attending and non-attending groups.

not differ significantly. However, statistically significant differences were found for other HRPF components: results of upper body muscular strength and endurance, $t(79) = -3.505$, $p = .001$ were lower and results of flexibility, $t(81) = 2.950$, $p = .004$ and BMI, $t(79) = 2.888$, $p = .005$ were higher comparing girls attending NFPE with the Lithuanian sixth grade girls.

There were no significant differences in explosive leg power, $t(88) = -0.972$, $p = .334$, and BMI, $t(85) = 0.054$, $p = .789$, in girls non-attending NFPE group compared to the Lithuanian sixth grade girls. Results of upper body muscular strength and endurance, $t(86) = -2.851$, $p = .005$, and abdominal muscular strength and endurance, $t(88) = -3.970$, $p = .000$, were worse and flexibility, $t(86) = 2.934$, $p = .004$, was better in girls non-attending NFPE, group.

No significant differences were found for the abdominal muscular strength and endurance, $t(119) = 1.249$, $p = .214$; explosive leg power, $t(118) = 1.669$, $p = .098$; flexibility, $t(116) = 0.737$, $p = .462$ among boys attending NFPE and of Lithuanian sixth grade boys. Results of upper body muscular

strength and endurance, $t(115) = -2.952$, $p = .004$, were lower and BMI, $t(122) = 3.606$, $p = .000$ was higher in NFPE attending group compared to Lithuanian sixth grade boys.

There were no significant differences in explosive leg power, $t(67) = -0.360$, $p = .720$; flexibility, $t(67) = -0.360$, $p = .720$, in boys non-attending NFPE compared to the Lithuanian sixth grade boys. Results of upper body muscular strength and endurance, $t(67) = -7.097$, $p = .000$; abdominal muscular strength and endurance, $t(67) = -2.897$, $p = .005$, were lower and BMI, $t(66) = 3.856$, $p = .000$, was higher in boys non-attending NFPE.

The results of the independent t test indicated that there was a statistically significant difference in abdominal muscular strength and endurance between NFPE attending and non-attending girls, $t(172) = 2.687$, $p = .008$. There was no significant difference between these groups in other HRPF tests, $p > .05$.

Boys' results in the NFPE attending group of cardiorespiratory fitness, $t(180) = -2.093$, $p = .038$; upper body muscular strength and endurance, $t(182) = 2.413$, $p = .017$; abdominal muscular

strength and endurance, $t(186) = 3.282$, $p = .001$; explosive leg power, $t(183) = 1.967$, $p = .049$, were significantly higher than in the NFPE non-attending group. Only indices of flexibility, $t(183) = 0.734$, $p = .464$ did not differ significantly. There was no significant difference between NFPE attending and non-attending groups in the BMI, $t(188) = -1.294$, $p = .197$.

DISCUSSION

This study examined the HRPF of sixth grade pupils and the impact of a NFPE on it. NFPE is deliberately chosen by children, planned and purposeful after-school physical education. It was hypothesized that most six-graders did not participate in NFPE and their HRPF was insufficient. Children who participate in NFPE at least once a week have higher indices of HRPF than those who do not participate.

The studies have found that children can obtain up to 50% of their daily recommended physical activity only in the after-school period (Olds et al., 2008; Tudor-Locke, Lee, Morgan, Beighle, & Pangazi, 2006). However, a lot of pupils do not participate in NFPE.

According to the study by the Sports Council for Wales (2009), 47% of secondary school age pupils take part in NFPE regularly (at least once a week). Football (47%) remains the most popular club activity for boys by a considerable margin, followed by rugby (32%). Dance and swimming are the most popular activities for secondary school girls. The comparable data were gained by Kromerova and Šukys (2013). The scientists revealed that among research participants, 43.4% ($n = 167$) were involved in competitive sports. In our study about half (56.3%) of children participated in NFPE. As in the research of the Sport Council of Wales (2009), most of the boys attended football, while girls attended dance classes.

Studies have suggested that children's HRPF is insufficient and decreasing. Depending on the test, between 28 and 74% of 12.4-year-old American Indian youths are in the healthy fitness zone. The majority of participants failed to meet healthy fitness zone for muscular strength and estimated body composition. Overall, 7% of the students were in the healthy fitness zone for all five components and 6% failed to reach the healthy fitness zone for any of the tests (Brusseau, Finkelstein, Kulinna, & Pangazi, 2014). In the study by Garber, Sajuria, and Lobelo (2014), 26% of boys and 55% of girls had unhealthy

cardiorespiratory fitness, 29% of boys and 35% of girls had unhealthy musculoskeletal fitness, 29% of boys and 44% of girls had unhealthy BMI.

We observed that in NFPE attending group results of muscular fitness (except for upper body muscular strength and endurance) were higher than the country average values. BMI was higher than average values of sixth-graders in Lithuania. The results of muscular fitness of sixth-graders not attending NFPE were lower, and BMI, as in the group attending NFPE, were higher than the average values of sixth-graders in Lithuania. The cardiorespiratory fitness of all children groups (except for boys attending NFPE – below sufficient) according to Volbekiene and Kavaliauskas (2007) were estimated as insufficient.

Photiou et al. (2008) compared some selected morphological and functional parameters of 7–14-year-old Hungarian schoolboys living in the middle of the 1970s and at the beginning of the new millennium. Means of height, body mass, body mass index, the sum of five skinfold tests, percentage of body fat, and two running performance times (400 m and 1.200 m) of the boys ($n = 3672$) studied in 1975 were compared to those of the boys ($n = 3758$) in 2005. Scientists observed significant secular changes in body mass and height. In addition, boys in 2005 had significantly more subcutaneous fat compared to 1975. The running times for the two distances were significantly poorer at the time of the second investigation. Similar trends were found for the Lithuanian children's physical fitness. Volbekienė and Kavaliauskas (2002) found, that during 10 years (1992–2002) for both genders sixth grade pupils' flexibility and cardiorespiratory fitness as well as girls' standing long jump and boys' upper body strength and endurance indices got worse statistically significantly. Comparing our research results with Lithuanian sixth graders' physical fitness data in 2002, we determined very similar tendencies: pupils' upper body muscular strength and endurance deteriorate, though their BMI increases. Estimating the indices of participants' cardiorespiratory system endurance, with reference to Volbekienė and Kavaliauskas (2007), we can maintain that 1610 meters run/walk results of six-graders are at a low level. We recommend including more exercises for upper body strength and endurance and cardiorespiratory fitness into their physical education, and providing pupils with the knowledge about benefits of these exercises for health enhancement and strengthening.

NFPE programs that include a physical activity component can be effective in improving physical activity levels and physical fitness. Results of this study suggest that cardiorespiratory fitness and musculoskeletal fitness for boys who participated in NFPE were statistically significantly ($p < .05$) higher than those in the group of non-attending NFPE. Similar results were found by London and Gurantz (2013). The scientists estimated that participation in fitness-focused NFPE programs was associated with a 10% increase in the probability of being physically fit after 2 years. This finding held for nearly all subgroups, including students who were initially unfit. Participation in 2 years of the program was associated with a 14.7% increased likelihood of subsequent fitness compared to 8.8% for 1 year of participation.

However, our study has shown that results for girls who participated in NFPE were marginally better than those who did not participate in NFPE. Only one test – Sit ups in 30 seconds (abdominal muscle strength and endurance) – indices statistically significantly differed, $p < .05$. Whereas most of the girls attended dance classes, the assumptions that dance classes did not have significant impact on girls' cardiorespiratory and musculoskeletal fitness can be done.

Arriscado, Muros, Zabata, and Dalmau (2014) found that the male students who performed at NFPE and those at earlier stages of development reported higher levels of physical activity. The direct correlations between physical exercise and fitness were detected, especially with respect to aerobic capacity ($r = .38$), and inverse correlations with hours in front of a screen ($r = -.18$), but not with body composition. The NFPE influence on BMI also was not determined in our research.

Future research should examine the types of activities, duration of physical activity, and extent of participation for girls in NFPE programs aiming to better understand the link between NFPE programs and girls' physical fitness.

CONCLUSION

More attention must be paid to training sixth grade pupils' upper body muscular strength and endurance as well as cardiorespiratory fitness. Non-formal physical education is a meaningful educational form for increasing children's, particularly boys', health related physical fitness, therefore it is purposeful to encourage children to participate in physical activities in school and after classes.

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Received on May 30, 2016
Accepted on August 11, 2016

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