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## Study about the Evolution of Joint Mobility in Pupils at the Primary School Level

Alexandru-Florin Ciocoi<sup>a\*</sup>, Sabina Macovei<sup>a</sup>

\* Corresponding author: Alexandru-Florin Ciocoi, alex.ciocoi90@gmail.com

<sup>a</sup>National University of Physical Education and Sports, 140 Constantin Noica Street, Bucharest, Romania

### Abstract

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The role of physical education is to act in order to increase the manifestation of motor ability indices among pupils. For this reason, the development of joint mobility in young pupils has a particular importance, by its limiting effects on the adjustments and designation of the movement easiness characterizing the ability of an element to move. The purpose of this paper was to make a diagnosis of the range of motion for the main joints, which included measurements of mobility in the scapular-humeral, coxofemoral and talocrural joints, in primary school pupils from Middle School No. 192. To achieve the intended purpose, it was initiated a comparative study conducted between December 2014 and January 2015, during 14 lessons (according to school schedule and curriculum). The subjects were 80 pupils from 1<sup>st</sup> to 4<sup>th</sup> grades, participants in the physical education and sports lesson. It was created a group of schoolboys and also a group of schoolgirls for each grade of the primary education, in total 4 groups of 10 schoolboys each and 4 groups of 10 schoolgirls each. Results were obtained using tests for the mobility or flexibility assessment, according to Brian Mackenzie, and through the statistical method, we calculated the arithmetic mean. Analysis of the results provides objective information about the level of mobility development in the subjects tested throughout their evolution.

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**Keywords:** Joint mobility; evolution; primary school level.

### 1. Introduction

Primary education represents a defining stage in building the child's personality, under the perspective of his/her subsequent becoming and social-cultural integration (Golu, 2010: 156).

Physical education is assigned the role of harmonizing and creating a balance between intellectual and psychomotor demands, in order to ensure physical development and movement ability of the pupils (*Programa școlară pentru educație fizică - clasa pregătitoare, clasa I și clasa a II-a*, 2013).



School environment provides the child aged 6 to 10/11 years opportunities of social integration, with large resonances on the biological and psychological planes, accumulations being facilitated by the growth and development particularities at these ages (Dragnea & Bota, 1999: 136; Golu, 2010: 14).

Motor conducts acquired in the first school years mainly aim to lay the basis of general motricity, a fundamental aspect for ensuring the individual's adaptation to complex life situations. The level of motricity development is expressed by the child's motor ability, through stable components that make reference to aptitudes, skills, motor qualities, knowledge, experiences, and state-related components regarding motivational, affective, volitional aspects (Dragnea & Bota, 1999: 41).

In the physical education lesson, one of the main objectives is the development of motor qualities, simultaneously with the formation of motor abilities and skills (Grigore & Dințică, 2010: 5), and one of the motor qualities that can be fully developed at this age level is the joint mobility (Manno, 1992: 167). We agree to this view, although data from specialized literature place the maximal influence towards older ages, after 10 years old (Famose & Durand, 1988: 103; Weineck, 1994: 254). In this regard, we underline the information provided by the field of rhythmic gymnastics, where the joint mobility is essential for practicing this discipline. Authors such as Jastrejevskaya (1995: 539) consider that the optimal age is 6 to 13 years, asserting that, after this period, accumulations may suddenly decrease if there are not taken the necessary steps to maintain the training state.

In specialized literature, descriptions referring to the evolution of different motor qualities at these ages mention the qualitative improvements in muscle contraction and motor control, reflected by the manifestations of strength, speed and motor coordination (Epuran & Stănescu, 2010: 190; Dragnea & Bota, 1999: 136). We notice however the lack of references about the manifestation of mobility.

The scarce information about the joint mobility, as compared to the extremely great number of research studies about the other motor qualities, is also highlighted by several authors (Macovei, 1999: 8; Knudson, Magnusson, & McHugh, 2000).

There are papers approaching the joint mobility manifestation in relation with different stretching techniques, but they are usually addressed to adult persons and performance athletes (Feland, Myrer, & Merrill, 2001; Schuback, Hooper, & Salisbury, 2004; Yuktasir & Kaya, 2009; Puentedura et al., 2011).

For the age level from 6 to 10 years, the authors' interest was focused on the girl athletes too, the joint mobility implications being decisive for certain sports disciplines (Bitang, 2008).

Some data referring to the joint mobility can be found in studies on the biomotor potential of pupils, but the latest one was achieved in 1992 (Paraschiv & Sintie, 1992: 101-112).

In the context of the above-mentioned aspects, we have in view that mobility should be permanently developed, particularly at those ages where the muscle and ligament structures show increased plasticity. In the young pupil, performing range of motions in various joints is conditioned by the low level of muscle tone and muscle mass, which leads us to take into consideration these issues, too (Dragnea & Bota, 1999: 136-138; Cârstea, 1993: 64).

### *1.1. Purpose*

The purpose of this paper is to make a diagnosis regarding the joint mobility values in the young pupil and their evolution according to the subjects' age and gender.

This study represents the beginning of a longitudinal research, which aims to establish some coordinates in the evolution of indices related to joint mobility and also the methods suitable to its development in pupils at the primary education level.

## **2. Materials and methods**

The research was conducted in the period from December 2014 to January 2015, within Middle School No. 192.

The subjects were 80 pupils from 1<sup>st</sup> to 4<sup>th</sup> grades, participants in the physical education and sports lesson. It was created a group of schoolboys and also a group of schoolgirls for each grade of the primary education, in total 4 groups of 10 schoolboys each and 4 groups of 10 schoolgirls each.

To achieve this study, the following methods were used: theoretical documentation, observation, testing method, statistical method and graphical representation method.

The subjects' mobility/flexibility was investigated at the level of scapular-humeral, coxofemoral and talocrural joints. The applied tests were: shoulder and wrist flexibility test (Mackenzie, 2005: 85), hip flexibility test (Mackenzie, 2005: 81) and ankle flexibility test (Mackenzie, 2005: 79).

Shoulder and wrist flexibility test: from prone position, with forehead on the floor and arms extended upwards, holding the gym stick at the shoulder width. The subject must raise the stick as high as possible, keeping the forehead on the floor during testing. It is measured the vertical distance between floor and stick. Required resources: gym stick and measuring tape.

Hip flexibility test: from sit on the floor position, with arms close to the body. The subject must lean the trunk forward without knee flexion, trying to reach tiptoes with the fingers, while keeping the chin to chest. It is measured the distance between fingertips and tiptoes. Values are negative if tiptoes are not reached, and become positive if their level is exceeded in depth. Required resources: gym bench and measuring tape.

Ankle flexibility test: from stand position facing a wall, with arms raised up, the entire body touching the wall. The subject must slowly slide the feet back from the wall as far as possible, keeping the chest in contact with the wall and the feet flat on the floor. It is measured the distance between wall and the toe line. Required resources: non-slippery floor, stable wall and measuring tape.

We have opted for these tests because they are easy to use in the physical education lesson, and measurement is unitary, in centimetres.

## **3. Results**

The results, which have been assessed in their evolution at the classroom level, show increased values for all joints, in both genders. Generally speaking, the statistical indicators presented in Table 1 reveal minor differences between male and female subjects, but the girls, as expected, have slightly better values. For the shoulder and ankle joints, there have been found improvements since the 1<sup>st</sup> grade towards the 2<sup>nd</sup> and 3<sup>rd</sup> grades, and a slight decrease in the 4<sup>th</sup> grade pupils.

Table 1. General results for flexibility evolution in the 1<sup>st</sup> to 4<sup>th</sup> grade pupils

Item no.	SCHOOLBOYS			SCHOOLGIRLS				
	Grade	Shoulder flexibility	Hip flexibility	Ankle flexibility	Grade	Shoulder flexibility	Hip flexibility	Ankle flexibility
Arithmetic mean	1 <sup>st</sup> grade	34.5	-13.85	38.7	1 <sup>st</sup> grade	31.75	-5	39.55
	2 <sup>nd</sup> grade	39.35	-7.65	46.8	2 <sup>nd</sup> grade	42.5	-3.05	40.65
	3 <sup>rd</sup> grade	45.7	-2.65	50.7	3 <sup>rd</sup> grade	41.4	-4	49.6
	4 <sup>th</sup> grade	39.7	-5.3	47.5	4 <sup>th</sup> grade	45.5	2.7	48.4
Arithmetic mean	39.812	-7.362	45.925	Arithmetic mean	40.287	-2.334	44.55	
Standard deviation	4.586	4.783	5.107	Standard deviation	5.949	3.451	5.181	
Coefficient of variation	11.520	-64.964	11.120	Coefficient of variation	14.767	-147.654	11.630	

Analysis of the results achieved by the 1<sup>st</sup> grade pupils shows that boys have better values than girls for the shoulder joint and approximately identical values for the ankles. But at the hip level, boys have modest results (-13.85), with a difference of 8.85 in favour of the girls, which indicates that the mobility development has not been stressed at this level.

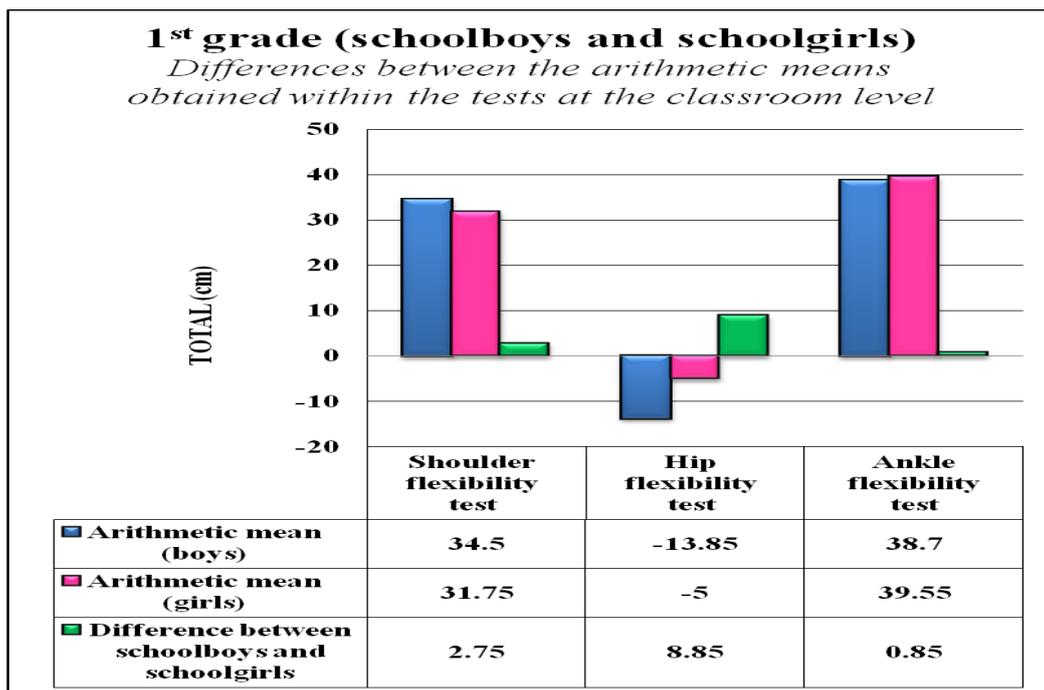


Fig. 1. Differences between the arithmetic means obtained at tests by the 1<sup>st</sup> grade pupils

In the 2<sup>nd</sup> grade, for the hip joint, the previously commented trend existing in the case of 1<sup>st</sup> grade pupils is still maintained. Figure 2 shows that, for the ankle joint, boys have a plus of 6.15 cm (46.8 cm) compared to the girls (40.65 cm), however the girls exceed the boys at the shoulder level by 3.15 cm (39.35 cm boys and 42.5 cm girls). For the hip, values have improved and got closer, but there is still a difference of 4.6 cm.

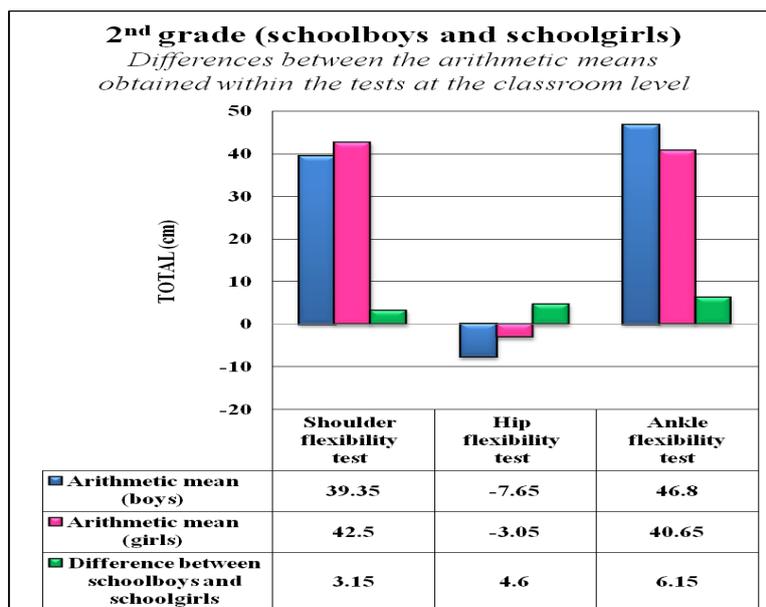


Fig. 2. Differences between the arithmetic means obtained at tests by the 2<sup>nd</sup> grade pupils

In Figure 3, for the indices achieved by the 3<sup>rd</sup> grade pupils, it is noted an increase for both groups of subjects, as well as closer mean values, with differences of 4.3 in favour of the boys for the shoulder joint and 1.1 cm for the ankle. As to the hip, it is recorded the smallest difference between boys and girls from all classrooms (1.35 cm).

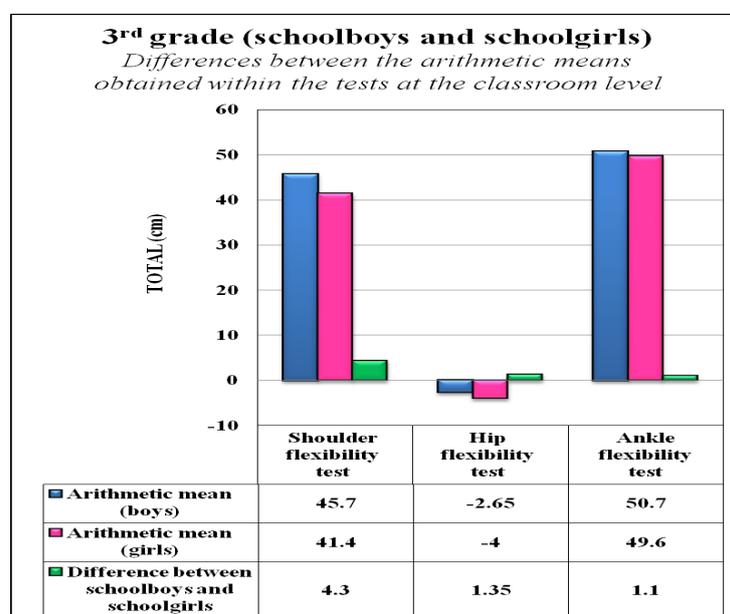


Fig. 3. Differences between the arithmetic means obtained at tests by the 3<sup>rd</sup> grade pupils

Gender-related differences in the 4<sup>th</sup> grade pupils show that girls have better results for all joints and there are noticed, for the first time, positive values in the hip joint (Fig. 4).

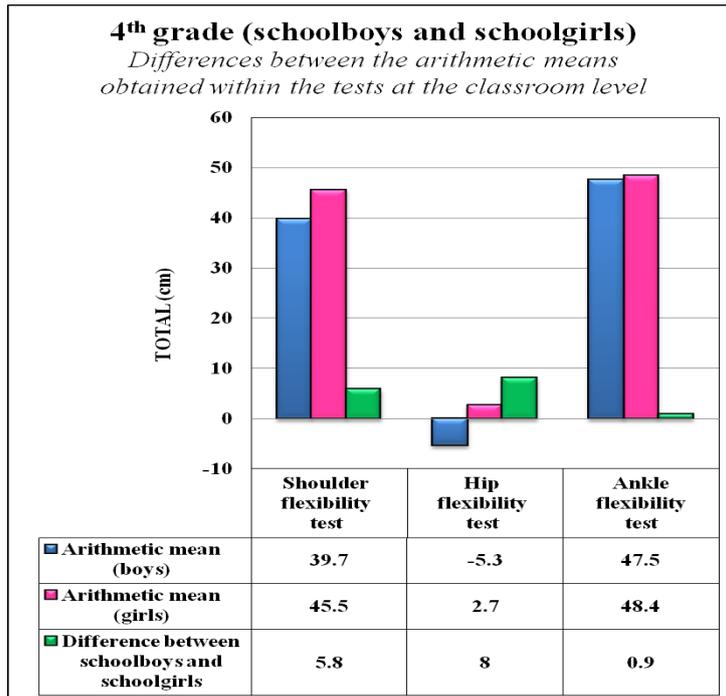


Fig. 4. Differences between the arithmetic means obtained at tests by the 4<sup>th</sup> grade pupils

#### 4. Discussions and conclusions

The mean values identified for each class of pupils, as well as the overall mean of tests for each joint, shown in Table 1, can be considered a current profile of the group of subjects. Driven by the desire to relate to the literature data, in order to see where these values are placed, we underline that we have not found scales for this age level. The reason also resides in the test typology.

But we can make references to some normative data regarding the shoulder flexibility test, recommended by Mackenzie (2005: 86). Although these ones are established for older pupils, we find out that our subjects - mean 39.81 cm boys and 40.28 cm girls - fall within the “exceptional” category (standard data for “exceptional” >31.8 cm boys and >29.8 cm girls). We estimate that the results could be associated to our introductory discussions, where we highlight that the mobility values decrease with age if not maintained through constant interventions.

For the ankle joint, normative data recommended by the same author (Mackenzie, 2005: 79) frame our groups of subjects within the “poor” level. But we consider that this situation is due to the differences in height between younger pupils and older pupils, the way of achieving the measurement being influenced by the tested subject’s height. Under this aspect, we estimate that the flexion angle measurement would be more objective.

As regards the differences noticed between female and male subjects, we emphasize the girls’ permanently better level in the hip joint mobility. We consider that this situation might also be due to their concerns for gymnastics and dance activities, unlike the boys, who are mainly oriented towards exercises that do not exert their mobility at this level. Relating to the scales identified in literature, we

find out that the values obtained by our subjects are rated “satisfactory” and only the 4<sup>th</sup> grade girls can be rated “good” (Tudor, 2013: 155).

The obtained results provide objective data about the mobility development level in the tested subjects and the evolution graph for each grade of primary education.

We think that the evolution of values depends on the growth and development particularities of young pupils, but also on the pedagogical intervention during the motor activities in which they are involved.

The study results generally depict the particularity of the joint mobility manifestation at the primary level within Middle School No. 192. By the achieved diagnosis, it has been created a database that will be used in our further research. We refer to the fact that, at the subsequent testing, we shall have available reference data to which we can relate.

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