

Somato-Functional Profile of Children at Risk of Educational and Social Exclusion in Western Romania

Virgil TUDOR^{1*}, Florin PELIN², Gabriel Iulian GHITESCU³, Alina-Daniela MOANTA⁴, Vasilica GRIGORE⁵, Iozsef HIDI⁶, Ana-Maria MUJEA⁷, Daniel HARCAU⁸, Robert NOSAL⁹, Dinu ONITA¹⁰, Costinel Dorian VASILICA¹¹, Ionut Bogdan RADOI FULGA¹², Martian-Flavius LEPA¹³, Artur SCHVANER¹⁴, Dezideriu Bogdan STETZ¹⁵, Marius Leon MUTHI¹⁶

¹National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania, virgiltro@yahoo.com

* Corresponding author

²National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

³National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

⁴National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

Abstract: *This paper aims to identify the somatic and functional profile of middle-school students from three areas of Romania (South-West, West and North-West). A group of 364 students (173 girls and 191 boys) aged between 10 and 16 years (12.75 ± 1.2) from 6 different schools in Mehedinti, Caras-Severin and Bistrita-Nasaud counties took part in this study. The target group category includes Roma ethnic students, students from disorganised families and students at high risk of early school dropout, from both urban and rural areas. The calculated statistical indicators were: arithmetic mean, standard deviation, coefficient of variation and Pearson coefficient. The anthropometric measurements made to identify the somatic and functional profile of students were height, weight, BMI, arm span and Ruffier test. The results show an upward trend in the height of boys aged between 10 (1.44 m) and 16 years (1.67 m), the maximum value recorded for girls aged 14 years being 1.59 m. The highest value of body weight was identified in boys aged 15 years (58.91 kg) and girls aged 14 years (52.63 kg). The highest value for arm span was found for 15-years-old boys (167 cm) and 14-years-old girls (158.83 cm). BMI values for both boys and girls were between 17.22 and 21.52 points. In Ruffier test, the scores obtained by students ranged between 9.95 and 13.4. This research is part of the "Sustainable social and education integration through sport activities" project (PNP001).*

Keywords: *physical development; assessment; development region; Romania.*

How to cite: Tudor, V., Pelin, F., Ghitescu, G. I., Moanta, A. -D., Grigore, V., Hidi, I., Mujea, A. -M., Harcau, D., Nosa, R., Onita, D., Vasilica, C. D., Radoi Fulga, I. B., Lepa, M. -F., Schvaner, A., Stetz, D. B., & Muthi, M. L. (2020). Somato-Functional Profile of Children at Risk of Educational and Social Exclusion in Western Romania. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, 11(4Sup1), 200-222. <https://doi.org/10.18662/brain/11.4Sup1/165>

⁵ National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

⁶ National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

⁷ National University of Physical Education and Sports, Faculty of Physical Education and Sport, Bucharest, Romania

⁸ Mehedinti County School Inspectorate, Romania

⁹ Caras-Severin County School Inspectorate, Romania

¹⁰ Bistrita-Nasaud County School Inspectorate, Romania

¹¹ Floresti Middle School, Mehedinti, Romania

¹² Hinova Middle School, Mehedinti, Romania

¹³ “Romulus Ladea” Middle School, Oravita, Caras-Severin, Romania

¹⁴ Middle School no. 8, Resita, Caras-Severin, Romania

¹⁵ “Mihai Eminescu” Middle School, Nasaud, Bistrita-Nasaud, Romania

¹⁶ “Nicolae Draganu” Middle School, Zagra, Bistrita-Nasaud, Romania

Introduction

In the contemporary era, educational and social exclusion has become a topic of interest, which attracts the attention of many specialists from all over the world.

Tarabini, Jacovkis and Montes (2017) mention that the processes of educational exclusion are multiple and diverse. Research has shown that exclusion from school goes far beyond access. It is associated with crucial issues related to educational processes (belonging, recognition or representation) and outcomes (knowledge or certificates).

Educational exclusion can lead to absenteeism and later to school dropout, which is inevitably conducting to social exclusion.

Social exclusion is a complex and multifaceted process that “involves the lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in a society” (Levitas et al., 2007, p. 9).

Social exclusion entails “inadequate social participation, lack of social integration and lack of power” (Room, 1995, p. 5).

In Romania, children at risk of educational and social exclusion have started being part of national programmes aimed to integrate them both educationally and socially. Numerous publications indicate that vulnerable young people are increasingly monitored (Coussée et al., 2009). In order to assess them as accurately as possible, researchers in social sciences generally use several indicators such as socioeconomic status or family influence (Batista-Foguet et al., 2004). However, the reflection of socioeconomic inequalities in adolescent health has been little studied until recently, partially due to the lack of appropriate measures (Currie et al., 2008).

One of the most delicate periods in ontogenesis, during which the social exclusion phenomenon is susceptible to appear, is adolescence. Adolescence is thought to be a period of changes and challenges, which has an influence on behaviour control, psychological orientation and social interaction (Due et al., 2005). Specialists mention that negative social interactions may have effects on adolescent health in this period (Due et al., 1999).

Marmot (2005) and Berry et al. (2010) have identified that people at risk of social exclusion face inadequate access to food, housing and other basic resources, as well as adversity from other people, which culminates in poor health. The aforementioned specialists state that these people are often in a downward spiral.

In contrast, Bambra, Netuveli and Eikemo (2010) claim that access to services such as education, sport and preventive health care, but also healthy living and working conditions, improve the ability of socially excluded people to cope with their situation.

In this context, education and sport are important factors that can promote social inclusion. However, according to European statistics, Romania ranks modestly in this regard. This is also true for other issues, for example, social innovation, whose main directions are social inclusion, health and education (Stănescu et al., 2020).

The basic idea emerging from those presented above reveals that physical activity is among the measures of social integration. In this respect, many specialists have argued, through their own research studies, the major importance of sport for the social integration phenomenon.

Lawson (2005) also highlights that the potential of sport and physical education professionals contributes to the development of collective identities, which facilitates social integration.

Currently, sport is recognised as an educational environment that can contribute to solving various social problems (Stănescu et al., 2020).

Physical education and sport essentially involve social integration, more precisely, by practicing specific group activities. Physical education and sport are the best way to come into contact with various people and establish new relationships, which induces relaxation and represents a valuable means of restoring energy (Badea, 2019).

Sport-for-development programmes can contribute to social integration through the proposed inclusive actions (Van der Veken et al., 2020).

In order to design programmes aimed at social integration, a comprehensive assessment is recommended, which identifies the profile of potential subjects at risk of educational and social exclusion. As regards physical activity, it is important to identify the somatic, functional and motor profile of subjects to achieve an integration action relating to their needs.

Therefore, through this research, we aimed at paying more attention to physical development. Monitoring physical development is a complex action focused on the level of somatic and functional indices.

Pietiläinen et al. (2002) state that growth and development processes depend on several factors whose genetic and environmental effects are difficult to clarify.

However, there are numerous publications in the literature that assess the physical development of children of different ages according to gender (Szabo et al., 2013), genetic inheritance (Delemarre van Waal, 1993)

and various environmental factors (Cojocaru et al., 2015; Delemarre van Waal, 1993; Pietiläinen et al., 2002; Stănescu et al., 2018; Szabo et al., 2013).

Rexhepi, Brestovci and Krasniqi (2011) mention that the development process is influenced by endogenous factors (genetic factors, endocrine glands, nervous factors) and external factors (socioeconomic conditions, mental health, culture, climate and seasons, various diseases, physical activities, etc.). This constellation consists of prenatal, psychosocial, climatic and socioeconomic factors, nutrition, urbanisation and physical activity (Delemarre van Haal, 1993; Pietiläinen et al., 2002).

Studies conducted in Romania show that child development is influenced by several internal and external (biological and social) factors, highlighting a downward trend in children's motor ability concomitantly with an overweight trend. All these issues have major social and economic implications at national level (Stănescu et al., 2016).

The term *secular trend* has emerged in the literature and “traditionally indicates the attainment of larger adult body dimensions than in previous generations and the progressively earlier onset of menarche in adolescents in industrialised countries during the last 150 years” (Danubio & Sanna, 2008, p. 91).

Basically, in establishing the secular trend, the social conditions are of interest, but the underlying biology is also important (Cole, 2003).

In Romania, the secular trend enjoys constant interest from specialists in the field, given its importance for public health and its selection potential for performance sport (Stănescu et al., 2018).

A commonly studied and assessed somatic index is height, as an important indicator of the secular trend.

Genetic and environmental factors, but also their interaction, determine the adult height. In arguing the influence of socioeconomic and environmental factors on height, Floud, Wachter and Gregory (1990) state that they do not have a direct effect, but act through biological factors such as nutrition and infection.

The influence of infection is also suggested in studies conducted by Ulijaszek (2006).

Proos (1993) mentions that these two factors, nutrition and infection, seem to be the main causes of the differences in growth and maturation between ethnic and social groups.

In Romania, Badea (2019) conducted a study on the assessment of somatic indices for people at risk of social exclusion in Bucharest and Ilfov county. The study reveals that the Roma population has lower values of the central tendency compared to the Romanian population. The same study

indicates a population with moderate somatic development in terms of height and an optimal ratio of body weight to height in the case of girls. In boys, the somatic development is also moderate, Roma boys having values below the profile of the male population.

Another relevant study was conducted by three specialists from UNEFS Bucharest. They have concluded that students aged 10 to 11 years, girls and boys living in urban plain areas, as well as girls living in rural mountain areas, are taller than other children of the same age from other geographical areas (Stănescu et al., 2018).

A study by the same specialists reveals that students in urban areas are taller than those in rural areas (Stănescu et al., 2016).

Another indicator of the secular trend is body weight, which provides important data on health status (Stănescu et al., 2016).

Physical activity and sport interventions can reduce the social and economic burden of non-communicable diseases and improve the wellbeing of the population (Gosselin, Boccanfuso, & Laberge, 2020).

Methodology

Participants

This study involved 364 middle-school students, of whom 173 girls and 191 boys aged 10 to 16 years (12.75 ± 1.2) from 6 different education units in the western development region of Romania. The counties involved were Mehedinti, Caras-Severin and Bistrita-Nasaud. The research was possible with the help of specialised inspectors and physical education and sport teachers. Therefore, we collaborated with Daniel Harcau, Robert Nosal, Dinu Onita, Costinel Dorian Vasilica, Ionut Bogdan Radoi Fulga, Martian-Flavius Lepa, Artur Schvaner, Dezideriu Bogdan Stetz, Marius Leon Muthi.

In Mehedinti county, the Floresti Middle School and Hinova Middle School were part of the research. The study included 59 students from Floresti Middle School and 67 students from Hinova Middle School. Gender distribution was not equal for Mehedinti county, the research involving 68 boys and 58 girls, therefore 126 students.

In Caras-Severin county, the “Romulus Ladea” Middle School in Oravita and Middle School no. 8 in Resita were part of the research. The study included 75 students from “Romulus Ladea” Middle School in Oravita and 75 students from Middle School no. 8 in Resita. Gender distribution was not equal for Caras-Severin county, the research involving 80 boys and 70 girls, therefore 150 students.

In Bistrita-Nasaud county, the “Mihai Eminescu” Middle School and “Nicolae Draganu” Middle School in Zagra were part of the research. The study included 48 students from “Mihai Eminescu” Middle School and 40 students from “Nicolae Draganu” Middle School in Zagra. Gender distribution was approximately equal for Bistrita-Nasaud county, the research involving 43 boys and 45 girls, therefore 88 students.

The target group category includes students with learning difficulties, Roma students, students from single-parent families, disorganised families or with parents abroad, students at risk of early dropout, students in foster care, commuting students – from urban and rural areas. The distribution by geographic area for the three counties shows that there are 96 boys and 82 girls in urban areas, and 95 boys and 91 girls in rural areas. All participants in this study are included in the main target group of the “Sustainable social and education integration through sport activities” project (PNP001) coordinated by UNEFS in partnership with the Norwegian School of Sport Sciences funded under the EEA and Norwegian Grants 2014-2021, “Local development and poverty reduction, enhanced Roma inclusion” Financial Mechanism Programme.

Testing procedures

To outline the somatic and functional profile of children at risk of social exclusion, we used anthropometric measurements unanimously known in our field of research.

For somatic indices, the height, weight, body mass index (BMI) and arm span were measured.

For BMI, the WHO nutritional status was used: below 18.5 (underweight); 18.5- 24.9 (normal weight); 25.0-29.9 (pre-obesity); 30.0-34.9 (obesity class I); 35.0-39.9 (obesity class II), above 40 (obesity class III) (WHO, 2020).

For functional indices of physical development, the Ruffier test was used.

To apply the tests, subjects first needed to get used to their protocols. Physical education teachers presented the protocols for them, and then applied the tests based on the instructions provided by the project implementation team. The tests involved identifying the anthropometric landmarks and using instruments such as stadiometer, scale, tape measure, stopwatch and pulse oximeter.

The tests were applied between October and November 2019 during the activities carried out within the “Sustainable social and education integration through sport activities” project (PNP001).

To identify the functional profile of students from the western development region of Romania through the Ruffier test, we used the interpretation provided by Cordun (2009, pp. 266-267), Horghidan as cited by Tudor (2013, pp. 172-173) and based on the obtained values: < 0 (very good adaptation to effort), 0.1 - 5 (good adaptation to effort), 5.1 - 10 (moderate adaptation to effort), 10.1 - 15 (insufficient adaptation to effort), 15.1 - 20 (poor adaptation to effort).

Statistical analysis

The SPSS program allows interpreting the obtained results and outlining, with the help of descriptive statistics (arithmetic mean and standard deviation), the somatic and functional profile of students at risk of educational and social exclusion from middle school. The coefficient of variation, minimum value and maximum value were calculated. The result interpretation allowed us to highlight:

- the somatic and functional profile of boys from the western region, by age;
- the somatic and functional profile of girls from the western region, by age;
- the somatic and functional profile of boys from the western region, by residence area;
- the somatic and functional profile of girls from the western area, by residence area;
- the somatic and functional profile of boys from Mehedinti county, by age;
- the somatic and functional profile of girls from Mehedinti county, by age;
- the somatic and functional profile of boys from Bistrita-Nasaud county, by age;
- the somatic and functional profile of girls from Bistrita-Nasaud county, by age;
- the somatic and functional profile of boys from Caras-Severin county, by age;
- the somatic and functional profile of girls from Caras-Severin county, by age.

Results

According to Table 1, boys aged 10 years from the western region of the country have an average height of 1.45 m, an average weight of 36.25 kg and an average arm span of 142.50 cm. The average BMI value is 17.23 kg/m² (underweight), and the average score in Ruffier test is 17.23 points (poor adaptation to effort).

Boys aged 11 years from the western region of the country have an average height of 1.48 m, an average weight of 45.22 kg and an average arm span of 148.33 cm. The average BMI value is 20.21 kg/m² (normal weight), and the average score in Ruffier test is 13.12 points (insufficient adaptation to effort).

Boys aged 12 years from the western region of the country have an average height of 1.54 m, an average weight of 46.67 kg and an average arm span of 154.14 cm. The average BMI value is 19.66 kg/m² (normal weight), and the average score in Ruffier test is 10.77 points (insufficient adaptation to effort).

Boys aged 13 years from the western region of the country have an average height of 1.59 m, an average weight of 53.5 kg and an average arm span of 155.83 cm. The average BMI value is 20.47 kg/m² (normal weight), and the average score in Ruffier test is 10.75 points (insufficient adaptation to effort).

Boys aged 14 years from the western region of the country have an average height of 1.64 m, an average weight of 56.15 kg and an average arm span of 165.05 cm. The average BMI value is 20.53 kg/m² (normal weight), and the average score in Ruffier test is 11.8 points (insufficient adaptation to effort).

Boys aged 15 years from the western region of the country have an average height of 1.66 m, an average weight of 58.91 kg and an average arm span of 167 cm. The average BMI value is 21.52 kg/m² (normal weight), and the average score in Ruffier test is 11.55 points (insufficient adaptation to effort).

Table 1. Descriptive data for the western region, boys, by age

Somatic tests	Arithmetic mean	Standard deviation	Coefficient of variation	Minimum	Maximum
Boys aged 10 years (n = 2)					
Height (m)	1.45	.021	1.5%	1.43	1.46
Weight (kg)	36.25	6.718	18.5%	31.50	41.00

Arm span (cm)	142.50	.707	0.5%	142.00	143.00
BMI (kg/m ²)	17.23	2.793	16.2%	15.25	19.20
Ruffier test (points)	12.40	.000	0.0%	12.40	12.40
Boys aged 11 years (n = 36)					
Height (m)	1.48	.084	5.7%	1.32	1.64
Weight (kg)	45.22	12.978	28.7%	26.10	76.00
Arm span (cm)	148.33	8.485	5.7%	131.00	168.00
BMI (kg/m ²)	20.21	4.291	21.2%	13.87	29.94
Ruffier test (points)	13.12	3.147	24.0%	7.70	20.80
Boys aged 12 years (n = 49)					
Height (m)	1.54	.099	6.5%	1.34	1.83
Weight (kg)	46.67	11.964	25.6%	24.60	81.00
Arm span (cm)	154.14	10.612	6.9%	138.00	191.00
BMI (kg/m ²)	19.66	3.800	19.3%	13.70	28.50
Ruffier test (points)	10.77	2.469	22.9%	4.80	16.80
Boys aged 13 years (n = 49)					
Height (m)	1.59	.088	5.6%	1.39	1.75
Weight (kg)	53.50	14.434	27.0%	30.00	100.00
Arm span (cm)	155.83	24.379	15.6%	1.57	178.00
BMI (kg/m ²)	20.47	4.625	22.6%	12.20	36.73
Ruffier test (points)	10.75	2.197	20.4%	3.40	15.30
Boys aged 14 years (n = 43)					
Height (m)	1.64	.086	5.3%	1.38	1.80
Weight (kg)	56.15	13.305	23.7%	29.40	95.00
Arm span (cm)	165.05	8.824	5.3%	141.00	185.00
BMI (kg/m ²)	20.53	3.895	19.0%	15.20	33.66
Ruffier test (points)	11.80	2.813	23.8%	6.20	19.20
Boys aged 15 years (n = 10)					
Height (m)	1.66	.122	7.4%	1.35	1.78
Weight (kg)	58.91	12.952	22.0%	40.00	80.00
Arm span (cm)	167.00	11.499	6.9%	140.00	180.00
BMI (kg/m ²)	21.52	4.786	22.2%	15.43	30.18
Ruffier test (points)	11.55	1.990	17.2%	9.00	15.20
Boys aged 16 years (n = 2)					
Height (m)	1.67	.021	1.3%	1.65	1.68
Weight (kg)	48.00	4.243	8.8%	45.00	51.00
Arm span (cm)	162.50	3.536	2.2%	160.00	165.00
BMI (kg/m ²)	17.30	1.090	6.3%	16.53	18.07
Ruffier test (points)	9.95	1.061	10.7%	9.20	10.70

Source: original data resulting from research

According to Table 2, girls aged 11 years from the western region of the country have an average height of 1.5 m, an average weight of 43.64 kg and an average arm span of 148.63 cm. The average BMI value is 19.21 kg/m² (normal weight), and the average score in Ruffier test is 11.38 points (insufficient adaptation to effort).

Girls aged 12 years from the western region of the country have an average height of 1.54 m, an average weight of 48.11 kg and an average arm span of 152.22 cm. The average BMI value is 20.01 kg/m² (normal weight), and the average score in Ruffier test is 11.34 points (insufficient adaptation to effort).

Girls aged 13 years from the western region of the country have an average height of 1.58 m, an average weight of 52.03 kg and an average arm span of 157.93 cm. The average BMI value is 20.24 kg/m² (normal weight), and the average score in Ruffier test is 11.74 points (insufficient adaptation to effort).

Girls aged 14 years from the western region of the country have an average height of 1.59 m, an average weight of 52.63 kg and an average arm span of 158.83 cm. The average BMI value is 20.34 kg/m² (normal weight), and the average score in Ruffier test is 11.43 points (insufficient adaptation to effort).

Girls aged 15 years from the western region of the country have an average height of 1.58 m, an average weight of 48.58 kg and an average arm span of 156.63 cm. The average BMI value is 19.37 kg/m² (normal weight), and the average score in Ruffier test is 13.4 points (insufficient adaptation to effort).

Girls aged 16 years from the western region of the country have an average height of 1.55 m, an average weight of 42.57 kg and an average arm span of 153.29 cm. The average BMI value is 17.69 kg/m² (underweight), and the average score in Ruffier test is 11.39 points (insufficient adaptation to effort).

Table 2. Descriptive data for the western region, girls, by age

Somatic tests	Arithmetic mean	Standard deviation	Coefficient of variation	Minimum	Maximum
Girls aged 11 years (n = 26)					
Height (m)	1.50	.067	4.5%	1.37	1.63
Weight (kg)	43.64	9.698	22.2%	31.00	62.00
Arm span (cm)	148.63	6.746	4.5%	135.00	160.00
BMI (kg/m ²)	19.21	3.533	18.4%	13.60	26.14

Ruffier test (points)	11.38	3.058	26.9%	5.60	19.00
Girls aged 12 years (n = 45)					
Height (m)	1.54	.092	6.0%	1.28	1.70
Weight (kg)	48.11	12.634	26.3%	26.00	96.00
Arm span (cm)	152.22	9.273	6.1%	128.00	170.00
BMI (kg/m ²)	20.01	3.821	19.1%	14.74	33.22
Ruffier test (points)	11.34	1.928	17.0%	5.00	14.50
Girls aged 13 years (n = 55)					
Height (m)	1.58	.069	4.4%	1.40	1.70
Weight (kg)	52.03	11.672	22.4%	27.70	87.80
Arm span (cm)	157.93	7.581	4.8%	141.00	174.00
BMI (kg/m ²)	20.24	4.143	20.5%	12.20	32.35
Ruffier test (points)	11.74	2.335	19.9%	6.50	20.80
Girls aged 14 years (n = 36)					
Height (m)	1.59	.066	4.1%	1.44	1.69
Weight (kg)	52.63	9.450	18.0%	35.40	74.30
Arm span (cm)	158.83	8.244	5.2%	135.00	173.00
BMI (kg/m ²)	20.34	3.019	14.8%	16.10	28.13
Ruffier test (points)	11.43	1.948	17.0%	7.00	14.80
Girls aged 15 years (n = 4)					
Height (m)	1.58	.041	2.6%	1.52	1.61
Weight (kg)	48.58	6.898	14.2%	38.30	53.00
Arm span (cm)	156.63	2.136	1.4%	153.50	158.00
BMI (kg/m ²)	19.37	2.002	10.3%	16.45	21.00
Ruffier test (points)	13.40	4.010	29.9%	9.40	17.60
Girls aged 16 years (n = 7)					
Height (m)	1.55	.075	4.9%	1.45	1.63
Weight (kg)	42.57	8.182	19.2%	32.00	51.00
Arm span (cm)	153.29	7.455	4.9%	145.00	163.00
BMI (kg/m ²)	17.69	2.615	14.8%	14.22	21.40
Ruffier test (points)	11.39	1.984	17.4%	8.10	14.20

Source: original data resulting from research

Table 3 shows the somatic and functional profile of both boys and girls, by residence area.

Boys aged 10-16 years in urban areas from the western region of the country have an average height of 1.59 m, an average weight of 52.22 kg and an average arm span of 157.31 cm. The average BMI value is 20.44 kg/m² (normal weight), and the average score in Ruffier test is 10.73 points (insufficient adaptation to effort).

Boys aged 10-16 years in rural areas from the western region of the country have an average height of 1.54 m, an average weight of 49.43 kg and an average arm span of 155.83 cm. The average BMI value is 19.99 kg/m² (normal weight), and the average score in Ruffier test is 12.25 points (insufficient adaptation to effort).

Girls aged 11-16 years in urban areas from the western region of the country have an average height of 1.57 m, an average weight of 50.13 kg and an average arm span of 154.43 cm. The average BMI value is 20.21 kg/m² (normal weight), and the average score in Ruffier test is 11.48 points (insufficient adaptation to effort).

Girls aged 11-16 years in rural areas from the western region of the country have an average height of 1.55 m, an average weight of 48.76 kg and an average arm span of 155.55 cm. The average BMI value is 19.66 kg/m² (normal weight), and the average score in Ruffier test is 11.61 points (insufficient adaptation to effort).

Table 3. Descriptive data for the western region, boys and girls
from urban and rural areas

Somatic tests	Arithmetic mean	Standard deviation	Coefficient of variation	Minimum	Maximum
Boys from urban areas (n = 96)					
Height (m)	1.59	.095	6.0%	1.35	1.79
Weight (kg)	52.22	11.974	22.9%	30.00	80.00
Arm span (cm)	157.31	19.006	12.1%	1.57	179.00
BMI (kg/m ²)	20.44	3.890	19.0%	12.80	32.05
Ruffier test (points)	10.73	1.985	18.5%	4.80	15.80
Boys from rural areas (n = 95)					
Height (m)	1.54	.114	7.3%	1.32	1.83
Weight (kg)	49.43	15.444	31.2%	24.60	100.00
Arm span (cm)	155.83	12.163	7.8%	131.00	191.00
BMI (kg/m ²)	19.99	4.429	22.2%	12.20	36.73
Ruffier test (points)	12.25	3.118	25.4%	3.40	20.80
Girls from urban areas (n = 82)					
Height (m)	1.57	.086	5.5%	1.28	1.70
Weight (kg)	50.13	11.212	22.4%	26.00	96.00
Arm span (cm)	154.43	9.274	6.0%	128.00	174.00
BMI (kg/m ²)	20.21	3.503	17.3%	13.60	33.22
Ruffier test (points)	11.48	1.497	13.0%	8.10	14.50
Girls from rural areas (n = 91)					
Height (m)	1.55	0.074	4.8%	1.37	1.69

Weight (kg)	48.76	11.623	23.8%	27.70	87.80
Arm span (cm)	155.55	8.275	5.3%	137.00	173.00
BMI (kg/m ²)	19.66	3.812	19.4%	12.20	31.50
Ruffier test (points)	11.61	2.855	24.6%	5.00	20.80

Source: original data resulting from research

In outlining the somatic and functional profile of middle-school students, the data by county, gender and age were analysed separately.

Boys aged 10 years from Mehedinti county have an average height of 1.46 m, an average weight of 41 kg and an average arm span of 142 cm. The average BMI value is 19.2 kg/m² (normal weight), and the average score in Ruffier test is 12.4 points (insufficient adaptation to effort).

Boys aged 11 years from Mehedinti county have an average height of 1.46 m, an average weight of 42.08 kg and an average arm span of 146 cm. The average BMI value is 19.57 kg/m² (normal weight), and the average score in Ruffier test is 13.39 points (insufficient adaptation to effort).

Boys aged 12 years from Mehedinti county have an average height of 1.52 m, an average weight of 44.08 kg and an average arm span of 154.35 cm. The average BMI value is 19.26 kg/m² (normal weight), and the average score in Ruffier test is 12.04 points (insufficient adaptation to effort).

Boys aged 13 years from Mehedinti county have an average height of 1.55 m, an average weight of 46.73 kg and an average arm span of 156.38 cm. The average BMI value is 17.27 kg/m² (underweight), and the average score in Ruffier test is 11.02 points (insufficient adaptation to effort).

Boys aged 14 years from Mehedinti county have an average height of 1.65 m, an average weight of 59.43 kg and an average arm span of 166.44 cm. The average BMI value is 20.94 kg/m² (normal weight), and the average score in Ruffier test is 13.2 points (insufficient adaptation to effort).

Boys aged 15 years from Mehedinti county have an average height of 1.74 m, an average weight of 70 kg and an average arm span of 178.5 cm. The average BMI value is 23.05 kg/m² (normal weight), and the average score in Ruffier test is 10.65 points (insufficient adaptation to effort).

Girls aged 11 years from Mehedinti county have an average height of 1.51 m, an average weight of 45.26 kg and an average arm span of 150.85 cm. The average BMI value is 19.79 kg/m² (normal weight), and the average score in Ruffier test is 11.52 points (insufficient adaptation to effort).

Girls aged 12 years from Mehedinti county have an average height of 1.55 m, an average weight of 47.94 kg and an average arm span of 156 cm. The average BMI value is 19.36 kg/m² (normal weight), and the average score in Ruffier test is 10.68 points (insufficient adaptation to effort).

Girls aged 13 years from Mehedinti county have an average height of 1.59 m, an average weight of 55.43 kg and an average arm span of 160.38 cm. The average BMI value is 20.3 kg/m^2 (normal weight), and the average score in Ruffier test is 11.64 points (insufficient adaptation to effort).

Girls aged 14 years from Mehedinti county have an average height of 1.58 m, an average weight of 53.2 kg and an average arm span of 159.83 cm. The average BMI value is 20.43 kg/m^2 (normal weight), and the average score in Ruffier test is 10.97 points (insufficient adaptation to effort).

Girls aged 15 years from Mehedinti county have an average height of 1.6 m, an average weight of 52.5 kg and an average arm span of 157.5 cm. The average BMI value is 20.55 kg/m^2 (normal weight), and the average score in Ruffier test is 14.1 points (insufficient adaptation to effort).

Boys aged 11 years from Bistrita-Nasaud county have an average height of 1.56 m, an average weight of 55.25 kg and an average arm span of 152.75 cm. The average BMI value is 22.84 kg/m^2 (normal weight), and the average score in Ruffier test is 11.88 points (insufficient adaptation to effort).

Boys aged 12 years from Bistrita-Nasaud county have an average height of 1.55 m, an average weight of 48.24 kg and an average arm span of 153.81 cm. The average BMI value is 20 kg/m^2 (normal weight), and the average score in Ruffier test is 10.8 points (insufficient adaptation to effort).

Boys aged 13 years from Bistrita-Nasaud county have an average height of 1.59 m, an average weight of 56.82 kg and an average arm span of 153.73 cm. The average BMI value is 22.26 kg/m^2 (normal weight), and the average score in Ruffier test is 11.19 points (insufficient adaptation to effort).

Boys aged 14 years from Bistrita-Nasaud county have an average height of 1.64 m, an average weight of 58.56 kg and an average arm span of 165.75 cm. The average BMI value is 21.59 kg/m^2 (normal weight), and the average score in Ruffier test is 11.34 points (insufficient adaptation to effort).

Boys aged 15 years from Bistrita-Nasaud county have an average height of 1.62 m, an average weight of 58 kg and an average arm span of 161.8 cm. The average BMI value is 22.4 kg/m^2 (normal weight), and the average score in Ruffier test is 12.28 points (insufficient adaptation to effort).

Boys aged 16 years from Bistrita-Nasaud county have an average height of 1.67 m, an average weight of 48 kg and an average arm span of 162.5 cm. The average BMI value is 17.3 kg/m^2 (underweight), and the average score in Ruffier test is 9.95 points (moderate adaptation to effort).

Girls aged 11 years from Bistrita-Nasaud county have an average height of 1.51 m, an average weight of 44.44 kg and an average arm span of 146.44 cm. The average BMI value is 19.39 kg/m^2 (normal weight), and the average score in Ruffier test is 11.51 points (insufficient adaptation to effort).

Girls aged 12 years from Bistrita-Nasaud county have an average height of 1.54 m, an average weight of 50.19 kg and an average arm span of 151.42 cm. The average BMI value is 20.92 kg/m^2 (normal weight), and the average score in Ruffier test is 11.54 points (insufficient adaptation to effort).

Girls aged 13 years from Bistrita-Nasaud county have an average height of 1.57 m, an average weight of 52.73 kg and an average arm span of 157.27 cm. The average BMI value is 21.22 kg/m^2 (normal weight), and the average score in Ruffier test is 11.69 points (insufficient adaptation to effort).

Girls aged 14 years from Bistrita-Nasaud county have an average height of 1.6 m, an average weight of 54.8 kg and an average arm span of 157.9 cm. The average BMI value is 21.3 kg/m^2 (normal weight), and the average score in Ruffier test is 11.85 points (insufficient adaptation to effort).

Girls aged 16 years from Bistrita-Nasaud county have an average height of 1.49 m, an average weight of 38.33 kg and an average arm span of 147.67 cm. The average BMI value is 17.29 kg/m^2 (underweight), and the average score in Ruffier test is 11.97 points (insufficient adaptation to effort).

Boys aged 11 years from Caras-Severin county have an average height of 1.48 m, an average weight of 42.93 kg and an average arm span of 149.33 cm. The average BMI value is 19.24 kg/m^2 (normal weight), and the average score in Ruffier test is 13.64 points (insufficient adaptation to effort).

Boys aged 12 years from Caras-Severin county have an average height of 1.55 m, an average weight of 47.69 kg and an average arm span of 154.45 cm. The average BMI value is 19.61 kg/m^2 (normal weight), and the average score in Ruffier test is 8.76 points (moderate adaptation to effort).

Boys aged 13 years from Caras-Severin county have an average height of 1.65 m, an average weight of 52.86 kg and an average arm span of 162.25 cm. The average BMI value is 19.41 kg/m^2 (normal weight), and the average score in Ruffier test is 8.78 points (moderate adaptation to effort).

Boys aged 14 years from Caras-Severin county have an average height of 1.61 m, an average weight of 47.88 kg and an average arm span of

162 cm. The average BMI value is 18.38 kg/m^2 (underweight), and the average score in Ruffier test is 10.43 points (insufficient adaptation to effort).

Boys aged 15 years from Caras-Severin county have an average height of 1.66 m, an average weight of 53.03 kg and an average arm span of 168 cm. The average BMI value is 19.04 kg/m^2 (normal weight), and the average score in Ruffier test is 10.93 points (insufficient adaptation to effort).

Girls aged 11 years from Caras-Severin county have an average height of 1.46 m, an average weight of 36.58 kg and an average arm span of 146.38 cm. The average BMI value is 16.9 kg/m^2 (underweight), and the average score in Ruffier test is 10.63 points (insufficient adaptation to effort).

Girls aged 12 years from Caras-Severin county have an average height of 1.53 m, an average weight of 42.86 kg and an average arm span of 150.9 cm. The average BMI value is 18.24 kg/m^2 (underweight), and the average score in Ruffier test is 11.43 points (insufficient adaptation to effort).

Girls aged 13 years from Caras-Severin county have an average height of 1.58 m, an average weight of 47.92 kg and an average arm span of 156.47 cm. The average BMI value is 18.9 kg/m^2 (normal weight), and the average score in Ruffier test is 11.91 points (insufficient adaptation to effort).

Girls aged 14 years from Caras-Severin county have an average height of 1.6 m, an average weight of 48.64 kg and an average arm span of 157.75 cm. The average BMI value is 18.92 kg/m^2 (normal weight), and the average score in Ruffier test is 11.96 points (insufficient adaptation to effort).

Girls aged 15 years from Caras-Severin county have an average height of 1.56 m, an average weight of 44.65 kg and an average arm span of 155.75 cm. The average BMI value is 18.19 kg/m^2 (underweight), and the average score in Ruffier test is 12.7 points (insufficient adaptation to effort).

Girls aged 16 years from Caras-Severin county have an average height of 1.59 m, an average weight of 45.75 kg and an average arm span of 157.5 cm. The average BMI value is 18 kg/m^2 (underweight), and the average score in Ruffier test is 10.95 points (insufficient adaptation to effort).

Conclusion

The average height of children from the western region of the country is between 1.45 m at the age of 10 years and 1.67 m at the age of 16 years for boys, and between 1.50 m at the age of 11 years and 1.59 m at the age of 14-15 years for girls.

The average height of children from Mehedinti county is between 1.46 m at the age of 10 years and 1.74 m at the age of 15 years for boys, and between 1.51 m at the age of 11 years and 1.60 m at the age of 15 years for girls.

The average height of children from Bistrita-Nasaud county is between 1.55 m at the age of 11-12 years and 1.67 m at the age of 16 years for boys, and between 1.51 m at the age of 11 years and 1.60 m at the age of 14 years for girls.

The average height of children from Caras-Severin county is between 1.43 m at the age of 11 years and 1.66 m at the age of 16 years for boys, and between 1.46 m at the age of 11 years and 1.59 m at the age of 16 years for girls.

The average weight of children from the western region of the country is between 36.25 kg at the age of 10 years and 58.91 kg at the age of 15-16 years for boys, and between 45.22 kg at the age of 11 years and 48.58 kg at the age of 14 years for girls.

The average weight of children from Mehedinti county is between 41.0 kg at the age of 10 years and 70.00 kg at the age of 15 years for boys, and between 45.26 kg at the age of 11 years and 53.20 kg at the age of 14 years for girls.

The average weight of children from Bistrita-Nasaud county is between 48.24 kg at the age of 11-12 years and 58.00 kg at the age of 15 years for boys, and between 44.44 kg at the age of 11 years and 54.80 kg at the age of 14 years for girls.

The average weight of children from Caras-Severin county is between 31.50 kg at the age of 10 years and 53.03 kg at the age of 15 years for boys, and between 36.58 kg at the age of 11 years and 45.75 kg at the age of 16 years for girls.

The average arm span of children from the western region of the country is between 142.50 cm at the age of 10 years and 167 cm at the age of 15 years for boys, and between 148.63 cm at the age of 11 years and 156.63 cm at the age of 15 years for girls.

The average arm span of children from Mehedinti county is between 142.00 cm at the age of 10 years and 178.50 cm at the age of 15 years for

boys, and between 146.00 cm at the age of 11 years and 160.38 cm at the age of 13 years for girls.

The average arm span of children from Bistrita-Nasaud county is between 152.75 cm at the age of 11 years and 165.75 cm at the age of 14 years for boys, and between 146.44 cm at the age of 11 years and 157.90 cm at the age of 14 years for girls.

The average arm span of children from Caras-Severin county is between 143.00 cm at the age of 10 years and 168 cm at the age of 15 years for boys, and between 146.38 cm at the age of 11 years and 157.75 cm at the age of 14 years for girls.

The average BMI of children from the western region of the country is between 17.22 kg/m² (underweight) at the age of 10 years and 21.52 kg/m² (normal weight) at the age of 15 years for boys, and between 19.21 kg/m² (normal weight) at the age of 11 years and 20.34 kg/m² (normal weight) at the age of 14 years for girls.

The average BMI of children from Mehedinti county is between 19.20 kg/m² (normal weight) at the age of 10 years and 23.05 kg/m² (normal weight) at the age of 15 years for boys, and between 19.79 kg/m² (normal weight) at the age of 11 years and 20.43 kg/m² (normal weight) at the age of 14 years for girls.

The average BMI of children from Bistrita-Nasaud county is between 19.39 kg/m² (normal weight) at the age of 11 years and 22.40 kg/m² (normal weight) at the age of 15 years for boys, and between 19.39 kg/m² (normal weight) at the age of 11 years and 21.30 kg/m² (normal weight) at the age of 14 years for girls.

The average BMI of children from Caras-Severin county is between 15.25 kg/m² (underweight) at the age of 10 years and 19.61 kg/m² (normal weight) at the age of 12 years for boys, and between 16.90 kg/m² (underweight) at the age of 11 years and 18.92 kg/m² (normal weight) at the age of 14 years for girls.

The average score in Ruffier test for children from the western region of the country is between 13.12 (insufficient adaptation to effort) at the age of 11 years and 9.95 (moderate adaptation to effort) at the age of 16 years in the case of boys, and between 11.34 (insufficient adaptation to effort) at the age of 12 years and 13.40 (insufficient adaptation to effort) at the age of 15 years in the case of girls.

The average score in Ruffier test for children from Mehedinti county is between 13.39 (insufficient adaptation to effort) at the age of 11 years and 10.65 (insufficient adaptation to effort) at the age of 15 years in the case of boys, and between 11.52 (insufficient adaptation to effort) at the age of 11

years and 14.10 (insufficient adaptation to effort) at the age of 14 years in the case of girls.

The average score in Ruffier test for children from Bistrita-Nasaud county is between 11.88 (insufficient adaptation to effort) at the age of 11 years and 9.95 (moderate adaptation to effort) at the age of 15 years in the case of boys, and between 11.51 (insufficient adaptation to effort) at the age of 11 years and 11.97 (insufficient adaptation to effort) at the age of 16 years in the case of girls.

The average score in Ruffier test for children from Caras-Severin county is between 13.64 (insufficient adaptation to effort) at the age of 11 years and 8.76 (moderate adaptation to effort) at the age of 12 years in the case of boys, and between 10.63 (insufficient adaptation to effort) at the age of 11 years and 12.70 (insufficient adaptation to effort) at the age of 15 years in the case of girls.

Acknowledgments

This paper is an integral part of the “Sustainable social and education integration through sport activities” project (PNP001) funded under the EEA and Norwegian Grants 2014-2021, “Local development and poverty reduction, enhanced Roma inclusion” Financial Mechanism Programme coordinated by the National University of Physical Education and Sports in Bucharest in partnership with the Norwegian School of Sport Sciences in Oslo.

Authors' contributions

All authors have equally contributed to this study and should be considered as main authors.

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