Croatian Journal of Education
Vol: 13 (4/2011), pages: 41-70
Original scientific paper
Paper submitted: 7th November 2011
Paper accepted: 12th December 2011

INFLUENCE OF THE ENHANCED PHYSICAL EDUCATION CURRICULUM ON CHILDREN'S PHYSICAL FITNESS

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ABSTRACT

This study was designed as a cluster-randomised quasi-experiment to assess the effect of implementing kinesiological intervention, through which some schools in Slovenia offer an enhanced PE curriculum, on children's physical fitness in the first four years of schooling. A total of 328 children from nine Slovenian primary schools were assigned to kinesiological intervention (n=157) and control groups (n=171). Data from the SLOFIT database was used to compare the differences in the physical fitness of children. The linear mixed model was used to test the influence of kinesiological intervention.

The kinesiological intervention group achieved better results than the control group in all motor variables, especially in the motor tasks of polygon backwards, sit-ups for 60 seconds, and 600-metre run. This is particularly important as the muscular endurance and running speed of children at that age have been falling in recent decades. The results point to a better quality of sessions in the kinesiological intervention consisting of a wider range of motor skills, suitable work organisation and greater amounts of exercises.

***Key words**: intervention; physical development; primary school*

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INTRODUCTION

Children's poor physical fitness is associated with many preventable diseases and represents a serious current and future public health problem (WHO, 2007). Regular and quality physical activity during childhood is one part of the solution (quality nutrition being the other) that can lead to improvements in numerous physiological and morphological variables in children (Owen et al., 2010). Therefore, in developed countries, interventions have been implemented that focus on changing dietary intake and physical activity levels (Brown & Summerbell, 2009; Kriemler et al., 2011). Schools have been a popular setting for the implementation of such interventions as they offer some continuous, intensive contact with children. Their infrastructure and physical environment, policies, curricula and staff have the potential to positively influence child's health.

The main part of children's physical activity is presently allocated to regular physical education (PE) classes in schools (Bailey, 2006). A sufficient amount of quality PE programmes can significantly contribute to the overall amount of moderate-to-intense physical activity of the school-age child (Trudeau & Shephard, 2005). PE should also serve as a venue to prepare students to be physically educated people: to teach them the importance of regular physical activity for health and to build skills that support active lifestyles (Ding, Sallis, Kerr, Lee, & Rosenberg, 2011; Fairclough & Stratton, 2005; Froberg & Andersen, 2010; Sallis, Prochaska, & Taylor, 2000). In addition, the fact that motor development and physical fitness are closely related to the cognitive and emotional-social areas of child's development (Kovač & Strel, 2000; Sibley & Etnier, 2003; Tomporowski, 2003) should not be disregarded.

The quantity and quality of motor stimuli is especially important between the ages of 6 and 10, when a child's physical growth decelerates, the muscular system grows intensively, and when the level of maturity of movement coordination represents the ideal time to start general sports exercising or intensive practicing of technically more demanding movements. Due to the rapid development of the cerebrum, and the myelination of the cortex in particular, this is the ideal time to learn motor activities that demand a large number of learned motor patterns (gymnastics, ballet, skiing, swimming etc.), and which cannot be found in the ontogenesis of human development (Jurimae & Jurimae, 2000). Recent studies show that children in this period have insufficient physical fitness development, which includes increased obesity and the diminished motor skills and functional abilities in comparison to former generations (Jurimae, Volbekiene, Jurimae, & Tomkinson, 2007; Strel, Kovač, & Jurak, 2007;

Tomkinson & Olds, 2007), which can lead to unfavourable results in their adulthood (Starc & Strel, 2011). This is also the period in which PE classes in Europe are mostly delivered by classroom teachers with no appropriate PE teaching competences (DeCorby, Halas, Dixon, Wintrup, & Janzen, 2005; Hardman, 2008; Janzen et al., 2003; Jurak, Kovač, & Strel, 2004b; Morgan & Hansen, 2008; Sallis et al., 1997).

In Slovenian primary schools, children have three compulsory PE lessons (135 minutes) per week during the first six years of schooling (Kovač, Strel, Starc, & Jurak, 2008). In addition, some schools in Slovenia have also been offering an interventional kinesiological programme since 1984, which entails an enhanced PE curriculum, most often by including two extra PE hours per week, jointly taught by a specialist PE teacher and a classroom teacher, as well as a wider selection of PE contents, which can also be conducted out of school. Recently, this interventional programme has been offered by 7% of primary schools in Slovenia (Jurak, Kovač, & Strel, 2004). Its placement in the school environment (the programme is carried out with the school council permission; the organisation and contents supplement regular PE) and the sports sphere (well-organised, regular and well-executed optional sports activities) represents a good option for quality regular and expanded school programmes with daily PE and additional sports activities (outdoor activities, various sports courses, etc.) for children whose parents prefer such education.

The latest research on the organisation of this work (Jurak et al., 2004) has found that PE lessons usually take place in the middle of the daily timetable. The PE activities that schools offer through courses are also usually organised during the educational process and less often after school lessons, during holidays or weekends. Schools offering such an intervention have good conditions for PE classes because they have large sports halls and grass or hard surfaces outside; the majority of them also have smaller sports halls and other specialist sports surfaces (athletics track, swimming pool, fitness room, long-jumping pit, jogging track, playroom, dance hall, etc.).

Most of them enrol children in this programme with parental prior consent for joining these classes and paying additional services. The way these programmes are financed varies. Some schools cover the costs of running the programme with local and government funds, sponsors and their own resources at no cost to children or parents, whereas others include the contributions of parents and some entirely cover the related costs through their funding. The average monthly contribution of parents needed to enable additional PE lessons is €11.40. Schools believe that this contribution is not high, so parents can generally afford it. It is further believed that this is still a cheap way of exercising. Specifically, in the case of

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clubs or private institutions parents also have to pay membership fees and transport even becomes an additional cost; besides, organised school exercising allows parents to save time importantly (Jurak et al., 2004).

One aspect of how such school-based intervention is efficient refers to the programme's influence on children's physical fitness and, indirectly, the impact on the quantity and quality of motor skills, participation in sport during their free time, body weight regulation, etc. The study was aimed at finding how the kinesiological intervention influences the physical and motor development of 7- to 10-year-old children.

METHODS

Subjects

The sample consisted of children from 27 classes from nine Slovenian primary schools. It included 76 girls and 81 boys in the experimental group (intervention), and 84 girls and 87 boys in the control group (regular PE programme). The baseline age in both groups was similar (intervention group mean =7.76, SD=0.33; control group mean =7.71, SD=0.32).

Instruments

Data were collected within the SLOFIT system, Slovenia's system for monitoring children's physical fitness, implemented in 1987 and formerly known as the Sports Educational Chart. Every April, qualified PE teachers who completed the anthropometry measurement course perform the measurements in all primary and secondary schools, as required by the PE curriculum which follows the official measurement protocol (Strel, 1997). The SLOFIT test battery includes eight motor tests (arm plate tapping, standing long jump, polygon backwards, sit-ups, standing reach touch, bent arm hang, 60-meter run, 600-meter run), and three anthropometric measurements (body height, body weight, triceps skinfold thickness). Measurement sessions are always organised in school gyms between 8 a.m. and 2 p.m. Subjects are weighed barefoot in their shorts and T-shirts to the nearest 0.1 kg with portable scales of various brands; height is measured with stadiometers of various brands to the nearest 0.1 cm; triceps skinfold is measured with the Holtain-Tanner callipers to the nearest mm. All instruments are calibrated once at the beginning of the measurements. Data

are checked to detect coding errors. In order to include and evaluate children's measurements in the SLOFIT system, and to use the data for scientific purposes, children need the written consent of their parents; the response rates in primary schools have remained above 94% since this system was introduced. The SLOFIT database currently includes more than five million sets of measurements and grows at a rate of approximately 210,000 sets of measurements per year.

Procedures

Nine primary schools that conducted the intervention through an enhanced PE curriculum provided regular PE classes (held by classroom teacher) three times a week and extra PE classes (jointly held by specialist PE teacher and classroom teacher, randomly selected and invited to participate in the study) twice a week. To exclude as many environmental factors as possible (the PE ***conditions offered by individual schools and the impact of school social environment),*** the control groups were from the same schools as the experimental ones.

We used the SLOFIT database to obtain data based on the eight motor tests and the three anthropometric measurements for every child included in the first four years of their schooling. The motor test results were used to calculate the physical fitness index (XT) and the body height and body weight results were used to calculate the body mass index (BMI) for every child in all the four years. XT values present standardized comparisons of each student's motor test results with the whole population; its distribution in every age and gender population subgroup is normal with a mean of 50 and a standard deviation of 10. The baseline and any follow-up measurement took place at schools during PE lessons in April, 2000-2003.

Data analysis

Since this was a cluster-randomised quasi-experiment, we constructed the linear mixed models for each dependent variable to test the influence of intervention on children's physical fitness controlling for gender and time (measurement year). The assessment of children's motor fitness was based on XT, which was computed by averaging the normalized (by rankit quantile normalization using the whole population as a reference group) scores of every motor test (8) and was linearly transformed, so that the entire population XT score (a particular gender and age) has normal distribution with mean of 50 and standard deviation of 10. BMI was

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calculated from body weight and height as weight (in kg) was divided by the square of the height (in m). The R 2.13 (http://r-project.org) programming environment with *nlme* library and REML (restricted maximum-likelihood) method was used for constructing the model. After testing several models, programme, year, gender and year–programme interaction – were used as fixed effects, while subject (within class), class (within school) and school were used as random effects.

RESULTS

Measurements in the first programme year showed (Table 1) that the physical fitness index of children included in the intervention was above the Slovenian average (50.0), whereas that of children from the control group was below the average. The intervention group children were better in every motor test. In contrast, their initial anthropometric status was not superior since they had the higher BMI and triceps skinfold thickness than the control group children. Children from both groups improved their motor test results through years, except for standing reach touch. In all the measurements, excluding bent arm hang for girls in year 3, children from the intervention group had better results. Regarding their physical development, children from both groups became taller, got heavier and gained subcutaneous fat, yet the differences in triceps skinfold thickness and BMI in the fourth year are in favour of the intervention group when they are compared with the baseline.

Table 1. Measurements of anthropometric and motor tests in four years by gender (B-boys, G-girls) and PE programme (intervention and control). Values are raw (SD) unless stated otherwise

		Intervention				Control			
Boys	Variable	year1	year2	year3	year4	year1	year2	year3	year4
	XT	53.54	53.49	53.25	52.88	47.65	48.70	48.72	48.34
		(6.29)	(6.30)	(6.56)	(6.64)	(5.86)	(5.12)	(6.12)	(5.82)
	BMI (kg/m²)	16.8	17.6	18.0	18.6	15.8	16.7	17.7	18.3
		(2.31)	(2.59)	(2.65)	(2.91)	(1.99)	(2.31)	(2.60)	(3.06)
	Triceps skinfold thickness (mm)	10.93	11.42	13.07	13.76	10.15	11.82	13.03	13.39
		(4.69)	(4.84)	(6.01)	(6.44)	(3.48)	(4.01)	(5.51)	(5.58)
	Body weight (kg)	28.8	32.7	36.2	40.4	26.8	30.7	35.0	39.0
		(5.00)	(6.05)	(6.93)	(8.10)	(4.37)	(5.52)	(6.86)	(8.24)
	Body height (cm)	130.8	136.0	141.4	146.8	130.1	135.1	140.2	145.5
		(5.26)	(4.72)	(5.24)	(5.52)	(5.42)	(5.64)	(5.81)	(6.19)
	Arm plate tapping (rep/20s)	25.1	28.2	31.0	34.2	23.3	27.7	29.7	32.7
		(3.32)	(3.45)	(3.59)	(3.86)	(3.81)	(4.09)	(3.82)	(4.00)
	Sit-ups (rep/60s)	31.6	38.3	39.8	43.5	26.9	30.6	33.3	36.2
		(6.28)	(6.71)	(8.19)	(7.43)	(6.21)	(6.42)	(6.40)	(8.32)
	Standing reach touch (cm)	44.6	44.9	44.8	44.5	41.5	42.7	42.0	42.3
		(5.30)	(4.79)	(5.56)	(5.82)	(5.79)	(6.42)	(6.20)	(6.77)
	Standing long jump (cm)	141.7	148.9	158.0	164.4	132.8	145.1	153.6	160.5
		(18.64)	(18.09)	(17.05)	(19.66)	(15.63)	(15.56)	(17.15)	(17.52)
	Bent arm hang (s)	32.0	41.1	41.5	42.8	22.6	31.2	29.2	31.1
		(25.26)	(26.70)	(30.19)	(31.06)	(17.72)	(20.73)	(22.22)	(26.32)
	Polygon backwards (s)	15.9	14.3	13.5	12.6	19.1	17.0	15.3	15.2
		(3.91)	(3.15)	(3.39)	(3.26)	(4.03)	(4.19)	(4.01)	(3.84)
	600-meter run (s)	195.9	173.7	161.9	155.6	206.0	187.5	178.2	171.7
		(40.38)	(26.53)	(23.01)	(22.59)	(38.94)	(28.76)	(35.35)	(28.96)
	60-meter run (s)	12.05	11.41	11.00	10.73	12.41	11.80	11.41	10.91
		(.88)	(.86)	(.96)	(.99)	(.93)	(.97)	(1.01)	(.92)

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		Intervention				Control			
Girls	XT	54.40	54.81	55.27	54.68	49.61	51.18	52.12	50.91
		(6.35)	(6.36)	(6.44)	(6.36)	(6.48)	(6.25)	(6.72)	(6.63)
	BMI (kg/m²)	16.1	16.8	17.5	17.9	15.9	16.4	17.2	17.9
		(2.48)	(2.20)	(2.83)	(2.85)	(2.39)	(2.28)	(2.58)	(2.84)
	Triceps skinfold thickness (mm)	11.92	13.09	13.28	13.80	11.48	12.90	13.80	13.57
		(4.21)	(4.53)	(4.61)	(4.92)	(3.92)	(3.29)	(3.89)	(4.53)
	Body weight (kg)	27.1	30.3	34.6	38.7	26.5	29.6	33.7	38.2
		(5.82)	(5.55)	(7.82)	(8.92)	(5.35)	(6.06)	(7.20)	(8.38)
	Body height (cm)	129.0	134.0	140.2	146.3	128.8	133.7	139.5	145.4
		(5.05)	(5.63)	(6.24)	(6.84)	(5.73)	(6.09)	(6.71)	(6.78)
	Arm plate tapping (rep/20s)	25.6	29.6	32.2	35.7	24.5	28.4	31.6	34.5
		(2.95)	(3.48)	(3.57)	(3.48)	(3.28)	(3.55)	(3.12)	(3.75)
	Sit-ups (rep/60s)	30.4	36.2	38.3	41.7	27.7	30.2	34.9	38.0
		(6.03)	(7.53)	(6.82)	(7.76)	(5.82)	(6.72)	(7.05)	(7.98)
	Standing reach touch (cm)	46.1	48.4	48.0	48.3	44.6	46.0	46.3	46.3
		(5.98)	(5.20)	(5.59)	(5.88)	(5.90)	(6.73)	(7.41)	(8.54)
	Standing long jump (cm)	132.5	142.2	152.7	158.5	127.9	140.8	149.4	157.2
		(17.20)	(15.42)	(16.66)	(19.47)	(15.86)	(17.12)	(17.97)	(18.66)
	Bent arm hang (s)	26.0	33.3	32.2	35.2	23.4	31.6	34.6	30.0
		(21.18)	(25.29)	(26.03)	(25.63)	(20.07)	(22.25)	(24.95)	(22.88)
	Polygon backwards (s)	17.9	15.7	13.9	12.9	19.7	17.5	16.1	15.1
		(4.91)	(3.39)	(2.94)	(2.70)	(4.18)	(4.14)	(4.11)	(3.72)
	600-meter run (s)	201.4	190.8	171.7	165.5	214.7	204.1	186.0	184.5
		(36.74)	(30.11)	(26.25)	(23.66)	(33.09)	(31.53)	(25.21)	(25.31)
	60-meter run (s)	12.46	11.67	11.25	10.86	12.74	12.03	11.61	11.07
		(.95)	(.91)	(1.00)	(.91)	(1.27)	(1.03)	(1.04)	(.89)

Table 2. Regression coefficients for the linear mixed model effects

							Interaction programme: year		
Effect	(Intercept)	Programme	year2	year3	year4	gender	year2	year3	year4
Reference group		Control		year1		boys	control:year1		
XT	-0.61	0.78	0.19	0.27	0.15	0.30	-0.17	-0.23	-0.18
BMI (kg/m²)	-0.40	*0.20*	0.27	0.59	0.84	*-0.16*	*0.04*	-0.12	-0.16
Triceps skinfold thickness (mm)	-0.39	*0.09*	0.32	0.54	0.55	*0.18*	-0.15	-0.17	*-0.06*
Body weight (kg)	-0.71	*0.16*	0.43	0.95	1.47	*-0.16*	*0.04*	*-0.03*	*-0.04*
Body height (cm)	-0.91	*0.06*	0.59	1.23	1.90	*-0.13*	*0.01*	*0.05*	0.07
Arm plate tapping (rep/20s)	-1.23	0.28	0.81	1.32	1.90	0.24	*-0.12*	*-0.10*	*-0.02*
Sit-ups (rep/60s)	-0.77	0.34	0.36	0.79	1.15	*-0.02*	0.37	*0.16*	0.22
Standing reach touch (cm)	-0.56	0.36	0.20	0.17	0.18	0.52	*-0.01*	*-0.02*	*-0.04*
Standing long jump (cm)	-0.77	0.38	0.62	1.04	1.41	-0.28	-0.20	-0.15	-0.21
Bent arm hang (s)	-0.30	*0.22*	0.34	0.36	0.30	*-0.13*	*-0.01*	*-0.04*	*0.10*
Polygon backwards (s)	-0.77	0.58	0.51	0.86	0.99	-0.17	*-0.06*	*-0.12*	*-0.02*
600-meter run (s)	-0.56	0.28	0.42	0.82	0.94	-0.32	*0.07*	*0.11*	0.17
60-meter run (s)	-0.77	*0.28*	0.57	0.93	1.39	-0.23	*0.08*	*0.06*	*-0.11*

Note: All variables were standardized. Motor variables, in which lower result means better fitness (PB, 600m, 60m), have the sign of their values inverted before analysis. Coefficients, not significant at alpha=5% are shown in italics; p-values in year and programme: year interaction are not adjusted for multiple comparisons.

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At each follow-up, children from both groups had statistically significant higher values than in the previous measures in all the tested variables (Table 2). After controlling gender and time (measurement year), the intervention programme group has higher expected values in all variables, although significant only in XT, arm plate tapping, sit-ups, standing reach touch, standing long jump, polygon backwards and 600-meter run. In some cases, especially in sit-ups and standing long jump, the programme is in interaction with time. Intervention has a much stronger impact on XT than on gender.

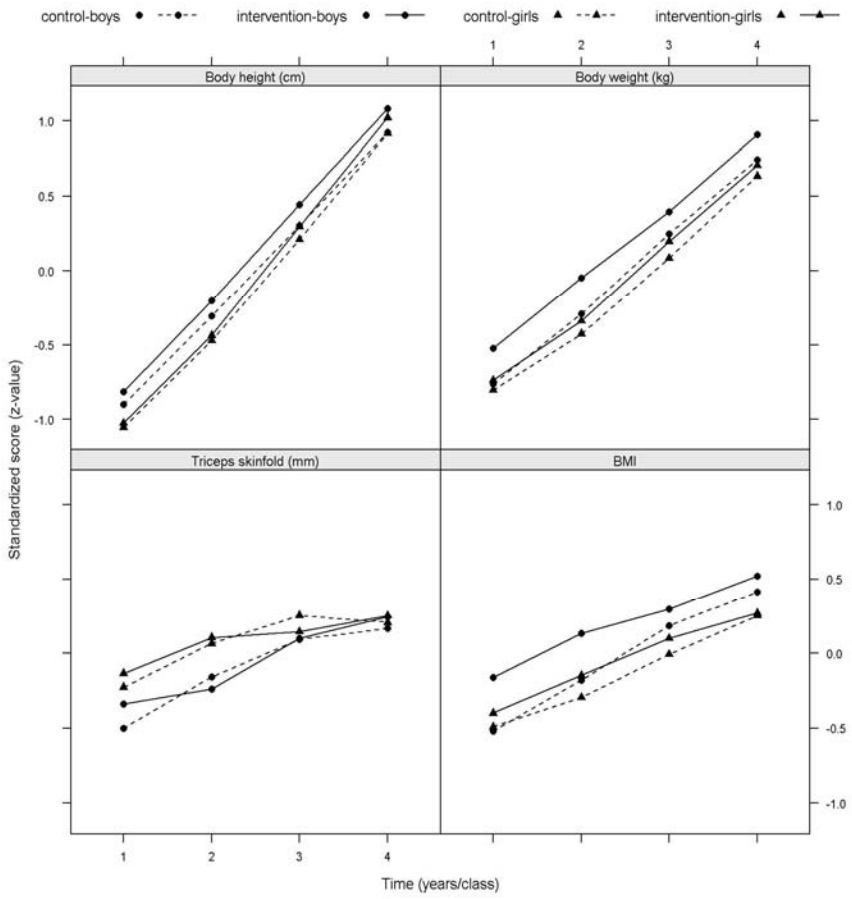

Figure 1. Interaction plots for anthropometric variables by year (class), programme and gender of students

Although differences between the intervention group and the control group in anthropometric variables are statistically non-significant,

the higher body weight and BMI of boys in the intervention group in all years, as well as a difference decrease in triceps skinfold thickness after the fourth year can be seen (Figure 1). The intervention group decreased its triceps skinfold thickness in comparison to the control group while the differences in body weight remain similar.

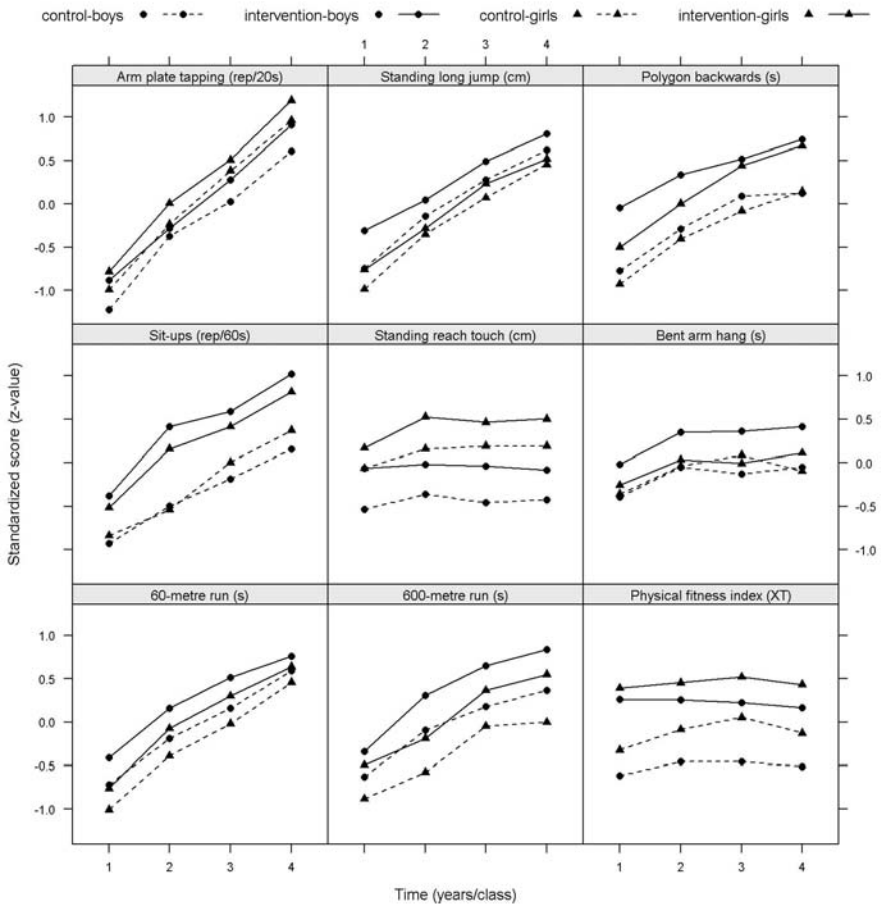

Figure 2. Interaction plots for motor variables by year (class), programme and gender of students

Intervention has a strong impact on XT, yet children from both groups retained their position in this variable (Figure 2). Specifically, XT is a linearly transformed average of every motor test (8 in total) in the entire population at particular genders and ages, so the visible progress regarding this variable cannot be expected. In the final testing, boys in the intervention group were better by 0.68 z-score units and girls by 0.56 z-

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score units than their peers from the control group. In individual motor abilities (see other plots in Figure 2), children from the control group mostly lagged behind those from the intervention group in the strength of abdominal muscles, i.e. in SU by 0.66 z-score units (-0.88 in boys and -0.44 in girls), general endurance, i.e. in 600m run by 0.52 z-score units (0.47 in boys and 0.55 in girls) and the whole body movement co-ordination, i.e. PB by 0.57 z-score units (0.61 in boys and -0.52 in girls).

DISCUSSION

Therefore, we were able to show that the enhanced PE curriculum, regularly delivered three times a week by classroom teacher and, additionally, twice a week by specialist PE teacher and classroom teacher, positively affected children's physical fitness. However, the influence was not as apparent as could be assumed.

The initial differences in motor tests indicate that children with better physical fitness enrol the kinesiological intervention, which confirms some previous findings (Novak, Petrović, Tušak, & Kovač, 1990). Children who participate in various sports programmes from their early childhood mature faster and have a biological advantage over other children (Jurimae & Jurimae, 2000). Presumably, children enrolled in such an intervention programme have parents with more positive attitudes towards a sports lifestyle and who can also afford this being ready to pay for such a lifestyle (Gubanc, 1999). According to the previous findings (Gubanc, 1999; Jurak, Kovač, & Strel, 2002), it can be also assumed that these parents more frequently enrol their children in sports activities during their free time and they are also physically active themselves. Therefore, these children get ahead of their peers in the motor development, they are more successful in sport, and take up sports more frequently.

As expected, at each follow-up, children from both groups (see Table 2) had higher values than in the previous measures in all tested variables (difference in tests at the alpha level .05). Specifically, a characteristic of the studied period (7 to 10 years of age) is the positive direction of physical and motor development for both genders (Malina, Bouchard & Bar-Or, 2004; Strel et al., 2007).

Despite the statistically significant influence of intervention on the physical fitness index (see Table 2), one might be sceptical about the efficiency of intervention when compared with the control group results (see Figure 2). However, analysing in more details provides a wider picture.

Although non-significant in our linear mixed models, differences in the physical development led to the assumption that the higher body weight of boys included in the intervention group could be explained by their higher biological maturity level at the time of entering school and their reduced triceps skinfold thickness could be seen as an impact of the intervention. An increase in body fat can be noted in boys under the age of 12 (Kovač, Leskošek, & Strel, 2007); therefore, the higher share of body fat in boys attending the kinesiological intervention can be explained by their higher biological age (Malina, 1994). Biological maturation could also influence differences in the motor fitness. Simultaneously, the greater differences in body weight compared with body fat indicate a larger amount of muscle tissue. As a result of the reduced difference in skinfolds (see Figure 1), it can be assumed that the difference in body weight is less due to the smaller increase in body fat in boys included in the intervention group. This is a very important indicator, because the cross-studies point out an increasing percentage of overweight and obese children of this age (Cacciari et al., 2006; Kovač et al., 2007; Leskošek, Strel, & Kovač, 2010).

Children from the intervention programme group had significantly higher values in physical fitness index, arm plate tapping, sit-ups, standing reach touch, standing long jump, polygon backwards and 600-meter run (see Table 2). The greatest differences were found in sit-ups, polygon backwards and 600-meter run (see Figure 2). Some better results regarding the whole body movement co-ordination of the intervention group children (task polygon backwards) indicate a better quality in running the sessions, a wider range of motor skills and a suitable work organisation, which ensured positive changes in the stated motor ability (Štihec & Kovač, 1992). It can be assumed that those pupils received different motor stimuli, which teachers differently passed on, so they also indicate a higher level of motor skills. The better results achieved in sit-ups and 600-metre run can be mainly explained by a larger amount of exercising (more PE hours). Such tasks represent different forms of endurance, which can be significantly improved through planned and adequate exercises. It is known that children of both genders who are regularly included in sports training show better cardiorespiratory fitness and higher levels of functional motor abilities (especially in muscular endurance and running speed). This has been proved in some cross-studies comparing active children (Strel et al., 2007) as well as in longitudinal studies (Beunen et al., 1992; Štihec & Kovač, 1992).

It could have been expected that there would be also bigger differences in the results of other motor variables. An improvement was not generally achieved in those motor tests that are largely genetically determined (speed, explosive power). In comparison, an improvement in

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the intervention group was mostly achieved in motor fitness dimensions, which can be significantly improved through exercises and for which the studied age group has revealed particularly negative changes in recent decades (Bös, 2003; Jurimae & Jurimae, 2000; Strel et al., 2007; Tomkinson et al., 2007). Further, a lower initial status always facilitates a greater improvement compared to a higher initial status. These factors could also explain the smaller differences between the children in both groups and can be a result of the samples used.

Limitations

There are limitations to our study and care should be taken in making generalisations to different countries, since there are considerable differences in the organisation and contents of PE curricula worldwide. The study was a quasi-experiment and did not control many important environmental and social factors, which influence children's physical and motor development, although we tried to control them by sampling classes from the same schools for both groups. The intervention group schools were not randomly selected but included on the basis of expert knowledge. Besides, we were unable to obtain the information on the current PE planning and teaching competences of the teachers included, which surely influence the quality of curriculum realisation. We had no information on whether children's out-of-school activities affected the results. The intervention group boys could be considered earlier maturers, but we were not able to determine the biological age of children from our data and could not control the maturation level analysis. Another limiting factor of the study lies in the fact that the children were tested in April, so any initial status differences had already been the result of more than half a year of systematic work in the two different programmes.

CONCLUSIONS

The better effects of kinesiological intervention on physical fitness probably result from better quality and larger amounts of exercising. We assume that the programme quality was mostly achieved due to the superior competences of teachers (Kovač, Sloan, & Starc, 2008; Starc & Strel, 2012) to improve some parts of children's physical fitness and a smaller number of children being taught, which thus ensured more individual work and better safety. Apart from the mentioned factors, the

quantity of exercising was also achieved through the larger number of PE hours available.

Since the positive effects of teaching shared by PE teacher and classroom teacher were confirmed (Peternelj, Škof, & Strel, 2008; Štihec & Kovač, 1992), it would be sensible to offer such a type of kinesiological intervention more frequently. In addition, it is usual in schools offering the kinesiological intervention that a higher level of PE classes based on the regular PE curriculum is also reached as a result of the positive transfer of knowledge between teachers (Novak et al., 1990). Kinesiological intervention programmes should be thus underpinned by the transfer of knowledge related to planning PE, as it has been found that classroom teachers lack skills in this area in particular (Jurak et al., 2004b). With the increased competences of teachers, it will be possible to apply more moderate-to-intense physical activities of children, as the amount of time they spend in modern school is rising. So, children could participate in physical activities at a proper intensity as part of extracurricular activities.

The results also reveal some disadvantages of the current work in the studied kinesiological intervention. It can be seen that teachers in these classes do not pay enough attention to the muscular strength of arms and shoulder girdle, as well as flexibility. The former is especially worrying, given that the muscular strength of arms and shoulder girdle of children at this age has dramatically decreased over last decades (Rychtecky, 2004; Strel et al., 2007).

Changes in the school environment (curriculum reform, longer working hours for parents) require a different (flexible) organisation of kinesiological intervention according to the specific features of particular school situation, yet it must still serve the same purpose: to improve schools that offer the same to all children, and to adjust to the wishes and needs of children and their parents.

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Croatian Journal of Education
Hrvatski časopis za odgoj i obrazovanje

Vol: 13 (4/2011)
pages: 41-70

UTJECAJ PROGRAMA KINEZIOLOŠKE INTERVENCIJE NA FIZIČKU KONDICIJU DJECE

SAŽETAK

Istraživanje ima cilj utvrditi kako poboljšani program tjelesne i zdravstvene kulture pomoću kineziološke intervencije, koju nude neke škole u Sloveniji, utječe na fizičku kondiciju djece u dobi od 7 do10 godina.

Longitudinalno istraživanje u trajanju od 4 godine obuhvatilo je 328 učenika u obliku pedagoškog eksperimenta. Podatci su prikupljeni uz primjenu testova u sklopu SLOFIT sustava. Razlike u učincima transformacije analizirane su pomoću analize kovarijance.

Utvrđeno je da kineziološki program ima pozitivan utjecaj na razvoj fizičke kondicije, osobito s obzirom na to da su podatci pojedinih motoričkih sposobnosti djece te dobi u padu u posljednjih nekoliko desetljeća. Nakon što su uklonjene razlike u početnom stanju, zabilježene su statistički značajne razlike u sljedećim motoričkim zadacima: poligon unatrag, podizanje trupa 60 sekundi i trčanje na 600 metara. Dječaci su imali značajnu razliku u težini. Napredak učenika koji su pohađali dodatni kineziološki program također ukazuje na bolju kvalitetu sesija, uključujući širi raspon motoričkih vještina, prikladnu organizaciju rada i kvalitetnije vježbanje.

Polazeći od dobivenih rezultata, ponuđene su sljedeće preporuke: češća suradnja učitelja tjelesne i zdravstvene kulture i učitelja razredne nastave na satima tjelesne i zdravstvene kulture, organizacija njihova usavršavanja, fleksibilna organizacija dodatnih kineziološkim programa zbog novih zahtjeva u školama i sustavnije planiranje nastavnih sati potrebnih za njihovu provedbu.

Ključne riječi: *osnovna škola, dodatna nastava tjelesne i zdravstvene kulture, fizička kondicija*

UVOD

Loša fizička kondicija djece povezuje se s mnogim bolestima koje se mogu spriječiti i predstavlja ozbiljan zdravstveni problem danas i ubuduće (Svjetska zdravstvena organizacija, 2007). Redovita i kvalitetna fizička

aktivnost u djetinjstvu dio je rješenja (drugi se dio odnosi na kvalitetnu prehranu) koji može dovesti do poboljšanja brojnih fizioloških i morfoloških varijabli djece (Owen i sur., 2010). U razvijenim su zemljama stoga intervenirali tako da su se usredotočili na promjene u unosu hrane i razinama fizičke aktivnosti (Brown i Summerbell, 2009; Kriemler i sur., 2011). Škole su popularne sredine za provedbu takvih intervencija jer se u njima nudi kontinuirani, intenzivni kontakt s djecom. Školska infrastruktura i fizičko okruženje, politika, nastavni planovi i programi te osoblje imaju snažnu mogućnost pozitivnog utjecaja na zdravlje djece.

Danas se glavni dio fizičke aktivnosti djece pripisuje redovitoj nastavi tjelesne i zdravstvene kulture u školama (Bailey, 2006). Dostatna provedba kvalitetnog nastavnog plana i programa može znatno pridonijeti sveukupnosti fizičke aktivnosti u rasponu od umjerene do intenzivne kada je riječ o djetetu školske dobi (Trudeau i Shephard, 2005). Nastava tjelesne i zdravstvene kulture treba također služiti kao poligon za pripremu budućih fizički obrazovanih osoba tako što će poučiti djecu o važnosti redovite fizičke aktivnosti po njihovo zdravlje te pružiti im vještine koje idu u prilog aktivnom životnom stilu (Ding, Sallis, Kerr, Lee i Rosenberg, 2011; Fairclough i Stratton, 2005; Froberg i Andersen, 2010; Sallis, Prochaska i Taylor, 2000). Osim toga, ne treba odbaciti činjenicu da su motorički razvoj i fizička aktivnost usko povezani s kognitivnim i emocionalno-društvenim područjima djetetova razvoja (Kovač i Strel, 2000; Sibley i Etnier, 2003; Tomporowski, 2003).

Kvantiteta i kvaliteta motoričkih podražaja osobito su važne u dobi između šeste i desete godine, kada se djetetov fizički razvoj usporava, mišićni sustav snažno razvija, a razina zrelosti koordinacije pokreta predstavlja idealno vrijeme za početak primjene općih sportskih vježbi ili intenzivnijeg uvježbavanja tehnički zahtjevnijih pokreta. Zahvaljujući brzom razvoju velikog mozga, osobito mijelinacijom korteksa, to je idealno razdoblje za usvajanje motoričkih aktivnosti koje zahtijevaju veći broj naučenih motoričkih obrazaca (gimnastika, balet, skijanje, plivanje, itd.) i ne mogu se naći u ontogenezi ljudskog razvoja (Jurimae i Jurimae, 2000). Novija istraživanja pokazuju da djeca u toj dobi, u usporedbi s prijašnjim generacijama, nisu stekla dovoljnu fizičku kondiciju, što obuhvaća povećanu tjelesnu težinu, odnosno smanjene motoričke vještine i funkcionalne sposobnosti (Jurimae, Volbekiene, Jurimae i Tomkinson, 2007; Strel, Kovač i Jurak, 2007; Tomkinson i Olds, 2007) te može dovesti do nepovoljnih rezultata u odrasloj dobi (Starc i Strel, 2011). To je također razdoblje kada nastavu tjelesne i zdravstvene kulture u Europi uglavnom izvode učitelji razredne nastave koji ne raspolažu odgovarajućim kompetencijama za poučavanje navedenoga predmeta (DeCorby, Halas, Dixon, Wintrup i Janzen,

2005; Hardman, 2008; Janzen i sur., 2003; Jurak, Kovač i Strel, 2004; Morgan i Hansen, 2008; Sallis i sur., 1997).

U slovenskim osnovnim školama djeca imaju tri obvezna nastavna sata (135 minuta) tjedno tijekom prvih šest godina obrazovanja (Kovač, Strel, Starc i Jurak, 2008). Neke škole u Sloveniji također nude intervencijske kineziološke programe od 1984. godine, što podrazumijeva bolji nastavni plan i program, uključujući najčešće dva dodatna sata tjedno u zajedničkoj realizaciji učitelja razredne nastave i učitelja specijaliziranog za nastavu tjelesne i zdravstvene kulture, te širi raspon sadržaja koji se mogu provoditi i izvan škole. Trenutno se takav intervencijski program nudi u 7% slovenskih osnovnih škola (Jurak, Kovač i Strel, 2004a). Njegova pozicija u školskom okruženju (program se realizira uz dopuštenje školskog vijeća, organizacija i sadržaj nadopuna su redovitoj nastavi) i sportskoj domeni (dobro organizirana, redovita i dobro provedena dodatna sportska aktivnost) predstavlja pravu opciju za kvalitetne redovite i proširene programe sa svakodnevnom nastavom tjelesne i zdravstvene kulture i dodatnim sportskim aktivnostima (aktivnosti na otvorenom, razni sportski tečajevi, itd.) kada je riječ o djeci čiji roditelji rado biraju takvu vrstu obrazovanja.

Najnovija istraživanja organizacije spomenutoga rada (Jurak i sur., 2004) pokazuju da se nastava tjelesne i zdravstvene kulture obično realizira u sredini dnevnog rasporeda. Tjelesne aktivnosti što ih škole nude putem tečajeva također su obično organizirane tijekom nastave, a rjeđe poslije nastave, u dane praznika ili vikenda. Škole u čijoj su ponudi takvi interventni programi imaju dobre uvjete za nastavu tjelesne i zdravstvene kulture kao što su velike sportske dvorane i travnate površine, odnosno tvrdi vanjski tereni; većina ih također ima manje sportske dvorane i ostale specijalizirane površine (atletska staza, bazen, prostorija za vježbanje, prostor za skokove, staza za džoging, igraonica, plesna dvorana, itd.).

Većina škola upisuje djecu u ovaj program nakon što prethodno dobiju roditeljsku suglasnost za takav tip nastave i dodatno plaćanje. Različiti su načini financiranja navedenih programa. Neke škole pokrivaju troškove realizacije uz pomoć lokalnih i državnih sredstava, sponzora i vlastitih izvora, što ne iziskuje nikakve troškove od djece ili roditelja, dok neke škole uključuju i roditeljske priloge ili pak potpuno pokrivaju troškove uz pomoć roditelja. Oni prosječno plaćaju dodatnu nastavu tjelesne i zdravstvene kulture € 11.40. Škole smatraju da taj mjesečni iznos nije tako visok da ga roditelji ne bi mogli podnijeti. Osim toga, vjeruje se da je to još uvijek jeftin način vježbanja. U slučaju pouke u klubovima ili privatnim institucijama roditelji također moraju plaćati članarinu kao i prijevoz; organizirano vježbanje u školi roditeljima omogućuje značajnu uštedu vremena, što je dodatna prednost (Jurak i sur., 2004).

Jedan vid učinkovitosti takve kineziološke intervencije u školi tiče se utjecaja što ga program ima na fizičku kondiciju djece i, neizravno, utjecaja na kvantitetu i kvalitetu motoričkih vještina, sudjelovanje u sportskim aktivnostima u slobodno vrijeme, regulaciju tjelesne težine, itd. Istraživanje ima cilj utvrditi kako kineziološka intervencija utječe na fizički i motorički razvoj djeteta u dobi između sedam i deset godina.

METODOLOGIJA

Ispitanici

Uzorak se sastojao od učenika 27 razreda iz 9 osnovnih škola u Sloveniji. U eksperimentalnu je skupinu (kineziološki interventni program) bilo uključeno 76 djevojčica i 81 dječak, dok su 84 djevojčice i 87 dječaka činili kontrolnu skupinu (redoviti program tjelesne i zdravstvene kulture). Polazna dob im je bila slična, za intervencijsku skupinu iznosila je 7.76 (SD = 0.33) a za kontrolnu skupinu 7.71 (SD = 0.32).

Instrumenti

Podatci su prikupljani uz pomoć SLOFIT-a, slovenskog sustava za praćenja fizičke kondicije djece, uvedenog 1987. godine i ranije poznatog pod nazivom Karton sportskog obrazovanja. Svake godine u travnju učitelji kvalificirani za nastavu tjelesne i zdravstvene kulture, koji su završili tečaj za antropometrijska mjerenja, provode ta mjerenja u svim osnovnim i srednjim školama prema zahtjevima nastavnog plana i programa, uz primjenu službenog mjernog protokola (Strel, 1997). SLOFIT baterija obuhvaća osam motoričkih testova (taping rukom, skok udalj, poligon unatraške, podizanje trupa, predklon, izdržaj u zgibu, trčanje na 60 metara i trčanje na 600 metara) i tri antropometrijska mjerenja (tjelesna visina, težina i kožni nabor tricepsa). Mjerenja su uvijek organizirana u školskim dvoranama između 8 i 14 sati. Ispitanici se mjere kada su bosonogi, u kratkim hlačicama i majicama. Tjelesna težina se mjeri najpribližnije do 0.1 kg s prijenosnim skalama raznih proizvođača; visina se mjeri uz uporabu visinomjera različitih proizvođača najpribližnije do 0.1 cm; tricepsi se mjere uz uporabu Holtain-Tannerovog kalipera do najpribližnijih mm. Svi se instrumenti kalibriraju jednom na početku mjerenja. Podatci se provjeravaju da bi se otkrile pogrješke u kodiranju. Da bi se uključile i vrednovale mjere u SLOFIT sustavu te da bi se podaci koristili u znanstvene svrhe, djeca trebaju pismenu

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suglasnost svojih roditelja; od uvođenja ovoga sustava, suglasnost se u osnovnim školama zadržala iznad 94%. SLOFIT baza podataka trenutno obuhvaća više od pet milijuna mjernih nizova i godišnje raste prosječno za oko 210 000 nizova.

Postupak

Nasumce je odabrano i pozvano na sudjelovanje u istraživanju devet osnovnih škola koje su provodile kineziološku intervenciju putem poboljšanog nastavnog programa realiziranog redovito tri puta tjedno uz pomoć učitelja razredne nastave i dva dodatna sata tjedno u zajedničkoj realizaciji učitelja specijaliziranog za nastavu tjelesne i zdravstvene kulture i učitelja razredne nastave. Da bi isključili što je moguće više vanjskih čimbenika (uvjeti za nastavu navedenog predmeta u pojedinim školama i utjecaj školskoga društvenog okruženja), kontrolne su skupine bile iz istih škola kao i eksperimentalne.

Koristili smo se SLOFIT bazom da bismo dobili podatke o osam motoričkih testova i tri antropometrijska mjerenja za svako dijete u prvom, drugom, trećem i četvrtom razredu. Rezultati su motoričkih testova poslužili za izračun indeksa fizičke kondicije (XT), a rezultati mjerenja tjelesne visine i težine za izračun indeksa tjelesne mase (MBI) za svako dijete u sva četiri razreda. XT vrijednosti predstavljaju standardne usporedbe motoričkih rezultata svakog djeteta s populacijom; distribucija je normalna u svakoj dobnoj i rodnoj populacijskoj podskupini sa srednjom vrijednošću 50 i standardnom devijacijom 10. Osnovna i sva naredna mjerenja provedena su u školama tijekom nastave tjelesne i zdravstvene kulture u travnju 2000.-2003. godine.

Analiza podataka

Budući da je ovo bio kvazi-eksperiment, konstruirali smo linearnu kombinaciju modela za svaku zavisnu varijablu da bismo testirali utjecaj kineziološke intervencije na fizičku kondiciju djece kontrolirajući rod i vrijeme (godina mjerenja). Motorička se kondicija određivala uz pomoć indeksa (XT), koji je izračunat kao prosjek normaliziranih (s rankit kvantilnom normalizacijom, gdje se cijela populacija koristila kao referentna skupina) rezultata svih osam motoričkih testova i linearno transformiranih tako da XT rezultat za cijelu populaciju (određeni rod i dob) ima normalnu distribuciju sa srednjom vrijednošću 5 i standardnom devijacijom 10. BMI je izračunat na temelju tjelesne težine i visine jer se težina (u kg) dijeli sa kvadratom visine

(u m^2). Za konstrukciju modela korišten je R2.13 (http://r-project.org) sustav za programiranje s *nlme* knjižnicom i REML (restriktivni maksimum-vjerojatnoća) metodom. Nakon testiranja nekoliko modela, program, godina, rod i godina – programska interakcija – korišteni su kao fiksni učinci, a ispitanici (unutar razreda), razred (unutar škole) i škola kao slučajni učinci.

REZULTATI

Tablica 1.

Mjerenja u prvoj godini programa pokazala su (Tablica 1) da je indeks fizičke kondicije djece uključene u kineziološki interventni program iznad slovenskog prosjeka (koji iznosi 50.0), dok su djeca iz kontrolne skupine ispod tog prosjeka. Djeca iz interventne skupine postigla su bolje rezultate u svim motoričkim testovima. Međutim, njihov antropometrijski status na početku mjerenja nije bio bolji jer su imali veći indeks tjelesne mase (BMI) i kožne nabore tricepsa nego djeca iz kontrolne skupine. Djeca iz obje skupine unaprijedila su rezultate svojih motoričkih testova tijekom godina, osim u slučaju predklona. U svim mjerenjima, osim u slučaju djevojčica u trećoj godini kada je riječ o elementu izdržaj u zgibu, djeca iz interventne skupine postigla su bolje rezultate. Što se tiče fizičkoga razvoja, djeca su iz obiju skupina imala sve veću visinu, bila su sve teža i imala su sve deblje potkožno tkivo. No razlike u pogledu kožnih nabora tricepsa i indeksa tjelesne mase u četvrtoj godini idu u prilog interventnoj skupini kada se usporede s polaznim mjerenjem.

Tablica 2.

Pri svakom sljedećem mjerenju djeca su iz obiju skupina imala statistički značajno veće vrijednosti nego pri prethodnim mjerenjima po svim testiranim varijablama (Tablica 2). Nakon kontroliranja roda i vremena (godina mjerenja), skupina iz interventnoga programa zabilježila je očekivano veće vrijednosti po svim varijablama, iako značajno samo u slučaju indeksa fizičke kondicije, tapinga rukom, podizanja trupa, predklona, skoka udalj,poligona unatraške i trčanja na 600 metara. U nekim slučajevima, osobito kada je riječ o podizanju trupa i skoku udalj, program je u interakciji s vremenom. Intervencija ima mnogo snažniji utjecaj na indeks fizičke kondicije nego rod.

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Slika 1.

Iako razlike između intervencijskih i kontrolnih skupina po antropometrijskim varijablama nisu statistički značajne, svake se godine može primijetiti veća tjelesna težina i indeks tjelesne mase za dječake u interventnoj skupini, a manja razlika u slučaju kožnih nabora tricepsa poslije četvrte godine (Crtež 1). Intervencijska skupina bilježi kožni nabor tricepsa u manjoj mjeri u usporedbi s kontrolnom skupinom dok razlike u tjelesnoj težini ostaju slične.

Slika 2.

Intervencija ima snažan utjecaj na indeks fizičke kondicije djece, ipak obje su skupine zadržale svoju poziciju kada je riječ o toj varijabli (Crtež 2). Specifično promatrano, indeks fizičke kondicije (XT) predstavlja linearno transformiranu prosječnu vrijednost svih osam motoričkih testova u cjelokupnoj populaciji za određeni rod i dob tako da se ne može očekivati vidljivi napredak u ovoj varijabli. Pri završnom testiranju, dječaci su u interventnoj skupini bili bolji za 0.68 jedinica z-vrijednosti, a djevojčice bolje za 0.56 jedinica z-vrijednosti nego njihovi vršnjaci u kontrolnoj skupini. U slučaju pojedinačnih motoričkih vještina (vidi druge čestice na Crtežu 2) djeca su iz kontrolne skupine uglavnom zaostajala za djecom iz interventne skupine po snazi abdominalnih mišića, tj. u podizanju trupa za 0.66 jedinica z-vrijednosti (-0.88 za dječake i -0.44 za djevojčice), općoj izdržljivosti, odnosno trčanju na 600 metara za 0.52 jedinica z-vrijednosti (0.47 za dječake i 0.55 za djevojčice), i koordinaciji pokreta cijeloga tijela, tj. poligon unatraške za 0.57 jedinica z-vrijednosti (0.61 za dječake i -0.52 za djevojčice).

DISKUSIJA

Ovim istraživanjem možemo pokazati da bolji nastavni plan i program, realiziran redovito tri puta tjedno uz pomoć učitelja razredne nastave i još dva sata tjedno uz zajedničku pomoć učitelja specijaliziranog za nastavu tjelesne i zdravstvene kulture i učitelja razredne nastave, pozitivno utječe na fizičku kondiciju djece. Međutim, taj utjecaj nije očigledan kako bi se moglo pretpostaviti.

Početne razlike u motoričkim testovima ukazuju na to da se djeca s boljom fizičkom kondicijom upisuju u program kineziološke intervencije, što

potvrđuje prijašnje rezultate (Novak, Petrović, Tušak i Kovač, 1990). Djeca koja sudjeluju u različitim sportskim programima od ranog djetinjstva brže sazrijevaju i u biološkoj su prednosti nad ostalom djecom (Jurimae i Jurimae, 2000). Pretpostavlja se da djeca upisana u program kineziološke intervencije imaju roditelje čiji je stav prema sportskom načinu života vrlo pozitivan i koji su ga spremni plaćati jer si to mogu priuštiti (Gubanc, 1999). Prema prethodnim rezultatima (Gubanc, 1999; Jurak, Kovač i Strel, 2002), može se pretpostaviti da takvi roditelji također češće upisuju svoju djecu u sportske aktivnosti u slobodno vrijeme te da su i sami fizički aktivni. Stoga njihova djeca imaju prednost nad vršnjacima kada je riječ o motoričkom razvoju, uspješnija su u sportu i češće se odlučuju za sport.

Očekivano, kod svakog sljedećeg mjerenja, djeca su iz obiju skupina (vidi Tablicu 2) imala veće vrijednosti nego kod prijašnjih mjerenja po svim testiranim varijablama (razlike na testovima na alpha = .05). Specifično govoreći, obilježje promatranog razdoblja (od sedam do deset godina) jest pozitivno usmjerenje fizičkog i motoričkog razvoja za oba roda (Malina, Bouchard i Bar-Or, 2004; Strel i sur., 2007).

Unatoč statistički značajnom utjecaju intervencije na indeks fizičke kondicije (vidi Tablicu 2), mogli bismo biti skeptični kada je riječ o učinkovitosti intervencije pri usporedbi s rezultatima kontrolne skupine (vidi Crtež 2). No detaljnija analiza pruža širu sliku.

Iako nisu značajne u slučaju naših linearno kombiniranih modela, razlike u fizičkom razvoju dovele su do pretpostavke da bi se veća tjelesna težina kod dječaka u interventnoj skupini mogla objasniti njihovom većom biološkom zrelošću u vrijeme polaska u školu, a njihovi su slabiji kožni nabori tricepsa objašnjivi utjecajem kineziološke intervencije. Povećanje tjelesne masnoće može se primijetiti među dječacima mlađim od 12 godina (Kovač, Leskošek i Strel, 2007); veći udio tjelesne masnoće kod dječaka uključenih u interventni program može se dakle objasniti njihovom starijom biološkom dobi (Malina, 1994). Biološka zrelost mogla bi također utjecati na razlike u motoričkoj kondiciji. Istovremeno, veće razlike u tjelesnoj težini u usporedbi s tjelesnom masnoćom pokazuju veću količinu mišićnog tkiva. Što se tiče rezultata smanjene razlike u kožnim naborima (vidi Crtež 1), može se pretpostaviti da je razlika u tjelesnoj težini manja zbog manjeg povećanja tjelesne masnoće kod dječaka uključenih u interventni program. To je vrlo bitan pokazatelj jer ostala istraživanja ukazuju na sve veći postotak pretile i predebele djece u toj dobi (Cacciari i sur., 2006; Kovač i sur., 2007; Leskošek, Strel i Kovač, 2010).

Djeca iz interventnoga programa imala su značajno veće vrijednosti indeksa fizičke kondicije, tapinga rukom, podizanja trupa, predklona, skoka udalj, poligona unatraške i trčanja na 600 metara (vidi Tablicu 2). Najveće su

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razlike pokazali u podizanju trupa, poligonu unatraške i trčanju na 600 metara (vidi Crtež 2). Bolji rezultati u koordinaciji pokreta cijelim tijelom (zadatak poligon unatraške) djece uključene u interventni program ukazuju na kvalitetniju provedbu sesija, širi raspon motoričkih vještina i odgovarajuću organizaciju rada, što je osiguralo pozitivne promjene u toj motoričkoj sposobnosti (Štihec i Kovač, 1992). Može se pretpostaviti da su ti učenici dobili različite motoričke podražaje, koje su im učitelji prenijeli na različite načine pa tako ujedno pokazuju višu razinu motoričkih vještina. Bolji rezultati postignuti u podizanju trupa i trčanju na 600 metara mogu se uglavnom objasniti intenzivnijim vježbanjem (više sati nastave tjelesne i zdravstvene kulture). Ti zadatci predstavljaju različite oblike izdržljivosti, što se može značajno unaprijediti kroz planirano i odgovarajuće vježbanje. Poznato je da djeca, bez obzira na rod, koja su redovito uključena u sportski trening pokazuju bolju kardiorespiratornu kondiciju i bolje funkcionalne motoričke sposobnosti (misli se najprije na izdržljivost i brzinu trčanja). To se pokazalo u nekim istraživanjima kada su se uspoređivala aktivna djeca (Strel i sur., 2007) kao i u longitudinalnim istraživanjima (Beunen i sur., 1992; Štihec i Kovač, 1992).

Moglo se očekivati da će biti i većih razlika u rezultatima kada je riječ o ostalim motoričkim varijablama. Uglavnom nije postignut napredak u onim motoričkim testovima koji su uvelike genetički određeni (brzina, eksplozivnost). U usporedbi s tim, postignut je napredak u interventnoj skupini uglavnom kada je riječ o dimenzijama motoričke kondicije, što se može znatno unaprijediti vježbanjem i za što je promatrana dobna skupina pokazala bitno negativne promjene posljednjih desetljeća (Bös, 2003; Jurimae i Jurimae, 2000; Strel i sur., 2007; Tomkinson i sur., 2007). Nadalje, niži početni status uvijek olakšava bolji napredak u usporedbi s onima čiji je početni status viši. Ti bi čimbenici mogli također objasniti manje razlike između djece u objema skupinama i biti rezultat korištenih uzoraka.

Ograničenja

Postoje ograničenja u slučaju našega istraživanja i treba paziti na generalizaciju u različitim zemljama jer su razlike značajne u organizaciji i sadržaju nastavnih planova i programa (tjelesna i zdravstvena kultura) širom svijeta. Istraživanje je predstavljalo kvazieksperiment i nije kontroliralo mnoge važne okolišne i društvene čimbenike koji utječu na fizički i motorički razvoj djece iako smo i njih nastojali kontrolirati tako što smo odabrali razrede za interventnu i kontrolnu skupinu iz istih škola. Škole iz interventne skupine nisu nasumce birane, već na temelju stručnog znanja. Nismo

također mogli prikupiti podatke o trenutnim kompetencijama planiranja i poučavanja učitelja tjelesne i zdravstvene kulture, što sigurno utječe na kvalitetu provedbe nastavnog plana i programa. Nemamo podatka o tome jesu li izvanškolske aktivnosti učenika utjecale na rezultate. Dječaci u interventnoj skupini mogli bi se smatrati ranije zrelima, ali nismo mogli odrediti biološku dob djece iz naših podataka te nismo mogli kontrolirati analizu razine zrelosti. Još jedan ograničavajući čimbenik istraživanja je taj da su djeca testirana u travnju, što znači da su razlike proizašle iz početnog statusa već rezultat više od pola godine sustavnoga rada u dvjema različitim programima.

ZAKLJUČAK

Bolji učinci kineziološke intervencije na fizičku kondiciju su vjerojatno rezultat kvalitetnijeg i intenzivnijeg vježbanja. Pretpostavljamo da se kvaliteta programa uglavnom postiže zahvaljujući izvrsnim kompetencijama učitelja (Kovač, Sloan i Starc, 2008; Starc i Strel, 2012), koji rade na poboljšanju nekih elemenata fizičke kondicije djece, i manjem broju djece, što je osiguralo individualniji pristup i veću sigurnost. Osim navedenih čimbenika, intenzitet se vježbanja također postiže većim brojem raspoloživih sati nastave tjelesne i zdravstvene kulture.

Budući da su potvrđeni pozitivni učinci suradnje učitelja tjelesne i zdravstvene kulture i učitelja razredne nastave (Peternelj, Škof i Strel, 2008; Štihec i Kovač, 1992), bilo bi razumno češće nuditi takav oblik kineziološke intervencije. Osim toga, uobičajeno je da se u školama gdje se spomenuta intervencija provodi postiže viša razina nastave tjelesne i zdravstvene kulture s redovitim nastavnim planom i programom kao rezultat pozitivnog prijenosa znanja među učiteljima (Novak i sur., 1990). Programi kineziološke intervencije trebali bi stoga biti poduprti prijenosom znanja o planiranju nastave tjelesne i zdravstvene kulture jer je ustanovljeno da učitelji razredne nastave ne raspolažu vještinama osobito u tom području (Jurak i sur., 2004). Uz povećane kompetencije učitelja bit će moguće više primjenjivati fizičku aktivnost od umjerene do intenzivne jer se količina vremena što ga djeca provode u suvremenoj školi povećava. Djeca bi, dakle, mogla sudjelovati u fizičkim aktivnostima odgovarajućeg intenziteta kao dijelu izvannastavnoga rada.

Rezultati ovoga istraživanja također pokazuju neke nedostatke današnjega rada u promatranoj kineziološkoj intervenciji. Može se vidjeti da učitelji u tim razredima ne poklanjaju dovoljno pozornosti mišićnoj snazi u rukama i ramenom pojasu te fleksibilnosti. Ono prvo je osobito

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zabrinjavajuće ako se zna da je mišićna snaga u rukama i pramenom pojasu djece te dobi dramatično slabija posljednjih desetljeća (Rychtecky, 2004; Strel i sur., 2007).

Promjene u školskom okruženju (nastavna reforma, duže radno vrijeme roditelja) zahtijevaju drukčiju (fleksibilnu) organizaciju kineziološke intervencije prema specifičnostima određene školske situacije, pa ipak ona mora služiti istoj svrsi – unaprjeđenju škole koja svakom djetetu nudi isto te prilagođavanju željama i potrebama djece i njihovih roditelja.