The European Proceedings of
Social & Behavioural Sciences
EpSBS

eISSN: 2357-1330

WLC 2016 : World LUMEN Congress. Logos Universality Mentality Education Novelty 2016 | LUMEN 15th Anniversary Edition

Comparative Analysis of the Biological and Motor Potential of School Population from Romania (Urban and Rural Areas)

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Abstract

http://dx.doi.org/10.15405/epsbs.2016.09.115

The population health state is conditioned by the biological and motor potential of the individuals. It is one of reason for what we indentified a permanent interest on the assessment of somatic, functional and motor human potential. The relation between the individual development and the environment influence, represents an important topic for many studies, among these the analysis on life environment influence it was noted.

The accepted opinion is that children development is influenced by many internal and external factors, biological and social, and the specialty literature emphasize a tendency of decrease of children motor capacity in the same time with the overweight tendency. All these aspects have major social and economical implications at national level.

This paper presents the results obtained under the national project *Evaluation of somatic, functional and motor potential of the school population from Romania* (2011 - 2012, MECTS, UNEFS), a research that sought to identify the bio-motor characteristics of students from Ist, Vth, IXth and XIIth grades. From the analysis of the data collected at national level, we can confirm that children biological and motor potential is influenced by life environment, and that between children from urban and rural environments there are significant differences on biological and motor development, on certain aspects.

Keywords: Biological development; motor development; environment; physical education; health; children.

1 Introduction

As a component of the life quality, the population health state is conditioned by the biological and motor resources of the individuals. This aspect determined a permanent interest on the somatic, functional and motor assessment of human potential. The relation between individual development and the influence of the environment is an important topic for many studies, and in particular for the analysis on living environment influence.

Over time more study directions linked with our reseach were identified. One of them concerns the influence of the environment or of the living conditions on individual development. (Wolanski, 1981; Farmosi et. al., 1986; Szabo et. al., 2013)

Constant interest was shown for the study of the influence of different biological and social factors on children development (Wolanski, 1981; Farmosi et. al., 1986), and a decreasing trend in the motor capacity of children (Mei et. al., 2002). The child and adolescent obesity represents another important topic (Must & Strauss, 1999; Deckelbaum & Williams, 2001; Flodmark et. al., 2004). Changes in body weight is actually another important indicator of health status, and there is a higher risk of a child becoming obese in adulthood if the parents are suffering from the same condition. The literature shows the link between downward trend in the motor capacity of students coupled with a tendency to become overweight, both trends having major social and economic implications for a nation.

There is also an increasing incidence of obesity found in children and adolescents in Europe (Flodmark et. al., 2004), in the USA (Ogden et. al., 2002) and in less developed countries (Ebbeling et. al., 2002). In this context, body mass index is an effective tool in identifying children at risk of obesity with age (Guo et. al., 1994; Mei et. al., 2002; Kuczmarski et. al., 2002).

These research directions were accompanied by those regarding the population evolution (Jørgensen et. al., Cazorla, 1989; Soppelsa & Albaret, 2005) (from anthropometric, functional or motor capacity perspectives), assessed with different instruments (as Eurofit, 1983, for motor capacity).

1.1. Biomotor potential of Romanian school population

In Romania there has been a constant interest concerning the evaluation of the biomotor potential of the school population. Identifying the level of the biomotor potential of the school population in Romania appeared at the initiative of a team led by professors Alexe N. and V. Mazilu and having as effect the modification and updating of the school curricula, designing attitudes and practices concerning the evaluation or outlining some views on education sports activities.

Investigations have been conducted since the 70s, then 80s and 90s. (Mazilu et. al., 1972; Nicu et. al., 1994; Nicu, 1982-1983) In this sense were applied batteries of tests, the content of which was thoroughly considered in time by evaluation systems: the Unique System of Verification and Assessment of the level of fitness and sport training of students (1970), the Unique System of Verification and Assessment of the level of fitness of students and detection of talent for sport performance (1986), the National School System of Assessment at Physical Education and Sport (SNSE, 1999).

We have seen that Romanian specialists have shown a constant interest for the assessment of the biomotor potential, underlined by their concern of identifying the most appropriate instruments, and by

http://dx.doi.org/10.15405/epsbs.2016.09.115
eISSN: 2357-1330 / Corresponding Author: Monica Stănescu
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periodic assessments aimed at capturing the evolution in time of this potential of the Romanian population. The first edition took place between 1969 - 1972, the second between 1981 - 1984, and the third between 1989 - 1994.

One of the defining particularities of the three evaluations regards the way in which parameters are recorded, by gathering information at relatively equal periods of time and from the same geographical areas. A battery of tests was used to assess the potential; it included 10 motor tests (jump vertically without countermovement, throwing the oina ball, speed, overall skills, frontal plane mobility, trunk lift lying back, face down trunk extension, tractions, pushups and running duration) and 5 anthropometric measurements (size, weight, bust, chest perimeter in inspiration and expiration).

From the above mentioned tests used in the three previous editions, six are found in the 2012 evaluation developed within project *The evaluation of somatic, functional and motor potential of school population from Romania* (coordinators: Ministry of National Education - MEN, National University of Physical Education and Sports - UNEFS, 2012). During the time we presented a series of partial results of this project. (Stănescu et. al., 2015; Cojocaru et. al., 2015; Cojocaru et. al., 2015; Stănescu et. al., 2015)

The results obtained in our research were linked to the six measurements whose averages and differences significance (at p=0,05) are given below. The paper presents the analysis of data obtained by 3865 physical education teachers, from 31 counties (from all over the country) who applied the assessment tests.

2 Research Methodology

2.1. Hypothesis

The results of the biomotor measurements might highlight the significant differences between students in urban and in rural areas, due to the specifice living conditions from these environments.

2.2 Objectives

The specific aims of our research were the following:

- presenting a clear picture of the relationship between the parameters evaluated in urban areas with those in rural areas;
- identifying the evolution of the somatic, functional and motor potential of students levels based on assessments made in previous years.

2.3 Methods

The assessment period was the school year 2011 – 2012. Transmission of the data to the coordinator (UNEFS) was realised during the school year 2012 – 2013. To assess the biomotor potential we used a battery of tests that included anthropometric measurement (height, weight), a functional one (Ruffier test) and 5 motor tests (shuttle race, pushups, throwing the oina ball, trunk lift lying back, face down trunk extension). Data were organized, centralized and processed using statistical functions of

Microsoft Office Excel (version 2013) (average, variability, differences significance – T-test). Graphs were made with the same tool.

The information was analyzed by reporting the results from urban to rural areas, to the average values obtained in previous national studies and to the actual National System of Evaluation for Physical Education and Sport (SNSE). The comparative analysis with results from previous editions of national assessments was performed only for similar tests.

2.4 Research group

As it can be seen in table 1, a total number of 50827 boys (M) from urban areas, 22617 boys (M) from rural areas, 50224 girls (F) from urban areas and 21969 girls (F) from rural areas participated in this research. Most of the students comes from urban regions. The study involved only students in grades I, V, IX and XII.

Table 1. Students distribution by grades

Environment	Gender	Ist grade	Vth grade	IXth grade	XIIth grade
Urban	M	10760	10796	18257	11014
Urban	F	10188	10297	17650	12089
Rural	M	9096	11563	2422	669
Rural	F	8448	10916	1958	647

3 Results and Interpretation

Data analysis was performed on three components: somatic, functional and motor. In terms of *height* of the students, it is noteworthy that in all classes evaluated, students from the city are taller than those from rural areas. (graphs 1 and 2). Also, it is remarkable that the values recorded in the 2012 assessments are higher than those from previous years by 1 to 2 cm, which shows an increase in height of the Romanian population over the 4 decades and a half that have passed since the first edition of the evaluation.

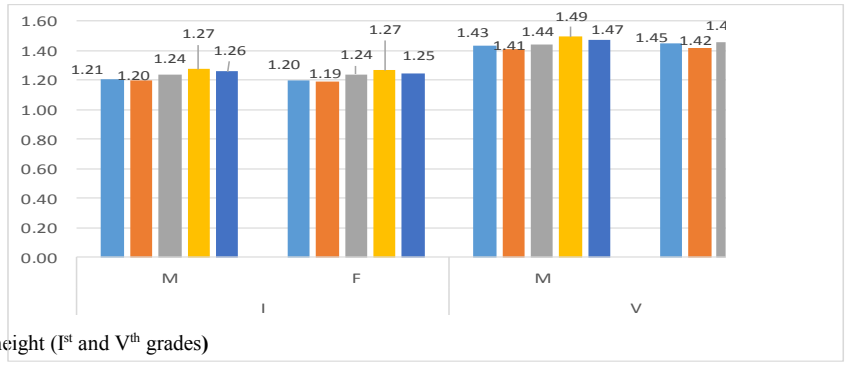

Fig. 1. The students' height (Ist and Vth grades)

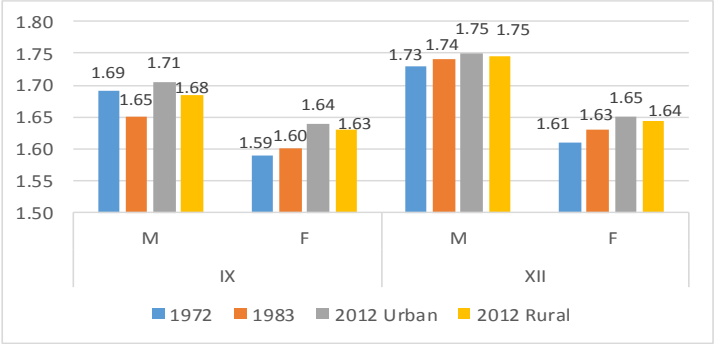

Fig. 2. The students' height (IXth and XIIth grades)

http://dx.doi.org/10.15405/epsbs.2016.09.115
eISSN: 2357-1330 / Corresponding Author: Monica Stănescu
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Mean values of te students' *weight*, measured in 2012, highlight the fact that people from the city are heavier than those from rural areas. (graphs 3 and 4) The biggest and significant differences are recorded between students in Vth grade, boys and girls alike, as it is apparent that students from rural areas exceed by about 2.7 kg their peers of the same age from rural areas. (graph 3) In other grades the differences are smaller, by about 1 kg or less. (graphs 3 and 4)

It is noteworthy, however, that rural students, in all grades, girls and boys, tend to have a weight that exceeds the national average from previous evaluation editions. This trend supports the findings related to the increasing trend manifested in relation to the height of the students.

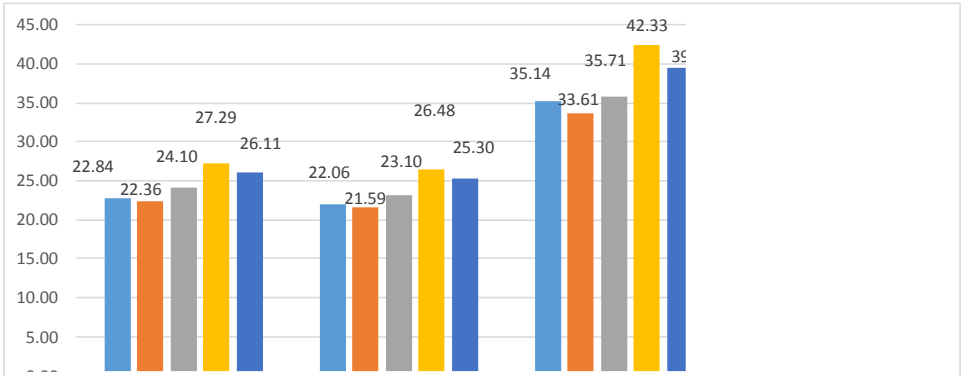

Fig. 3. Students' weight (Ist and Vth grades)

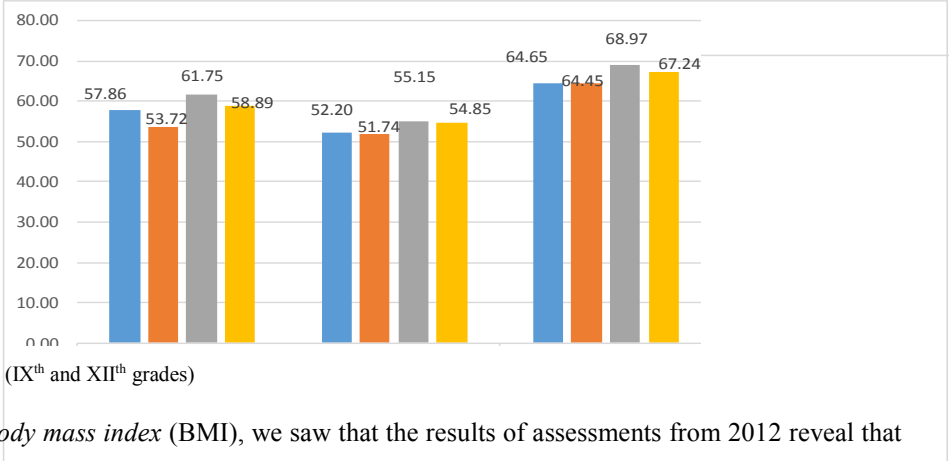

Fig. 4. Students' weight (IXth and XIIth grades)

Analyzing the *body mass index* (BMI), we saw that the results of assessments from 2012 reveal that urban boys show higher values of this index than those in rural areas. (graph 5)

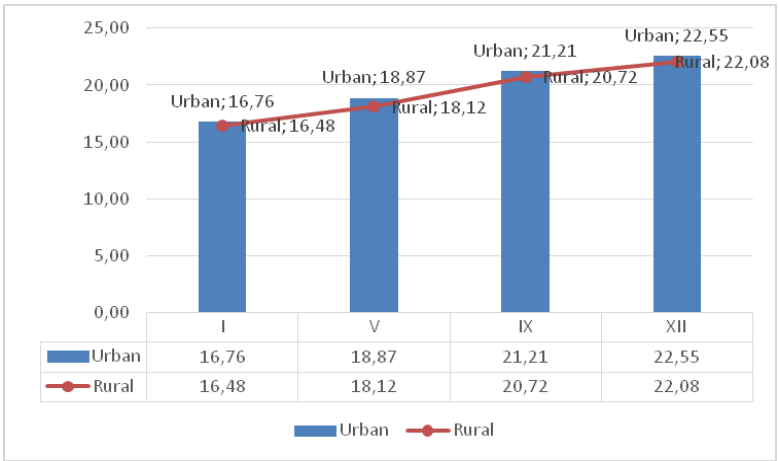

Fig. 5. BMI results (boys) 2012

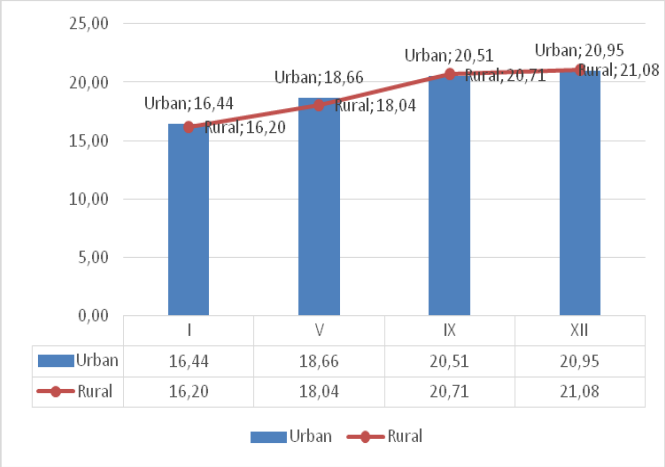

Fig. 6. BMI results (girls) 2012

Regarding girls in the high school grades analyzed, the body mass index in rural areas insignificantly exceeds the one registered in urban school girls. (graph 6) Regardless of gender, we noted that in all classes analyzed, the BMI values remain normal, with values <25 (threshold indicating the state of overweight).

Regarding the assessment of the *exercise capacity* of the body, by the Ruffier test, we noted an increase of values from one grade to another including the IXth grade, something that shows a decrease in the exercise capacity of students with age. (graphs 7 and 8)

In the XIIth grade, for girls and boys alike, there is a downward trend of the registered values, indicating a positive trend in the exercise capacity, both in urban and in rural areas. The average values, compared to the reference ones for this test, show an average level of physical capacity.

As a general trend, results in rural areas have lower values than those in urban areas, which indicates a better exercise capacity. For girls in the XIIth grade, the values resulting from the application of the Ruffier test shows slightly higher values than those in urban areas.

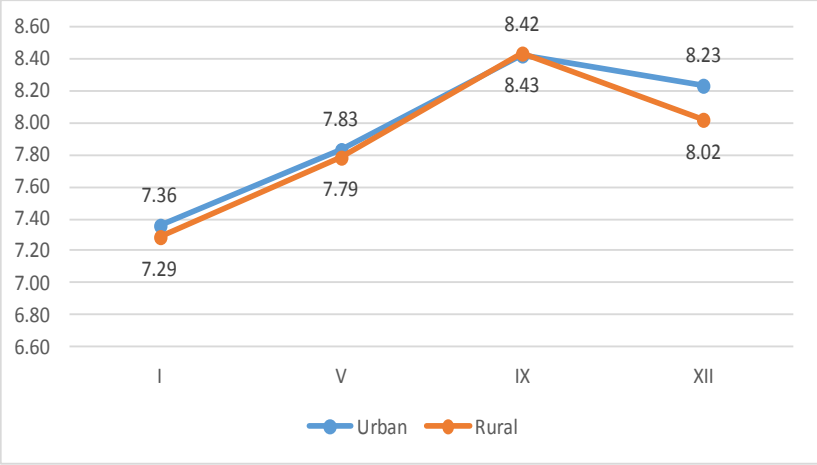

Fig. 7. Results of Ruffier test (boys), 2012

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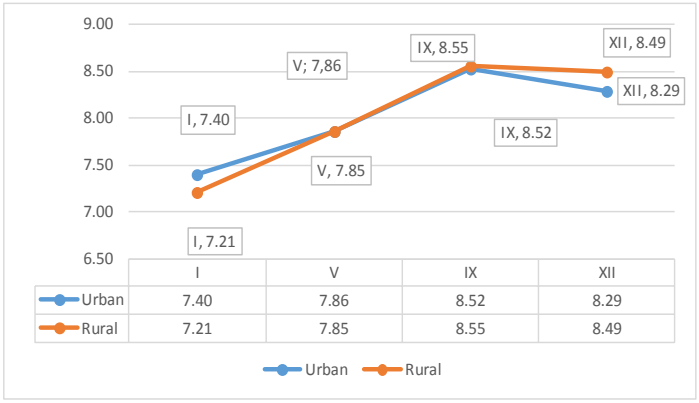

Fig. 8. Results of Ruffier test (girls), 2012

Regarding the samples for *motor functions*, the results are shown based on the skills assessed. For *speed*, the sprint shuttle test 10 x 5 m (V, IX, XII grades) / 5 x 5 m (Ist grade) we noted that the average values are higher in rural areas compared to urban areas. (graph 9 and 10) There is an exception in the XIIth grade, especially for boys, whose values are better than those of their peers from urban areas.

Although they have a better exercise capacity, the speed of rural students, aged between 7 and 15 years, is lower than the speed of urban students. Although the differences are in the range of about 50 hundredths, this trend is manifested for both girls and boys.

Fig. 9. Results at shuttle sprint (boys)(2012)

Fig. 10. Results at shuttle sprint (girls)(2012)

The biggest differences are registered relative to the provisions of the SNSE, in Ist grade. For this grade, we believe that it is necessary to review the scale for that grade.

Regarding *muscular strength*, the assessment tests targeted the strenth of upper limbs, torso and legs. For the arms muscular strength in endurance conditions, in Ist grade, the mean values calculated

for the 31 counties, indicate higher values in rural areas, both in girls and boys. In the Vth grade only, girls from urban areas had better results than those from rural areas, all other keeping the previous values. Also, we noted higher values than those in 1972 and 1992 and lower than in 1983, only in the Vth grade, for girls and boys alike (graph no. 11)

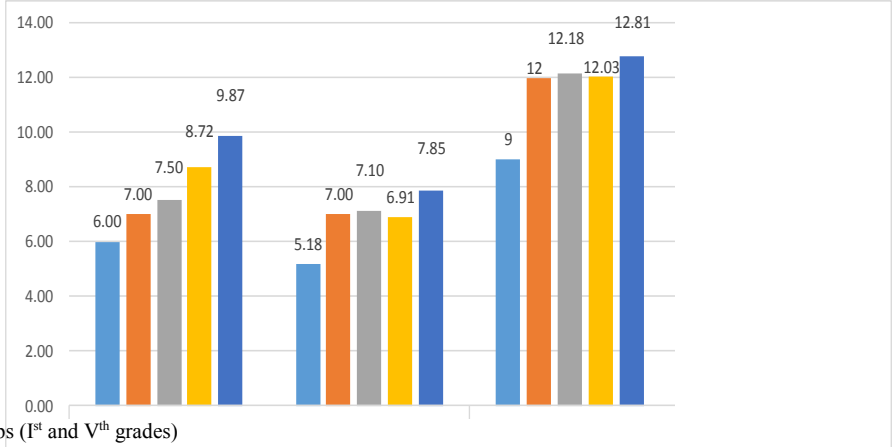

Fig. 11. Results at pushups (Ist and Vth grades)

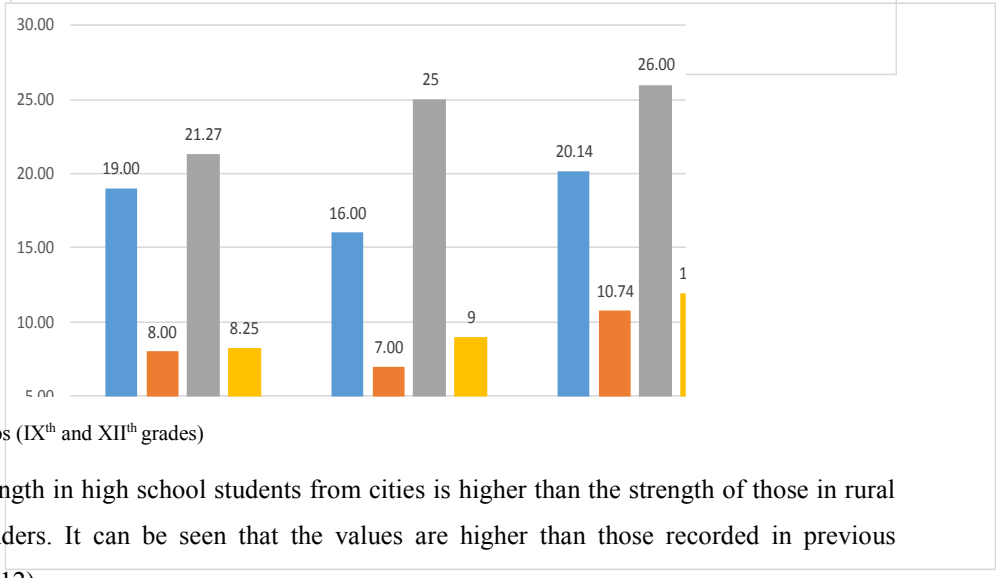

Fig. 12. Result at pushups (IXth and XIIth grades)

Arm muscle strength in high school students from cities is higher than the strength of those in rural areas, for both genders. It can be seen that the values are higher than those recorded in previous assessments (graph 12).

For the arms explosive strength, the rural environment shows superior values for both girls and boys, in all 4 grades recorded, at throwing the oina b all (with a significant differences of 3.26 m for the XIIth grade, boys) (graph 13 and 14). But the comparative analysis with previous studies regarding the throwing of oina ball shows a significant drop in values in the Ist and Vth grades, for the boys, and in Vth grade, for the girls. (graph 13) In high school, we have the same downward trend in strength for boys, while the values for girls are close to those of previous studies. (graph 14)

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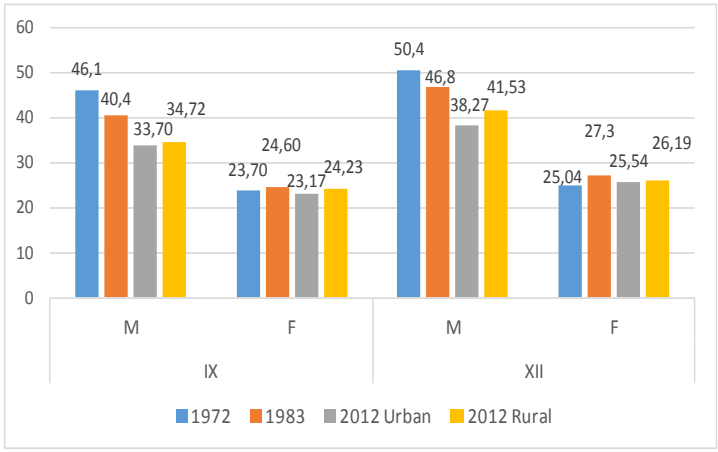

Fig. 13. Results at throwing the oina ball (I[st] and V[th] grade)

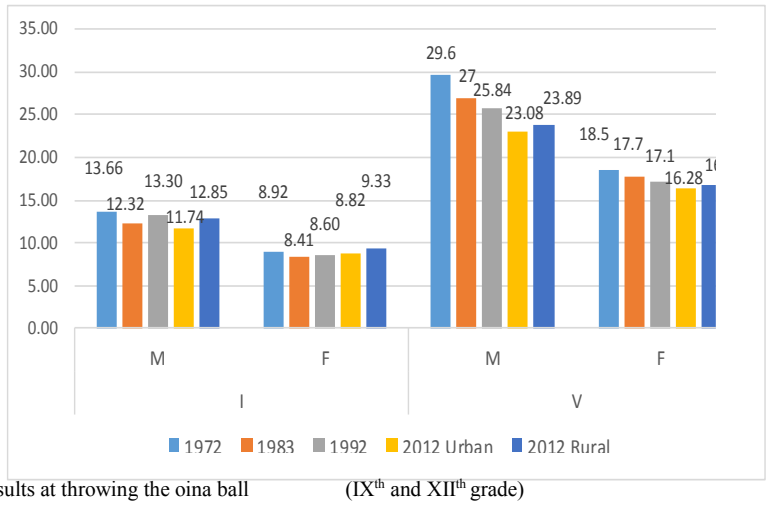

Fig. 14. Results at throwing the oina ball (IX[th] and XII[th] grade)

At the test relating to the *face down trunk extension,* we noticed that in urban areas were recorded higher values in all grades (graph 15 and 16). Students in primary and secondary education had higher significant results in the 2012 assessment, compared to all other previous assessments. (graph 15)

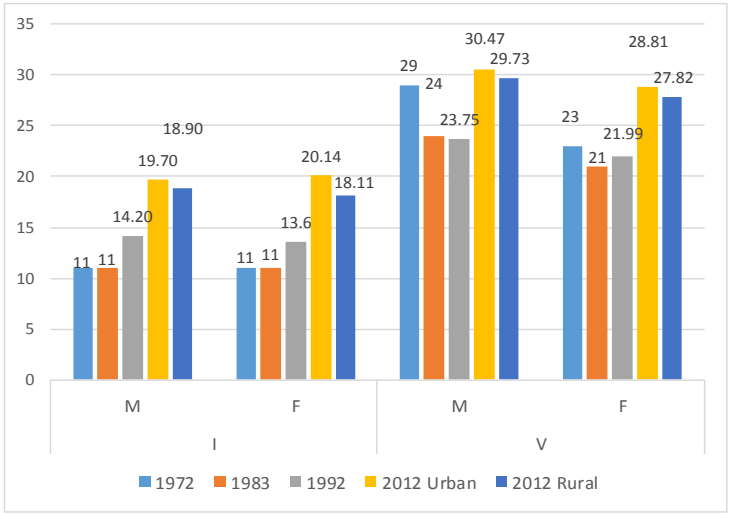

Fig. 15. Results at face down trunk extension (I[st] and V[th] grade)

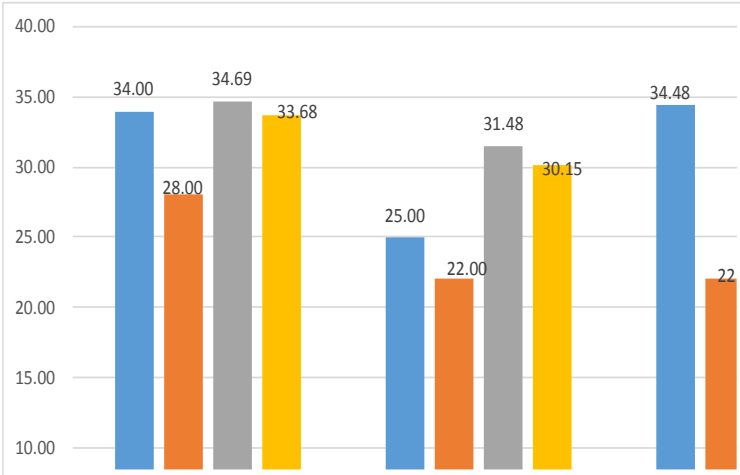

Fig. 16. Results at face down trunk extension (IXth and XIIth grade)

At high school, we identified the same trend as for the Ist and Vth grade, with differences of 4.08 repetitions in the XIIth grade, girls and 2.26 for boys. In IXth grade the differences are not significant (1.01 repetitions for boys and 1.33 repetitions for girls). (graph 16)

For the *trunk lift lying back test* we find the same trend in high schools, where we see higher values in previous assessments by up to 29 repetitions. (graph 18) The results are higher in urban areas, with the sole exception in IXth grade boys. (graph 18) The test highlights in the 2012 assessment lower values than those recorded in previous assessments. It is worth noting that there are considerable differences compared to the 1983 şi 1992 studies, in the Ist and Vth grades. This tendency indicates a clear drop in abdominal muscle strength. (graph 17)

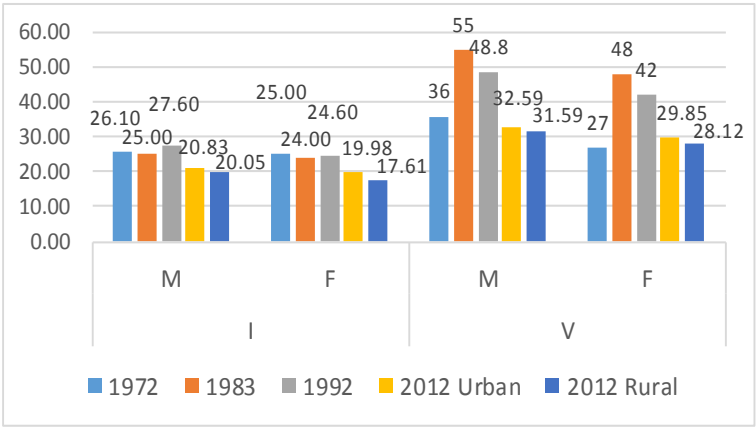

Fig. 17. Results at trunk lift lying back (Ist and Vth grade)

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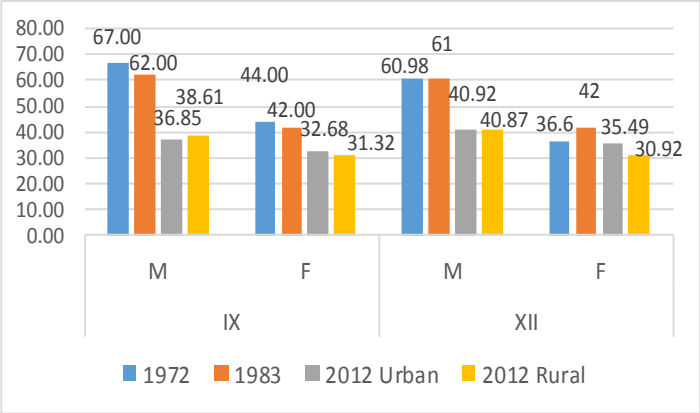

Fig. 18. Trunk lift lying back (IXth and XIIth grade)

On the motor tests it was noted that there is a high degree of variability in the results, allowing us to highlight that within each age group homogeneity is low.

4 Conclusions

From the point of view of students' height, synthetic means linked to the previous assessments indicate the trend of population growth in height. Students from the city are taller than those in rural areas. Meanwhile, the mean values of the weight highlight the fact that students from the city are heavier than those from rural areas. If the previous parameter is an indicator without a degree of concern, one with prospects for practice of sports performance, weight keeps the same rising trend, which requires special attention in order to maintain health.

The body mass index calculated still puts us in a position of normality in terms of values identified by reference to benchmarks. Urban boys show higher values than those from rural areas, and there is a continuous increase in this parameter from one educational cycle to another. Girls kept this trend only in grades I and V.

Regarding the Ruffier test, there is an increase in the recorded values from one grade to another up to the IXth grade including, something that highlights a decrease in the exercise capacity of students from one grade to another. The results from rural areas indicates a better exercise capacity for students in these areas.

After calculating the average speed test and reporting them to the evaluation system in place it was found that the values are better than those provided in the system, which requires adjustments on these rates. Comparative analysis of urban and rural areas, in the speed tests, show that the average values in both boys and girls are better in rural areas compared to urban areas, the ratio reversing only to XIIth grade for boys.

On the tests of force, contrary to the assumption that the motor values of children in rural areas are higher than in urban areas, the results refute that hypothesis. Analyzing the results from the rural and urban areas, we can say that the biomotor potential of the school population in Romania is influenced by the living conditions and social environment of students.

Of the evaluation tests analyzed, the only test that recorded values considerably higher than assessments from previous years is the one targeting the back muscles, namely, extensions of the trunk

lying face down. On the other tests there was a decrease in the average values. Therefore, the results indicate a decrease in the motor performance of students nationwide, in connection with records of previous studies and the evaluation system in place.

Given the above, we propose a number of amendments to the National System of School Assessment in Physical Education and Sport, considering the evolution of the motor capabilities of the students. These changes can lead to encouraging students to spend more time performing motor activities.

Designing assessment tools in line with the biomotor development aims to draw attention to the fact that physical education is an important determinant of health, and the lack of physical activity coupled with a sedentary lifestyle can damage the quality of life.

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