

# The effects of acrobatics on morphological characteristics of school children

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**Abstract.** The aim of this paper is to determine the effects of acrobatic elements on changes in morphological characteristics in children who were experimentally treated. The sample consists of elementary school children from Kosovska Mitrovica N = 52, who regularly attend physical education classes and additional acrobatics trainings three times a week for the implementation of acrobatics in additional classes of physical education. The variables used to assess the circular dimensions and body mass are: Upper arm circumference expressed in cm (AONDL), calf circumference expressed in cm (AOPTK), chest circumference expressed in cm AOGRK, body weight expressed in kg (AMAST). The variables used to estimate the subcutaneous fat tissue are: Upper-arm skinfold expressed in mm (ANNDL), calf skinfold expressed in mm (ANPTK), Abdominal skinfold expressed in mm ANTRB. T-test was used to determine statistically significant differences in variables (ANNDL p=.006), (ANPTK p=.005), (ANTRB p=.008). The obtained results can contribute to the rationalization of regular and additional teaching of physical education for the optimal planning and control of work.

**Keywords.** Experimental program, growth and development, hypokinesia, students.

## Introduction

When it comes to children of 11 and 12 years old, according to the research, it was found that the level of physical activity was not satisfactory, neither in volume nor in intensity (Paušić, 2007; Bajrić et al., 2015). The urban way of life has contributed to the fact that the physical abilities of children are constantly decreasing, and the problem of

acceleration (especially in urban children), which shows disharmony in physical development, which comes due to children reduced ability and need to move (Zrnzević, 2007). This is due to the expansion of computer technology, where children are occupied with various forms of entertainment, spend time in a sitting or lying position, they play less, and all results in decrease in motor and functional abilities physical deformities (Deflandre et al., 2001; Zrnzević & Zrnzević, 2015). Monitoring of children's growth and development takes a significant place in the study of the overall anthropological status of children, both from the point of view of biological anthropology and from the point of view of medical sciences like physiology, psychology, and kinesiology (Duraković, & Mišigoj-Duraković, 2011; Sretenović & Nedović, 2015). Data on the growth and development of children, among other things, can be obtained by measuring and testing relevant anthropometric characteristics, but also by assessing motor skills (Bala et al., 2009; Sretenović & Nedović, 2015). Morphological characteristics are the basis for the later formation and development of motor abilities and motor skills (Breslauer et al., 2004; Di Cagno et al., 2009; Dedaj, 2011; Torlaković, 2014). However, how children will develop physically depends on both physical exercise and lifestyle (Sabo, 2006). Physical education should become such a mechanism which it will fight all the negative effect of the modern way of life. The choice of teaching contents which will cause optimal reactions of the organism, or to say changes in the domain of

morphological characteristics, is necessary, which is the basic task of physical education in elementary school (Zrnezić, 2007; Zrnezić & Zrnezić, 2015).

The importance of acrobatics and its contents is perceived as very applicable, with accessible forms and ways of practicing, in all branches and areas of activity and one's everyday life. It can be applied at all stages of growth and development of the human organism from the earliest ages of children. It has been applied in all civilizations in the historical development of humanity for various purposes and through various forms of exercise, and has been included in everyday life as an integral part of the general culture (Živčić-Marković et al., 2015). For this reason, every lesson of physical education must be well planned, and the main goal should be multiple development of children (Broomfield & Mark, 2011). The aim of this paper is to determine the effects of acrobatic elements on changes in morphological characteristics in children who were experimentally treated. Information on the results achieved between the two states (two checks) is an indicator of development and progress in the system of estimating and evaluating the results of the work of the acrobatics realization.

## Methods

### Population

The population from which the sample was derived is made up of primary school children from Kosovska Mitrovica, male, aged 11 and 12. The total sample of 52 respondents took part in the regular classes of physical education and acrobatics trainings three times a week for the implementation of acrobatics for the additional classes of physical education. Respondents met, for the first time, with a training process organized as part of additional physical education classes for the realization of elements of sports gymnastics, that is, acrobatic elements. All students voluntarily participated in the measurement.

### Measurements and Data Collection

The variables used in this research for measuring the circular dimensionality and body mass are: 1) Upper-arm circumference expressed in cm (AONDL), 2) Calf circumference expressed in cm (AOPTK), 3) Chest

circumference expressed in cm (AOGRK), 4) Body mass expressed in kg (AMAST).

Upper-arm circumference, calf circumference and chest circumference were measured using cm tape, while body mass was measured using digital anthropometric scale.

The variables used in this research for measuring subcutaneous fat are: 1) Upper-arm skinfold expressed in mm (ANNDL), 2) Calf skinfold expressed in mm (ANPTK), 3) Abdominal skinfold expressed in mm (ANTRB).

Upper-arm skinfold, calf skinfold and abdominal skinfold were measured using Harpender skinfold kaliper. Measurement was realized in a Special school 'Kosovski Božur' in Kosovska Mitrovica.

### Data Analysis

The differences between the initial and final state of the experimental group have been determined by the T-test. It has been calculated using arithmetic meanings for initial and final measurement. A multivariate variance analysis (MANOVA) has been used to determine the intergroup differences of the experimental group at the initial measurement. The data has been processed with a statistical pack Statistica for Windows (data analysis software system), version 7.0.

The proposed pattern of anthropometric measures was based on the recommendations of the International Biological Program (Lohman et al., 1988).

## Results

The analysis of Table 2 in which the results of the significance of an isolated discriminatory function of the morphological characteristics of all anthropometric measures of morphological characteristics within the experimental treatment group at the final measurement. It can be stated that one discriminating function shows medium high intensity (CR = 81%), which shows the correlation of the data set on the basis of which a discriminatory analysis of the obtained results was carried out. The results of the discriminatory intensity of anthropometric measures were given by the Wilks'-Lambda test .201, which indicates that the differences between the initial and

final measurements in the morphological characteristics of the experimental group are significant ( $p = .000$ ), since the size of the Hi square of the test has a high value ( $\text{Chi-Sqr} = 147.00$ ).

Table 3 presents the results of the t-test of the morphological characteristics between the initial and

final measurement of the experimental group. After the analysis of the obtained results, it is concluded that there is a statistically significant difference in the upper arm skinfold (ANN DL .006), calf skinfold (ANPTK .005) and abdomen skinfold (ANTRB .008)

**Table 1**

Plan of the content for the realization of acrobatic exercising of experimental group.

Program Units	Number of Hours
Initial diagnosis of morphological characteristics	Before program realization
1. Warming-up exercises	On every lesson
2. Acrobatic exercises and stretching	26
3. Training acrobatic exercises through compositions	6
4. Plyometric exercises and stretching	4
Final diagnosis of morphological characteristics	After program realization
Overall:	36

**Table 2**

The significance of the isolated discriminatory function of the morphological characteristics of the experimental group.

Disk. Func.	Eigenvalue	Cannonicl R	Wilks' Lambda	Chi-Sqr.	df	p
1	2.244	0.81	.201	147.00	7	.000

Legend: squared coefficient of discrimination (Eugenvalue), canonical correlation coefficients (Cannonical R), values of Bertlet's test (Wilks' Lambda), size of Hi squared test (Chi-Sqr), degrees of freedom (df) and level of significance of the determination coefficient (P-Level)

**Table 3**

Significance of differences between the arithmetic means of the experimental group respondents in morphological characteristics.

Measurements	Mean (Ei)	Mean (Ef)	t	p
AONDL	17.72	20.36	1.12	.173
AOPTK	27.36	29.73	1.71	.185
AOGRK	66.70	69.64	1.54	.123
AMAST	39.95	42.87	1.27	.214
ANN DL	16.86	13.25	3.52	.006
ANPTK	25.31	19.32	3.28	.005
ANTRB	12.45	9.36	3.08	.008

Mean (Ei): The arithmetic mean initially, Mean (Ef): The arithmetic mean finally.

## Discussion

Analyzing the average results of the morphological characteristics of the students of the experimental group at the final measurement, it can be concluded that there have been positive statistical changes in the variables for estimating the subcutaneous fat tissue, while in the variables for the estimation of Circular dimensions and the body weight there are changes, but they are not statistically significant. Skin folds depend, to a great extent, on the diet and physical activity (Đurašković, 2001), and it is possible to influence them. The average values of the skin folds at the final measurement are lower than the average values obtained at the initial measurement, so it can be stated the subcutaneous fat tissue has decreased, which is considered as a positive occurrence. In this case, the greatest contribution on reducing subcutaneous fat tissue can be attributed to the program that has been applied in the experiment. In the variables for estimating the circular dimensionality of the skeleton, changes were noticed but not statistically significant, in all tests, whose values were increased, on average, by about 26 mm (which is within the limits of normality). Upper arm and calf circumference is within the limits of the normality which is affected by the change in the mass of the musculature, while in the chest circumference the elasticity of the chest. The results of the circumference directly depend on the growth of the rib-bones in length (Gajdoš, 1983; Zrnzević & Zrnzević, 2015). Average values of body mass indicate that the students of the experimental group, on average, gained about 3 kg of weight, which is within the limits of annual growth for this age (2 to 3 kg). Changes that have arisen within the dimensions of the morphological status, it can be stated, were due to the growth and development of the organism of children and that they were mainly genetically conditioned. The developmental period from 11 to 15 years is often called real childhood. However, this is the period of sexual maturation. Between 10 and 12, the child is still a child. Regarding sexual maturation, with boys it is in the period of 12 and 13 years old, even 16 years old. In this period, the uneven development is very strong. In many children we distinguish two phases. The first phase (11-13 years) is characterized by the fact that the child experiences only himself and begins to imitate adults. That is why in many cases there is a conflict

with the environment. It should be noted that some children do not go through this phase, and in many cases it soon disappears without an intervention of an adult (parents, trainers, professors ...).

The development of musculature, in particular the extremities, is very uneven, because it follows bone growth. The hull is small and still not completely developed. The growth in height is more noticeable than development in width. The second phase is characterized by a period of hormonal changes, perfection and unity. Body proportions are equalized and typical male anatomical features break down. In this period there are changes in the activities of the whole organism. Large changes, in addition to body growth and body mass (in this period, children annually grow about five centimeters, and in body weight they receive an average of 2 to 3 kg (Medved, 1981; Kragujević & Rakić, 2004); increase of muscle mass (30% body mass) and strength of the musculature. Therefore, the changes that occurred during experimental treatment in skin folds are thanks to the contents and means of the program that included the experiment. Accordingly, we can conclude that our results are approximate to the values that came (Bala, 1981; Gajdoš, 1983; Zrnezić, 1984; Zrnezić, 2003; Zrnezić, 2007; Zrnezić & Zrnezić, 2015; Krsmanović, 1985; Bižaca & Kučić, 1999; Kosinac & Katić, 1999; Babin et al., 1999; Toskić, 2000). On the basis of the obtained results it can be concluded that after application of the experimental program of acrobatics there were statistically significant changes in the variables for estimating the subcutaneous fat tissue, in the positive sense, since all the skin folds (which were applied in the research) were reduced at the time of program realization. Results that do not show a statistically significant difference in circular dimensionality and body mass were not shown due to, most likely, the short period of the duration of the experiment, but the difference between the two measurements is visible, which gives us positive information about the effects of acrobatics. The obtained results can contribute to the rationalization of regular and additional teaching of physical education for optimal planning and control of work. This would make it more effective to check the state of their physical status and, if possible, to determine more valid and purposeful projections of further desired development.

## References

- Babin J, Katić R, Vlahović L. The influence of programmed teaching of physical and health culture on changes in the morphological characteristics of seven-year-old students. The second international scientific conference Dubrovnik. Kineziology of 21st century (collection of works). Zagreb: Faculty of physical culture Zagreb, 1999.
- Bajrić O, Srdić V, Stanković A. The prognostic values of the morphological features on the results of the program content of sports games in the teaching of physical education. Collection of works of the Fifth International Conference "Sports Science and Health". Banja Luka: Pan-European University Apeiron Faculty of Sports Sciences, 2015.
- Bala G, Jakšić D, Popović B. Trends of relations of morphological characteristics and motor skills of pre-school children: Bala G. [yp.] Relations of anthropological characteristics and abilities of pre-school children, Novi Sad: Faculty of Sport and Physical Education, 2009.
- Bala G. Structure and development of morphological and motor dimensions of SAP Vojvodina children. Novi Sad: Faculty of physical culture, 1981.
- Bižaca J, Kučić R. The connection of some specific pedagogical loads with pathological changes in the foot in children from the first to the fourth grade of primary school. In: Milanović D. [ur.] Second International Scientific Conference "Dubrovnik 1999. Kinesiology for the 21st Century (collection of works), Zagreb: Faculty of Physical Culture, University of Zagreb, 1999.
- Breslauer N, Delija K, Jelenić A. Analysis of differences between groups of subjects involved in different kinesiological activities. In: V. Findak (ed.) Proceedings of the 14th Summer School of Kinesiologists of the Republic of Croatia, Rovinj: Croatian Kinesiological Association, 2004.
- Broomfield MA. Policing masculinity and dance reality television: what gender nonconformity can teach us in the classroom. *Journal of Dance Education* 2011; 11(4): 124-128.
- Dedaj M. The importance of physical education for the health of children and young people - historical overview (The importance of physical education for the health of children and youth - Historical review). *Pedagogy in Serbian* 2011; 66(2): 346-356.
- Deflandre A, Lorant J, Gavarry O, Falgairette G. Determinants of physical activity and physical and sports activities in French school children. *Perceptual and Motor Skills* 2001; 92(2): 399-414.
- Di Cagno R, Rizzello CG, Gagliardi F, Ricciuti P, Ndagijimana M, Francavilla R, Guerzoni ME, Crecchio C, Gobetti M, De Angelis M. Different fecal microbiotas and volatile organic compounds in treated and untreated children with celiac disease. *Appl Environ Microbiol* 2009; 75: 3963-3971.
- Zrnzević N, Milenović B. Anthropometric, biomotor and functional characteristics of children from 7 to 11 years selected for sports gymnastics. Collection of works. *OOOR Physical Education* 1984; (3): 187-198.
- Duraković Z, Mišigoj-Duraković M. Does chronological age reduce working ability? *Collegium Antropologicum* 2006; 30(1): 213-219.
- Đurašković R. Biology of human development with sports medicine. Niš: Sven, 2001.
- Gajdoš A. The process of training gymnasts and gymnasts of younger and middle school age with regard to their morphological and functional abilities. *Physical Culture Journal of Sport Science and Physical Education* 1983; (3): 226-230.
- Kosinac Z, Katić R. Longitudinal study of the development of morphological and motor characteristics of boys and girls from fifth to seventh year. Second International Scientific Conference Dubrovnik. *Kinesiology for the 21st century (Proceedings)*. Zagreb: Faculty of Physical Culture, University of Zagreb, 1999: 144-146.
- Kragujević G, Rakić I. Physical and health education in the first grade of elementary school: teacher's manual. Institute for Textbooks and Teaching Resources, 2004.
- Krsmanović B. The effectiveness of teaching physical education depending on the curriculum model. Unpublished doctoral dissertation, Novi Sad: Faculty of Physical Culture, 1985.
- Lohman TG, Roche AF, Martorell R. Anthropometric Standardization Reference Manual. Champaign, IL: Human Kinetics Books, 1988.
- Medved R. Sports medicine. Second, a revised edition. JUMENA - Yugoslav Medical Circulation, 1981.
- Paušić J. Construction and evaluation of measurement procedures for assessing physical holding in a boy aged 10 to 13 years. Doctoral dissertation, Zagreb: Faculty of Kinesiology, 2007.
- Sabo E. Differences between boys and girls in anthropometric characteristics when enrolling in elementary school. *Pedagogical Reality*, 2006; 52(3-4): 302-310.
- Sretenović I, Nedović G. Comparison of anthropometric characteristics of children with cognitive impairments, children with sensory disorders and children of typical development Belgrade defectological school. Belgrade: School of Special Education and Rehabilitation, 2015; 21(2): 9-23.
- Torlaković A. The effects of the swimming school program on situational motoring and some morphological characteristics of children. *Sports Logos* 2014; 13(23): 37-45.
- Toskić D. The impact of a one-year judo training on certain anthropological dimensions in pupils of the younger school age. Doctoral dissertation, Leposavić: Faculty of Physical Culture, 2000.
- Živčić Marković K, Krističević T, Milčić L, Fišter M. From body turns to hand stands. Poreč: Proceedings of the 24th Summer School of Kinesiologists of the Republic of Croatia, 2015: 481-489.

Zrnzević N, Zrnzević J. Effects of teaching physical education on the functional abilities of female students of younger school. *Journal of the Anthropological Society of Serbia* 2015; 50: 1-9.

Zrnzević N. Efficiency of realization of program contents in teaching of physical education in lower grades of elementary school. Master's thesis, Novi Sad: Faculty of Physical Culture, 2003.

Zrnzević N. Transformation of morphological characteristics, functional and motor skills of students. Doctoral dissertation, Niš: Faculty of Sport and Physical Education, 2007.