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Original article

JOINT MOBILITY VALUES IN PRIMARY SCHOOL PUPILS BEFORE AND AFTER THE SUMMER HOLIDAY

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Abstract*

Aim. Motor behaviours and accumulations achieved during primary school are crucial for the development of movement ability in younger pupils. One of the motor abilities that can be easily developed in this stage is joint mobility, a component with well-defined meanings and implications for ensuring ease of movement and its adjustment to various conditions imposed by the motor skill learning situations.

The study aimed to investigate the range of motion in primary education children from Middle School no. 192, Bucharest, before and after the summer holiday, our interest being to see if the lack of specialized teaching intervention leads to changes in mobility values. The investigated joints are the scapular-humeral, coxofemoral and talocrural ones.

Method. The comparative study based on an ascertaining experiment used the test method to assess mobility, after Brian Mackenzie. Initial tests were conducted in the 2nd semester (spring) of the school year 2014-2015 and at the beginning of the 1st semester of the school year 2015-2016 (autumn), within Middle School no. 192 of Bucharest. The subjects were 68 children participating in the physical education lesson, from grades 1, 2 and 3 in the school year 2014-2015, who passed to grades 2, 3 and 4 in the next school year.

Results. Analysis of the results was performed separately for the two genders, using SPSS analysis software program, version 15. The obtained data revealed differences between mobility values in the two tests, with particularizations specific to each joint.

Conclusions. Analysis of the tests performed before and after the summer holiday has identified stagnation and even regression of joint mobility values in primary school pupils, which leads us to the conclusion that the interruption of physical activities is not beneficial for the development of this motor ability.

Keywords: joint mobility, primary school, physical education.

Introduction

One of the important components of education is physical education, which is achieved in school through specific contents and tasks whose influences are expressed in the ontogenetic development of pupils at the motor, physical, intellectual, affective, aesthetic and cultural levels. The concept of physical education is an abstraction and also a generalization of experiences gained over time (Dragnea, coord., 2000).

Primary education represents the first compulsory link of our educational system and is intended for children aged between 6 and 11 years, organized in the preparatory class and grades 1 to 4 (Stănescu, 2012).

This stage is thought to be crucial, since it has an essential role for the development of child's personality, from the perspective of their social and cultural formation. It is the period when learning, as a dominant activity, is achieved on the verbal, motor, affective, social, cultural planes (Golu, 2010).

All these aspects are found in the content of "physical education" school subject, with references to the acquisition of various and complex movement skills, harmonious physical development, development of motor capabilities, etc. As stipulated in the school physical education curriculum for primary education, the subject aims at forming key competences that ensure integration into the natural and social environment.

Also, through its connection with the other educational subjects, it provides a pedagogical approach integrated and adapted to the specific age-related particularities of the younger pupil (http://www.edu.ro/index.php/articles/22422).

Through its formative content, physical education focuses on preparing the child for life, facilitating the transfer of motor skills acquired in the lesson to

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everyday life, an also on the development of personality traits (Stănescu, 2012).

The improvement of motor capabilities is one of the main objectives in the process of preparing younger pupils, which is achieved concomitantly with the formation of their motor abilities and skills. The initial level of manifesting motor capabilities depends on the hereditary genetic background, having a native character, and the development and formation of motor skills occur in the same time with the evolution of the growth and development process. These are influenced by the activities performed in the school environment, the geographical and climatic environment, the specific activities carried out and the living conditions (Grigore and Dinţică, 2010).

The development of motor capabilities in the younger pupil is defining for the acquisition of motor abilities and skills, and is supported by the age-related and biological development particularities. At these ages, motor control and the quality of muscle contraction improve, the child being able to better manifest the strength, speed and coordination components (Dragnea and Bota, 1999; Epuran and Stănescu, 2010).

They must be added the mobility, which, through the range of motion, ensures ease of movement and its adjustment to various conditions imposed by the motor skill learning situations. As emphasized in specialty literature, joint mobility is one of the components of motor ability, which can be successfully developed in younger pupils due to the favourable morphological particularities at these ages (Manno, 1992, Famose and Durand, 1988; Weineck, 1994).

However, it should be noted the low interest of research in the evolution of mobility indices with age (Macovei, 1999; Knudson et al., 2000) and the paucity of data reported for the primary school pupils.

Studying the evolution of mobility indices at these ages has been of interest rather for performance sports activity, in the disciplines where this ability has a major intervention in achieving the technique, for instance rhythmic gymnastics and swimming (Jastrejevskaya, 1995; Bitang, 2008; Macovei, 1998; Macovei, 2003).

It has been proven, through a purposely designed programme issued following the conducted study, a significant improvement in mobility and coordination, and the emergence of a difference in the body mass index, showing that girls respond better to a low-intensity programme, while boys show benefits at higher intensities or differently designed programmes. Thus, these outcomes lead the decision-makers to orient towards the physical exercise field for primary school children in favour of purposely designed programmes based on demographic and anthropometric data (Galli et al., 2015).

The most recent study on the biomotor potential of pupils is achieved in 1992 and includes data about the mobility of certain joints (Paraschiv and Sintie, 1992).

Reflecting upon the above-mentioned issues, we support the idea that joint mobility is recommended to be permanently developed, particularly during the ontogenetic period where muscle-ligament structures show the greatest plasticity. Because of the constraints imposed by the low level of muscle mass and muscle tone on performing a broad range of motion, we are compelled to take into account this aspect too (Dragnea and Bota, 1999; Cârstea, 1993).

Hypothesis

The lack of teaching intervention and guidance in motor activities during the summer holiday can lead to stagnation in the manifestation of joint mobility values.

Purpose and premises

The study aimed to investigate the level of mobility manifestation within a timeframe in which pupils were engaged in didactic activity (the 2nd semester of the school year 2014-2015) and after the summer holiday break (the beginning of the 1st semester of the school year 2015-2016). The joints concerned are the scapular-humeral, coxofemoral and talocrural ones.

We wanted to see whether changes occurred and what their nature was – progression, regression or stagnation – related to the range of motion in the joints aforementioned.

We have started from the premise that mobility is a motor ability strongly influenced by the hereditary factor, but it can develop within the inherited limits, especially by improving the muscle-ligament functionality (Ifrim, 1994).

The functionality of a joint, in terms of laxity-stiffness relationship, reveals the genetic factor and the correlation between the range of motion and individual particularities (Macovei, 1999).

Studies conducted on twins highlighted differences in the heritability coefficients depending on the joint, the scapular-humeral one being rated as the most dependent joint, genetically speaking (Ifrim, 1986).

This research is a continuation of a previous study, in which we have tried to make a diagnosis of mobility values for the primary school pupil. There were then investigated pupils from grades 1 to 4, monitoring the evolution of mobility values in relation to age and gender. The study was presented at the International Congress of Physical Education, Sports and Kinetotherapy, 5th edition, organised by UNEFS Bucharest on 10-13 June 2015 (Ciocioi and Macovei, 2005).

Methods

The research was conducted from March 2015 to September 2015, with the primary education classrooms from Middle School no. 192 of Bucharest.

The investigated subjects were 68 in number, pupils participating in the physical education lesson, from grades 1, 2 and 3 in the school year 2014-2015, who passed to grades 2, 3 and 4 in the next school year. Initial tests were conducted in the 2nd semester (spring) of the school year 2014-2015, and final tests were performed at the beginning of the 1st semester of the school year 2015-2016 (autumn).

The research methods used are: documentation, observation, test method, statistical method and graphical representation.

To measure the shoulder joint, we used the shoulder and wrist flexibility test (http://www.brianmac.co.uk/flextest2.htm), the hip flexibility test for coxofemoral mobility (Tudor, 2013) and the ankle flexibility test (Mackenzie, 2005).

The shoulder and wrist flexibility test is performed in prone position, holding a stick with both hands shoulder width apart. From this position, the stick is raised as high as possible while keeping the forehead on the ground throughout the investigation.

The examiner measures the vertical distance from the ground to the bottom of the stick. Material resources required to administer this test are a stick and a meter ruler.

The hip flexibility test is performed in sitting on the gym bench position, trunk upright and arms close to the body, then the trunk bends forward without knee flexion, and hands try to reach the tiptoes or go beyond them in depth.

It is measured in centimetres the distance between finger tips and tiptoes, the values being negative when these ones are not reached, and positive when the finger tips exceed in depth the support level. Material resources required to administer this test are a gym bench and a meter ruler.

The ankle flexibility test is performed in stand position facing a wall, with arms raised up and the chest in contact with the wall. From this position, the researched subject slowly slides the feet back from the wall as far as possible, without losing contact with the wall, while the feet remain flat on the ground.

The examiner measures the distance between the subject's toe line and the wall. Material resources required to administer this test are a meter ruler, a wall and a non-slippery surface.

The reason for choosing these tests within our research is their rapidity and accessibility to the groups of school age children, and also because they require modest material resources, easy to provide by any education unit.

Results

The obtained results were tabulated and analysed using the SPSS statistical calculation software, variant 15. The calculated statistical indicators were: arithmetic mean, median, difference between means, standard deviation, coefficient of variation, Wilcoxon test, Mann-Whitney U test.

The results show significant differences in the mobility values between the two tests, with specific particularizations for each joint. According to data shown in table 1, we notice insignificant decreases in most cases.

Table 1. Overall results for mobility evolution in primary school classrooms

Item no.			BOYS						GIRLS					
	Grades		**1-2**		**2-3**		**3-4**		**1-2**		**2-3**		**3-4**	
	Testing		**Spring**	**Autumn**	**Spring**	**Autumn**	**Spring**	**Autumn**	**Spring**	**Autumn**	**Spring**	**Autumn**	**Spring**	**Autumn**
Shoulder mobility	Number of cases		18	18	14	14	5	5	9	9	12	12	10	10
	Arithmetic mean		39.94	30.94	42.00	34.93	46.60	40.40	32.33	33.78	44.83	41.92	43.80	43.30
	Median		36.50	31.00	44.00	34.00	50.00	40.00	28.00	39.00	48.00	43.00	43.50	43.00
	Diff. (spring - autumn)	Diff.	-9.0		-7.07		-6.20		1.44		-2.92		-0.50	
		%	-22.5%		-16.8%		-13.3%		4.5%		-6.5%		-1.1%	
	Standard deviation		14.11	11.19	11.30	9.03	10.09	10.50	13.18	14.59	9.09	10.62	10.55	12.53
	Coefficient of variation		35.34%	36.15%	26.91%	25.84%	21.65%	26.00%	40.77%	43.20%	20.28%	25.34%	24.09%	28.95%
Hip mobility	Number of cases		18	18	14	14	5	5	9	9	12	12	10	10
	Arithmetic mean		-15.06	-9.00	-5.64	-5.43	-0.80	-1.60	-5.67	-5.89	-0.83	-2.75	-3.60	-3.10
	Median		-19.50	-9.50	-5.50	-3.50	0.00	1.00	0.00	-4.00	0.00	-1.00	-8.00	-4.50
	Diff. (spring - autumn)	Diff.	10.00		2.00		1.00		-4.00		-1.00		3.50	
		%	+51.3%		+36.4%		-		-		-		-43.8%	
	Standard deviation		11.54	10.78	8.78	9.76	9.07	11.17	8.65	6.77	11.67	11.16	11.87	12.45
	Coefficient of variation		-76.63%	-119.73%	-155.52%	-179.87%	-1133.30%	-698.21%	-152.57%	-115.00%	-1400.21%	-405.85%	-329.76%	-401.60%
Ankle mobility	Number of cases		18	18	14	14	5	5	9	9	12	12	10	10
	Arithmetic mean		40.44	39.56	50.21	47.00	50.40	47.80	37.78	37.67	40.83	41.08	50.00	44.30
	Median		41.00	41.50	50.50	47.50	50.00	47.00	36.00	42.00	38.50	40.00	49.50	44.50
	Diff. (spring-autumn)	Diff.	-0.89		-3.21		-2.60		-0.11		0.25		-5.70	
		%	-2.2%		-6.4%		-5.2%		-0.3%		0.6%		-11.4%	
	Standard deviation		5.91	5.45	7.60	6.41	6.50	9.15	7.07	8.83	6.28	8.28	7.39	7.35
	Coefficient of variation		14.62%	13.77%	15.13%	13.64%	12.90%	19.14%	18.71%	23.45%	15.38%	20.16%	14.79%	16.59%

For the shoulder joint, the 1st graders (spring) – 2nd graders (autumn) show a negative evolution of -22.5%, according to table 1. Thus, between the two tests for shoulder flexibility, we notice, in figure 1, a shift from 39.94 cm in the spring to 30.94 cm in the autumn, the difference in the arithmetic mean being 9 cm. Girls of the same age had a slight increase in the shoulder flexibility, namely from 32.33 cm in the spring, they reached 33.78 cm in the autumn. According to table 1, they show a positive evolution of +4.5%.

In the 1st grade (spring) – 2nd grade (autumn), both the boys and the girls had a statistically insignificant evolution between the two tests as regards hip flexibility, represented by a slight increase in the median, for the boys, from -19.50 cm in the spring to -9.50 cm in the autumn (+51.3%), and a slight decrease in the arithmetic mean, for the girls, from -5.67 cm in the spring to -5.89 cm in the autumn, according to table 1.

The 1st graders (spring) – 2nd graders (autumn), both boys and girls, recorded a decrease in the arithmetic mean between the two tests as regards the level of ankle flexibility, in the case of boys, from 40.44 cm in the spring to 39.56 cm in the autumn (-2.2%), and in the case of girls, from 37.78 cm in the spring to 37.67 cm in the autumn (-0.3%), according to table 1.

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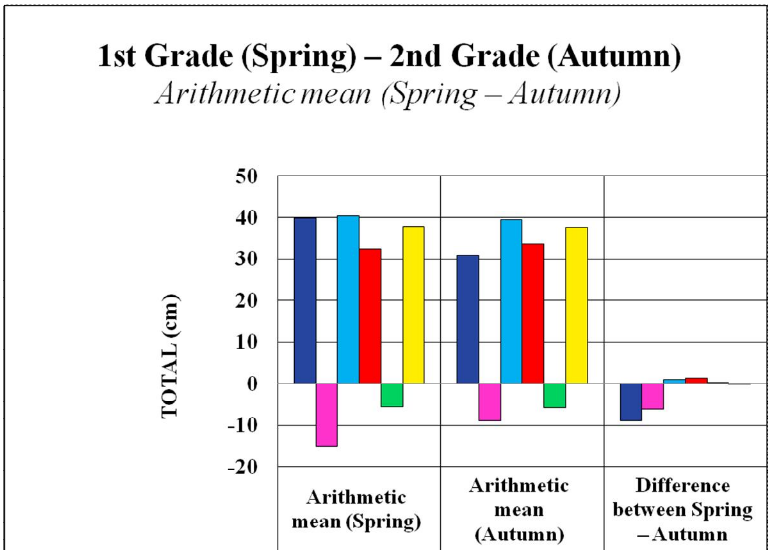

	Arithmetic mean (Spring)	Arithmetic mean (Autumn)	Difference between Spring – Autumn
Shoulder flexibility test (boys)	39.94	30.94	-9
Hip flexibility test (boys)	-15.06	-9	-6.06
Ankle flexibility test (boys)	40.44	39.56	0.88
Shoulder flexibility test (girls)	32.33	33.78	1.4
Hip flexibility test (girls)	-5.6	-5.8	0.2
Ankle flexibility test (girls)	37.78	37.67	0.1

Figure 1. 1st Grade (Spring) – 2nd Grade (Autumn) – Arithmetic mean (Spring – Autumn)

In the 2nd grade (spring) – 3rd grade (autumn), for the shoulder joint, there is still a negative evolution of -16.8% for the boys and -6.5% for the girls, according to table 1. In figure 2, we notice that the arithmetic mean of boys has dropped from 42.00 cm in the spring to 34.93 cm in the autumn, which indicates a regression of 7.07 cm, while the girls have recorded 44.83 cm in the spring and reached 41.92 cm in the autumn, showing a difference of only 2.92 cm.

In the 2nd grade (spring) – 3rd grade (autumn), both the boys and the girls had a statistically insignificant evolution between the two tests as regards hip flexibility, represented by a slight increase in the median, for the boys, from -5.50 cm in the spring to -3.50 cm in the autumn (+36.4%), and a slight decrease, from 0.00 cm in the spring to -1.00 cm in the autumn, for the girls, according to table 1.

The 2nd graders (spring) – 3rd graders (autumn) had a statistically insignificant evolution between the two tests for ankle flexibility. Figure 2 shows a slight decrease in the arithmetic mean, in the case of boys, from 50.21 cm in the spring to 47.00 cm in the autumn (-6.4%), and a slight increase, from 40.83 cm in the spring to 41.08 cm in the autumn (+0.6%), in the case of girls, according to table 1.

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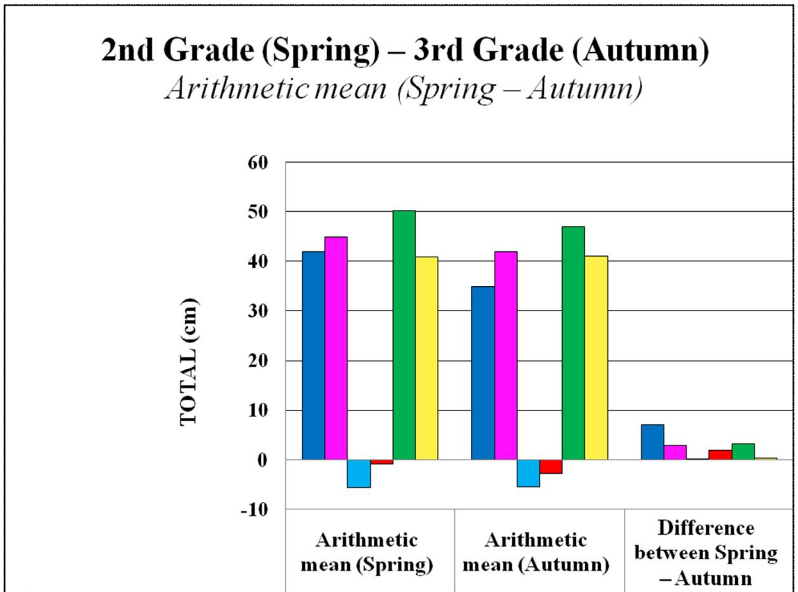


	Arithmetic mean (Spring)	Arithmetic mean (Autumn)	Difference between Spring – Autumn
Shoulder flexibility test (boys)	42	34.93	7.07
Shoulder flexibility test (girls)	44.83	41.92	2.92
Hip flexibility test (boys)	-5.64	-5.43	0.21
Hip flexibility test (girls)	-0.83	-2.75	1.92
Ankle flexibility test (boys)	50.21	47	3.21
Ankle flexibility test (girls)	40.83	41.08	0.25

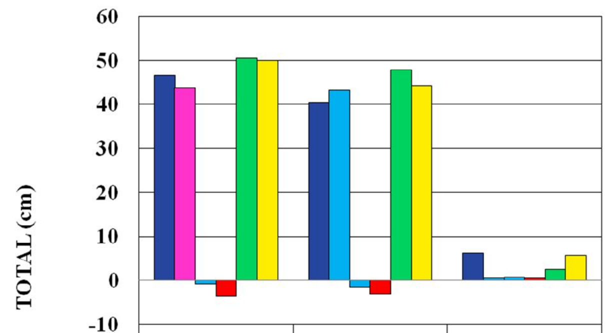
Figure 2. 2nd Grade (Spring) – 3rd Grade (Autumn) – Arithmetic mean (Spring – Autumn)

In table 1, we notice that, in the 3rd grade (spring) – 4th grade (autumn), for the shoulder joint, there is still a negative evolution in both genders, from -13.3% in the case of boys to -1.1% in the case of girls. In figure 3, it can be seen a decrease in the arithmetic mean of boys, from 46.60 cm in the spring to 40.40 cm in the autumn, which indicates a regression of 6.20 cm, while the girls have recorded 43.80 cm in the spring and reached 43.30 cm in the autumn, which indicates a regression of only 0.50 cm.

In the 3rd grade (spring) – 4th grade (autumn), both the boys and the girls recorded an increase in the median between the two tests as regards hip flexibility. In the case of boys, from 0.00 cm in the spring, it increased to 1.00 cm in the autumn, and in the case of girls, from -8.00 cm in the spring, it increased to -4.50 cm in the autumn, according to table 1.

Male pupils in the 3rd grade (spring) – 4th grade (autumn) had a slight decline in this test for ankle flexibility. Figure 3 shows a decrease in the arithmetic mean from 50.40 cm in the spring to 47.80 cm in the autumn, which means a difference of 5.2%, according to table 1. The girls recorded a decrease between the two tests as regards the arithmetic mean, from 50.00 cm in the spring to 44.30 cm in the autumn, with a difference of 11.4%, according to table 1.

3rd Grade (Spring) – 4th Grade (Autumn)
Arithmetic mean (Spring – Autumn)



	Arithmetic mean (Spring)	Arithmetic mean (Autumn)	Difference between Spring – Autumn
Shoulder flexibility test (boys)	46.6	40.4	6.2
Shoulder flexibility test (girls)	43.8	43.3	0.5
Hip flexibility test (boys)	-0.8	-1.6	0.8
Hip flexibility test (girls)	-3.6	-3.1	0.5
Ankle flexibility test (boys)	50.4	47.8	2.6
Ankle flexibility test (girls)	50	44.3	5.7

Figure 3. 3rd Grade (Spring) – 4th Grade (Autumn) – Arithmetic mean (Spring – Autumn)

Discussion

After analysing the relationship between initial testing (spring) and final testing (autumn), we notice that most of the results have negative trends but with insignificant differences, from the statistical point of view. Significant differences but in regression are found for the shoulder in male subjects in the 1st-2nd grade and 2nd-3rd grade.

The only positive trends are recorded for the coxofemoral joint and, surprisingly, in the groups of boys, the girls recording such an evolution only in the 3rd-4th grade.

Overall analysis of the data reveals that the subjects' mobility has recorded changes, but they were small and statistically insignificant. However, because most of them show regression values, we can assert that they might have been caused by the lack of guidance in motor activities.

If we relate to the literature data regarding the ontogenetic period of maximal influence on joint mobility (Manno, 1992; Jastrejevskaya**,** 1995), we can consider that the lack of motor activities, even at this age of maximal sensitivity for the development of mobility, can lead to negative trends in the range of motion, which will be more difficult to recover in the subsequent periods of growth and development. Joint limitations may increase energy consumption in the muscles and hinder the acquisition of motor skills (http://prevost.pascal.free.fr/public/pdf/Souplesse.pdf).

Thus, we can state that the lack of movement in primary school children during the summer holiday is not beneficial for the evolution of mobility. From the result analysis, we can assert that mobility in the three joints has recorded stagnation.

Conclusions

We believe that the positive evolution of joint mobility values is directly dependent on the specialized practical and methodical intervention.

We find that, in school physical education, the motor ability "mobility/suppleness" is not given the importance it deserves, and the lack of exercise may lead in the future to inconveniences and rigidity in the manifestation of movement ability.

The research results, based on the statistical calculations performed, support our hypothesis that the lack of guidance in motor activities can lead to stagnation in the evolution of joint mobility indices.

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