THE EFFECT OF PHYSICAL ACTIVITIES ON THE DEVELOPMENT OF COORDINATION ABILITIES IN INTACT AND OVERWEIGHT CHILDREN

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Abstract:
Knowledge from the domain of physical fitness in prepubertal age is crucial for conceptual, balanced, and intentional formation of children's motor skills also in relation to somatic parameters. Adhering to the principles of good dietary habits and sufficient levels of physical activity in school-aged youth plays a key role in preventing obesity. The sample included 87 pupils aged 9 to 10 years. The effect of exercise programs on children's coordination abilities is studied within the grant project VEGA 1/0625/16 entitled "The effects of physical activities on the development of motor abilities in intact and integrated children with behavior disorders". The effect of exercise programs on children's motor abilities was determined using a standardized Körperkoordinationstest für Kinder test battery. One nine-year-old girl was found to be underweight. Seventy pupils had normal BMI values and three girls and six boys were overweight, respectively. Six pupils were obese. Physical activities had effect on the coordination abilities in intact children, including overweight children.

INTRODUCTION

Monitoring of motor performance of child population is an irreplaceable part of the education process in case of physical education in schools and a motivating determinant of children's relation to physical activity. Knowledge from the domain of physical fitness in prepubertal age is crucial for conceptual, balanced, and intentional formation of children's motor skills also in relation to their somatic parameters [Ružbarská, Chovanová 2017].

Overweight and obesity during school age and adolescence currently represent a global health issue that attracts the attention of both expert and lay public. The increase in the number of overweight and obese children is determined by their poor dietary habits and low physical activity levels. The number of overweight and obese children worldwide and in Slovakia is growing continuously, which brings about a variety of health-related and psychosocial consequences. Adhering to the principles of good dietary habits and sufficient levels of physical activity in school-aged children play a crucial role in the prevention of obesity origination [Kožuchová, Bašková 2013], which has been also reported by Lopes et al. [2011] and Psotta et al. [2010].

Active lifestyle, in which appropriate and regular physical activity plays a crucial role, appears to be one of the dominant factors underlying a person's current health status. Physical activity is not understood from the biological perspective as physical activity respects

biopsychosocial component of the existence and functioning of human organism. Optimal exercise regime and balanced diet play a key role in a healthy lifestyle [Vladovičová 2007].

Exercise programs that proportionally cover key domains of motor skills may represent an effective tool of educating children. The test battery recommended for the assessment of motor coordination is the Körperkoordinationstest für Kinder KTK [Schilling, Kiphard 2007]. The suitability of the KTK – test battery was determined by Vandorpe et al. [2010], who evaluated Körperkoordinations Test für Kinder (KTK) as an assessment instrument for the gross motor coordination in 2,470 Flemish children. The authors of the study aimed to establish age- and gender-specific reference values for gross motor coordination in children aged 6 to 12 years from Flanders anno 2008. In addition, the suitability of KTK critical points in Flemish population was analyzed by comparing the MQ of the Flemish sample with a sample of normally developing German children. The study has shown that KTK is a sufficiently valuable instrument for the assessment of the gross motor coordination of Flemish children.

AIM

The aim of the study was to determine the effect of physical activities on the development of coordination abilities in intact and obese children.

Research problem:
There will be more overweight boys than girls.
Girls will show greater improvements in coordination abilities than boys.

MATERIAL AND METHODS

The study was conducted during the school year of 2016-17. The sample included 87 pupils aged 9 to 10 years who attended 3rd and 4th grades at elementary schools. The sample consisted of 50 girls and 37 boys who lived in rural areas [Sabolová 2017]. The participation in the study was voluntary and anonymous. Only participants whose parents provided a written informed consent were included in the study.

None of the pupils was an active athlete who engaged in sports activity on a regular basis. The research was conducted at four selected elementary schools located in the district of Vranov. The effect of exercise programs on children's coordination abilities is studied within the grant project VEGA 1/0625/16 entitled "The effects of physical activities on the development of motor abilities in intact and integrated children with behavior disorders". The effect of exercise programs on children's motor abilities was determined using a standardized Körperkoordinationstest für Kinder test battery.

Methods of data processing

Performances in particular tests were recorded in test protocols, which were used to compare coordination levels between boys and girls. The mathematical and statistical characteristics used to describe coordination levels were arithmetic mean (*M*) and standard deviation (*SD*). To determine significant differences between samples at $p < .05$, we applied a paired samples t-test using the statistical software STATISTICA v.12.

RESULTS

Of the total number of 87 children, only one nine-year-old girl was underweight. Seventy pupils had normal BMI values and three girls and six boys were overweight, respectively. Six pupils, 3 girls aged 10 years and 3 boys aged 9 to 10 years, were obese (Figure 1).

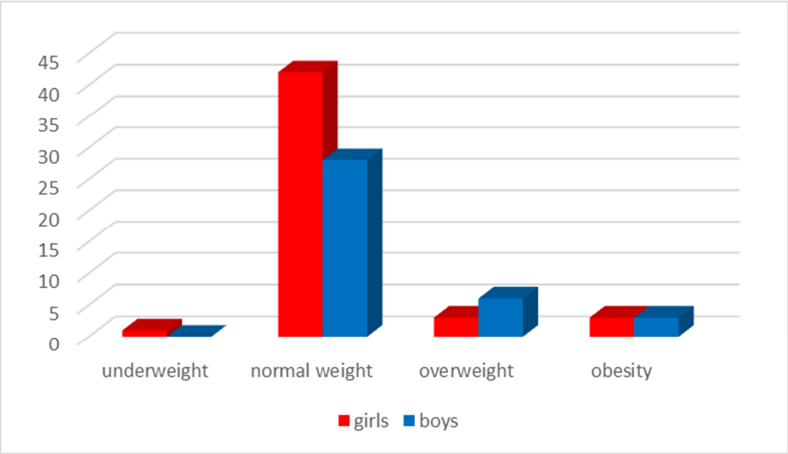

Figure 1 BMI for 9- and 10-year-old boys and girls

Children participated in the exercise program during physical education classes over the period of eight weeks. The differences between pretest and posttest scores are presented in Tables 1 and 2.

Table 1 Differences between pretest and posttest mean scores - girls

		G9 (*n* = 22)	**G10 (*n* = 28)**	
WB	PrT	47.27 ± 17.4115	46.68 ± 16.20483	$p < .01$
	PT	58.63 ± 12.16766	51.82 ± 14.72728	
HH	PrT	23.63 ± 8.97905	23.03 ± 11.37405	$p < .01$
	PT	25.27 ± 8.8704	25.14 ± 11.43651	
JS	PrT	49.05 ± 11.21851	52.39 ± 15.60232	$p < .01$
	PT	54 ± 11.95229	55.71 ± 16.65968	
MS	PrT	21.18 ± 3.73703	21.07 ± 4.56986	$p < .01$
	PT	22.9 ± 3.68923	22.71 ± 4.68929	

Note. n - sample size; PrT - pretest; PT - posttest; G9 - 9-year-old girls; G10 - 10-year-old girls; WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; $p < .01$ - significant difference at $p < .01$

To determine significant differences between pretest and posttest for particular motor tests, we applied the paired samples t test. We aimed to determine whether the participation in the exercise program and exercised targeted to develop children's coordination abilities had positive effect on performance in particular tests of motor coordination. Boys and girls across both age groups showed significant improvements.

Table 2 Differences between pretest and posttest mean scores - boys

		B9 (*n* = 17)	**B10 (*n* = 20)**	
WB	PrT	40.94 ± 18.30461	40.35 ± 17.33957	$p < .01$
	PT	47.82 ± 17.01189	47.15 ± 17.20549	
HH	PrT	23.94 ± 12.24985	22.3 ± 9.73383	$p < .01$
	PT	25.58 ± 12.25285	23.75 ± 9.93068	
JS	PrT	49.76 ± 14.53672	55.6 ± 12.96717	$p < .01$
	PT	54.65 ± 14.80262	60.55 ± 14.14018	
MS	PrT	19.53 ± 3.42997	21.1 ± 4.37577	$p < .01$
	PT	21.41 ± 2.82973	22.9 ± 4.7005	

Note. n - sample size; PrT - pretest; PT - posttest; B9 - 9-year-old boys; B10 - 10-year-old boys; WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; $p < .01$ - significant difference at $p < .01$

The results have shown that physical activities have positive effect on the development of coordination abilities in intact children. Boys and girls aged 9 to 10 years showed improved scores for all motor coordination tests. Significant changes are presented in Tables 1 and 2. We may conclude that boys and girls showed significant improvements in all tests. Children showed better test scores at posttest than at pretest. The significant differences between pretest and posttest indicate that children improved most significantly in Test no. 1, walking backwards, which assesses dynamic balance. On the contrary, girls and boys showed little improvement in Test no. 2, hopping for height, which assesses ability to couple movements and kinesthetic-differentiation ability.

The analysis of somatic parameters of boys and girls

Physical activities included in the exercise program had positive effect on coordination abilities in both intact and overweight children. The measurement of somatic parameters, such as body height and body mass, and the subsequent computation of BMI were used to assign children to particular zones – underweight, normal weight, overweight, and obesity (Figure 1). Of all boys and girls, nine boys and six girls were overweight. Normal BMI values were found for 70 children. All groups, including overweight children, showed improvements in motor coordination. Some overweight students achieved coordination test scores comparable with the mean recorded for intact pupils.

CONCLUSIONS

We determined the effect of physical activities on the development of coordination abilities in intact and overweight children during prepuberty. We have found that the number of overweight boys was larger than that of girls. Girls aged 9 to 10 years showed higher levels of coordination abilities than boys of the same age. Targeted physical activities have positive effect on the development of children's motor abilities. We recommend having pupils engage in physical activities that pupils find new and interesting. The exercises that are time-consuming and require a lot of equipment should be incorporated and integrated according to the intentions of teachers, even into one of the parts of classes within interdisciplinary relations.

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