THE EFFECT OF PHYSICAL ACTIVITIES ON MOTOR ABILITIES IN 7- TO 8-YEAR-OLD CHILDREN

Erika **CHOVANOVÁ**[1], Mária **MAJHEROVÁ**[2]

1. University of Presov, Faculty of Sports, Department of Sports Educology and Humanistics, Slovakia
2. University of Presov, Faculty of Humanities and Natural Sciences, Department of Physics, Mathematics, and Techniques, Slovakia

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Abstract:
The development of a hypothetical model of motor abilities at school age and the explanation of its internal relations contribute to updating of theoretical foundations for the formulation of educational goals, especially in terms of their more precise operationalization. This allows determining of those domains of motor fitness that are crucial for conceptual and balanced and intentional formation of children's motor skills. The exercise programs offered that proportionally cover dominant domains of motor skills may offer an effective educational tool for children. This study was conducted within the project VEGA 1/0625/16 'The effect of physical activities on the development of motor abilities in integrated children with behavior disorders'. The effect of exercise programs on children's motor abilities was determined using the EUROFIT test battery and KTK (Körperkoordinationstest für Kinder) test battery [Schilling, Kiphard 2007]. The results showed that 7- to 8-year-old children showed improved levels of motor abilities.

INTRODUCTION

Human motor skills represent an integral part of a personality structure and contribute to the formation of personality structure on all ontogenesis levels. Their current concepts, interpretations, and structural models are still of hypothetical character only and clarification is conditioned by a long-term empirical research. Framing of a hypothetical model of motor abilities and explanation of its inner relations contributes to actualization of theoretical basis inevitable for definition of education goals mainly in terms of their more precise operationalization. The enable the areas of motor performance, which are crucial for the conception and balanced intentional formation of child motor skills also in relation to health aspects of motor performance, to be determined [Ružbarská, Chovanová 2017].

Over the past 20 years, the studies have shown decline in the physical activity levels regardless of age and gender. Children are currently interested in computer technology, videogames, surfing the internet, and an alarming finding is that one tenth of children engage in physical activities during their leisure time. A disturbing fact is that the amount of physical activity performed by children at elementary and high schools has declined as well. The penetration of information and computer technologies into the educational process at elementary schools causes gradual elimination of the full-fledged and regular physical activity from the daily educational schedule at schools. The interest in sports may be supported through a wider spectrum of physical activities. We may encounter various forms of physical activities, such as activities performed before classes, during classes, and during recessions [Durkáč, Chovanová 2013; Iivonen, Sääkslahti, Laukkanen 2015].

One of the qualifying criteria applied when assessing the level of coordination abilities is motor educability, which refers to quantification of speed, amount, and quality of acquired movement or motor skills. The degree of educability is determined by administering tests of motor aptitude. Such tests include also the test battery known as Körperkoordinationtest für Kinder – KTK, which was developed by E. J. Kiphard a F. Schilling.

Iivoven, Sääkslahti, Laukkanen [2015] administered KTK test battery as a tool for the assessment of children's motor coordination and found that motor coordination plays an important role in the overall development of children. Motor coordination is the ability to integrate sensory perception and physical activity into effective movements, which is important for motor skills. The authors recommend using Körperkoordinationstest für Kinder KTK [Kiphard, Schilling 1974, 2007], which was devised in Germany in 1970, to assess motor coordination of children.

Exercise programs that proportionally cover dominant domains of motor skills may represent an effective tool for educating children. Within the grant project VEGA 1/0625/16 entitled *'The effect of physical activities on the development of motor abilities in integrated children with behavior disorders*', Ružbarská, Chovanová [2017] studied the effects of exercise programs on the development of children's motor abilities. The results of the pilot study showed significant improvements in their coordination abilities.

The formulation of theoretical foundations of the research objective when determining the effects of exercise programs on the development of children's motor abilities has led to the determination of the research problem.

The research problem was:

- *to determine the levels and development of motor abilities in 7- to 8-year-old children by gender.*
- *to determine the effects of exercise program on the development of children's motor abilities.*

AIM

To assess the level and development of children's motor abilities, we administered the EUROFIT test battery and Körperkoordinationstest für Kinder test battery [Schilling, Kiphard 1974, 2007], which allow a complex assessment of motor abilities and the determination of the effects of the exercise program on the development of children's motor abilities.

MATERIAL AND METHODOLOGY

This study was conducted within the project VEGA *1/0625/16 'The effect of physical activities on the development of motor abilities in integrated children with behavior disorders*'.

The participation in the educational research was voluntary and anonymous. Only participants whose parents provided a written informed consent were included in the study.

We carried out a two-group educational experiment between November 2016 and April 2017. *The experimental group* consisted of 7- to 8-year-old students who attended Elementary school located at ul. 17. novembra in Sabinov. The children in the experimental group engaged in interventional movement games aimed to develop their motor abilities. Of 42 students, 32 students participated in both pretest and posttest.

The control group consisted of 7- to 8-year-old students who attended an elementary school at Komenského street in Sabinov. The children in the control group did not engage in any interventional movement games. In line with the teaching curriculum, the students attended two classes of physical education per week. Of 42 students, 32 students participated in both pretest and posttest.

Methods of data processing

The test scores were recorded in test scoresheets. The levels of parameters measured were described using mathematical and statistical characteristics: arithmetic mean (*M*) and standard deviation (*SD*). To determine differences between means for selected parameters, we used Mann-Whitney U test at $p < .05$ in STATISTICA v.12.

RESULTS

The results of pretest and posttest for experimental and control groups of girls and boys from the viewpoint of somatic and motor parameters are presented in Tables 1, 2, 3, 4, 5, and 6. The pretest test scores, which were statistically processed, showed samples pretest homogeneity for both somatic and motor parameters. We determined the effect of the intervention exercise program on the development of somatic and motor parameters in children aged 7 and 8 years.

The effects of the intervention program for girls and boys, respectively, are presented in Tables 1, 2, 3, 4, 5, and 6. Mean scores indicate predominantly improved levels of somatic and motor parameters for both groups. However, there were statistically significant changes for the experimental group only. We found that the recommended movement games had positive effect on fitness development in second grade students at the primary education level.

Table 1 Somatic parameters of girls

		PRETEST		**POSTTEST**	
		EG (*n* = 17)	**CG (*n* = 16)**	**EG (*n* = 17)**	**CG (*n* = 16)**
BH	*M* ± *SD*	130.62 ± 5.29	130.03 ± 6.57	132.26 ± 5.18	130.94 ± 6.88
	p	0.78		0.53	
BM	*M* ± *SD*	28.75 ± 5.49	28.38 ± 6.27	30.08 ± 5.83	28.64 ± 6.8
	p	0.85		0.52	
BMI	*M* ± *SD*	16.77 ± 2.52	16.68 ± 2.83	17.11 ± 2.62	16.56 ± 2.67
	p	0.93		0.55	

Note. BH - body height; BM - body mass; BMI - body mass index; EG - experimental group; CG - control group

Motor parameters at pretest and posttest for girls (Tables 3 and 4) showed a significant difference for sit-and-reach test, which assesses trunk flexibility, and flexed arm hang. Differences between pretest and posttest were significant only for walking backwards and moving sideways.

Posttest data for boys (Tables 4, 5, and 6) showed significant improvements for the test of static balance, the Flamingo test. Boys in the experimental group showed significant differences ($p < .05$) between pretest and posttest for sit-and-reach test, which assesses trunk flexibility. As regards motor coordination, boys in the experimental group showed a significant difference at posttest for walking backwards, which assesses dynamic balance.

Table 2 Motor parameters of girls (EUROFIT)

		PRETEST		POSTTEST	
		EG (*n* = 17)	**CG (*n* = 16)**	**EG (*n* = 17)**	**CG (*n* = 16)**
FBT	*M* ± *SD*	0.71 ± 1.36	1.13 ± 2.09	0.82 ± 1.63	0.69 ± 1.54
	p	0.5		0.81	
PT	*M* ± *SD*	22.09 ± 3.75	21.1 ± 3.51	20.28 ± 4.2	19.45 ± 3.62
	p	0.44		0.55	
SRT	*M* ± *SD*	28.03 ± 6.97	25.19 ± 4.43	***33.59 ± 5.83***	***26.81 ± 4.29***
	p	0.17		***0***	
SLJ	*M* ± *SD*	103.59 ± 17.52	97.5 ± 13.84	107.53 ± 18.1	104.13 ± 14.32
	p	0.28		0.56	
SU	*M* ± *SD*	11.65 ± 5.56	11.88 ± 4.35	12.06 ± 5.08	11.88 ± 5.63
	p	0.9		0.92	
FAH	*M* ± *SD*	9.67 ± 7.16	16.01 ± 12.73	***7.14 ± 6.57***	***11.97 ± 6.5***
	p	0.09		***0.04***	
SR	*M* ± *SD*	26.82 ± 2.76	27.22 ± 2.17	26.85 ± 2.01	27.43 ± 3.78
	p	0.65		0.59	
ESR	*M* ± *SD*	15.18 ± 10.27	10.44 ± 0.51	13.41 ± 7.07	14.31 ± 6.64
	p	0.08		0.71	

Note. FBT - Flamingo balance test; PT - plate tapping; SRT - sit-and-reach test; SLJ - standing long jump; SU - sit-ups in 30 s; FAH - flexed arm hang; SR - shuttle run 10 x 5 m; ESR - endurance shuttle run; EG - experimental group; CG - control group

Table 3 Motor parameters of girls (KTK tests)

		PRETEST		POSTTEST	
		EG (*n* = 17)	**CG (*n* = 16)**	**EG (*n* = 17)**	**CG (*n* = 16)**
WB	*M* ± *SD*	***44.29 ± 13.85***	***34.94 ± 9.15***	***44.88 ± 12.36***	***36.56 ± 11.53***
	p	***0.03***		***0.05***	
HH	*M* ± *SD*	43.35 ± 13.42	49.06 ± 6.48	47.88 ± 11.28	49.06 ± 9.98
	p	0.13		0.75	
JS	*M* ± *SD*	36.35 ± 4.53	34.5 ± 3.41	***36.82 ± 2.81***	***39.94 ± 5.35***
	p	0.2		***0.04***	
MS	*M* ± *SD*	44.12 ± 14.06	48.5 ± 14.16	50.65 ± 14.58	50.31 ± 13.45
	p	0.38		0.95	

Note. WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; EG - experimental group; CG - control group

Table 4 Somatic parameters of boys

		PRETEST		POSTTEST	
		EG (*n* = 15)	**CG (*n* = 16)**	**EG (*n* = 15)**	**CG (*n* = 16)**
BH	*M* ± *SD*	131.4 ± 6.02	129.94 ± 6.75	132.63 ± 6.18	131.25 ± 6.77
	p	0.53		0.56	
BM	*M* ± *SD*	28.62 ± 4.52	30.13 ± 7.42	29.62 ± 5.16	31.21 ± 7.91
	p	0.5		0.51	
BMI	*M* ± *SD*	16.58 ± 2.51	17.65 ± 3.24	16.85 ± 2.88	17.92 ± 3.44
	p	0.32		0.36	

Note. BH - body height; BM - body mass; BMI - body mass index; EG - experimental group; CG - control group

Table 5 Motor parameters of boys (EUROFIT)

		PRETEST		POSTTEST	
		EG (*n* = 15)	**CG (*n* = 16)**	**EG (*n* = 15)**	**CG (*n* = 16)**
FBT	*M* ± *SD*	2.6 ± 4.14	3.06 ± 3.11	***1.4 ± 1.64***	***4.44 ± 3.97***
	p	0.73		***0.01***	
PT	*M* ± *SD*	20.3 ± 3.14	20.41 ± 2.23	19.44 ± 2.97	18.08 ± 3.14
	p	0.91		0.23	
SRT	*M* ± *SD*	27.53 ± 10.09	26.25 ± 5.69	***32.27 ± 5.13***	***24.56 ± 4.34***
	p	0.66		***0***	
SLJ	*M* ± *SD*	120.07 ± 17.59	115.06 ± 17.51	115.67 ± 17.32	113.94 ± 22.36
	p	0.43		0.81	
SU	*M* ± *SD*	14.27 ± 4.82	17.88 ± 4.54	14.4 ± 3.42	13.31 ± 5.38
	p	0.72		0.51	
FAH	*M* ± *SD*	15.41 ± 9.38	19.94 ± 17.2	13.44 ± 7.06	10.87 ± 6.19
	p	0.38		0.29	
SR	*M* ± *SD*	24.31 ± 2.38	25.18 ± 3.47	24.99 ± 2.45	25.79 ± 3.36
	p	0.43		0.46	
ESR	*M* ± *SD*	14.27 ± 8.15	10.18 ± 2.77	20.6 ± 12.75	17.44 ± 9.68
	p	0.11		0.4	

Note. FBT - Flamingo balance test; PT - plate tapping; SRT - sit-and-reach test; SLJ - standing long jump; SU - sit-ups in 30 s; FAH - flexed arm hang; SR - shuttle run 10 x 5 m; ESR - endurance shuttle run; EG - experimental group; CG - control group

Contrary to the boys in the control group, the boys in the experimental group showed significant differences between pretest and posttest scores in both static and dynamic balance tests.

Table 6 Motor parameters of boys (KTK tests)

		PRETEST		POSTTEST	
		EG (*n* = 15)	**CG (*n* = 16)**	**EG (*n* = 15)**	**CG (*n* = 16)**
WB	*M* ± *SD*	36.53 ± 5.8	33.31 ± 10.34	***44.07 ± 6.73***	***33.69 ± 9.98***
	p	0.3		***0***	
HH	*M* ± *SD*	***42.4 ± 10.7***	***49.19 ± 7.64***	44.73 ± 10.8	47.38 ± 7.11
	p	***0.05***		0.42	
JS	*M* ± *SD*	32.27 ± 6.66	33.44 ± 4.8	35.8 ± 8.42	36.25 ± 6.43
	p	0.58		0.87	
MS	*M* ± *SD*	47.27 ± 16.8	44.75 ± 14.87	55.4 ± 13.05	51.06 ± 13.81
	p	0.66		0.38	

Note. WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; EG - experimental group; CG - control group

CONCLUSIONS

We determined gender-specific levels of motor abilities in children aged 7 to 8 years. The exercise program was found to be effective in the development of motor abilities. Our educational recommendations are as follows:

- motor abilities must be developed on a continual and long-term basis,
- the selection of physical activities must be based on the principles of progression and appropriateness to age,
- simpler exercises must be incorporated first while placing emphasis on the execution of movements and gradual increase in the complexity of exercise,
- motor abilities must be tested regularly,
- movement games and exercises must vary,
- the use of model-based and experimentally verified movement games as one of the game portfolios for school physical education practice should be emphasized.

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