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DEVELOPMENTAL CHARACTERISTICS OF MOTOR ABILITIES OF HIGH SCHOOL GIRLS

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Abstract. *This study was conducted on a sample of 710 high school girls, ranging from freshmen to seniors, who were divided into four sub-samples according to their chronological age: 180 female freshmen, 177 female sophomores, 177 female juniors and 176 female seniors. The aim of the study was to determine the differences in the developmental trend of motor abilities for students from 14 to 18 years of age. The testing of their motor abilities was done during regular physical education classes with 11 tests of motor skills that assessed speed, strength, flexibility, balance and coordination. The characteristics of the variables and sample size allowed the application of univariate analysis of variance and multivariate statistical factor analysis. The results showed the uneven growth of some abilities from the ages of 14 to 18. Students achieved the best results at the age of 15 and after that they halted or slightly declined. The largest decline in the results was determined for the balance test (MSUK) and static strength test (MVIS). A somewhat lesser decline was determined in the flexibility test (MDPK), and that is probably because of the decreased activity of the female population in this age group (a trend recorded in several studies), and it is known that flexibility is developed and maintained exclusively by exercise. An explanation of these results may be in the students' generally reduced level of physical activity, inadequate effects of physical education classes and insufficient engagement of society in general in solving these problems.*

Key words: *motor abilities, development, high school girls.*

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INTRODUCTION

The term physical abilities appeared in the works of theorists of physical education, in the late 19th and early 20th century. Today, the most commonly used term is "motor ability", which in experimental research is usually described as operationally defined latent dimensions derived from a system of measuring instruments.

Barrow and McGee (Barrow & McGee, 1975; as cited in Milojević, 2002) suggest that motor ability can be defined as the existence of an acquired or innate ability to professionally execute the movement of a general or basic nature, especially in specialized sports and gymnastic techniques. Furtherly, they divide motor skills into two components: motor skills composed of relatively lasting components, slowly changing under the developmental influence, and motor readiness that is more affected by exercise, and whose changes during development are easier to perceive and measure.

According to Kurelić, Momirović, Stojanović, Šturm, Radojević et al. (1975) motor ability is the part of the overall mental and physical ability that refers to a certain level of development of the basic human latent dimensions of motion, which condition the successful execution of movement, regardless of whether these skills were acquired through training.

Zaciorski (1967) gave perhaps the best definition of motor abilities stating they are those aspects of motor activity that appear in movement structures that can be described by the same parametric system, measured by an identical set of measures where analog physiological, biochemical, cognitive and conative mechanisms take place.

Among the researchers who deal with the problem of identification and measurement of motor skills, considerable disagreement exists regarding the number of these skills, and their anthropological meaning, which is best illustrated by Kukolj (2006) in an overview of the motor skills structure that different authors propose. The overview is as follows:

- Ozolin (1949), Matveev (1964), Harre (1971), Platonov (1984, 1997): Strength, speed, endurance, flexibility, agility;
- Zaciorski (1969): Strength, speed, stamina, agility, flexibility, sense of balance, muscle relaxation skill, a sense of time and space;
- Važni (1970): Strength, speed, endurance, coordination;
- Fidelius (1972): Strength, speed, (endurance);
- de Vris (1976): Strength, speed, agility, endurance, power, coordination, balance, flexibility, body control;
- Opavski (1983), Jarjulin (1999): Power, speed, endurance;
- Bompa (1999): Power, speed, stamina, strength, quickness, agility and flexibility, mobility
- Željaskov (2004): Power, endurance, speed, coordination and flexibility.

As far as the development of motor abilities is concerned, it can be said that it is an integral part of the overall development of a person. According to Zaciorski (1969), the development of physical properties (abilities) depends on the creation of conditional-reflex connections in the central nervous system, and to an even greater extent of biochemical and morphological changes in the body as a whole. Zaciorski made a distinction between the education and development of motor abilities.

"It has been determined in strength development that it gradually increases to the age of 25-30, after which a period of stabilization and decrease begins. The education of physical properties is called the pedagogical process of influences on the development, in order to guide changes in the right direction."

Thus, the basis of the development of motor abilities are changes in the body (mostly affected by heredity).

According to Bernstein (Bernstein, 1967; as cited in Milojević & Stanković, 2010) in children, as in adults, movement is not just a product of the central nervous system, but also the biomechanical properties of the body and the energy, environmental support, and the specific conditions of the task.

The relationship among these components is not hierarchical but pervasive, and Bernstein concludes that the action must be formed at a very abstract level, since it is impossible for the CNS to program interaction of all these factors in advance.

Farfelj (1972, as cited in Milojević, 2002) analyses the development of motor skills most thoroughly in his physiological theory, where he reports on the age-related development of motor abilities. His scientific approach is based on physiological parameters. Farfelj emphasizes the physiological and biochemical processes underlying the development of motor skills. His explanation of the development of motor skills is the following: the motor analyzer, as well as all the other functions of the CNS, develops with age (as in Zaciorski, 1969).

The intensity of the development of the motor analyzer depends on the amount and variety of movements that are performed in daily motor activity. Since motor activity is very intense in the younger school age, both in girls and boys up to the ages of thirteen or fourteen, and the result is a natural tendency to move at that age, it contributes to the development of the cortical part of the motor analyzer. Scientists have, studying changes in cell structure of the motor areas of the cortex, come to the conclusion that the process of cell maturation of the brain part of the motor analyzer ends at the age of thirteen to fourteen, when full maturity of nerve cells is completed, according to Farfelj (1972). There is a concurrence of morphological and physiological data on the development of motor abilities, and that is not incidental according to Farfelj. "It is well known that the structure of the body depends on its function, and in turn a function can be determined by the structure of organs. Therefore, it can be said that the morphological and functional maturation of the motor analyzer takes place during school age, ending mostly in 13-14 years of age." (Farfelj, 1972, 107). The explanation for the delay in motor development (at the age of 13-14), Farfelj saw that adolescent high school students, apart from their school work, are also interested in other activities such as art, music, etc., which further restrict their mobility in their daily activities.

On the other hand, there have been reports that due to the limited duration of hours and number of hours in the curriculum, despite different forms of work in order to improve the physical development and motor abilities of students in physical education classes, physical education teachers cannot significantly influence students' physical development and motor abilities (Višnjić, Jovanović & Miletić, 2004).

Farfelj (1972) further claims that there are two groups of motor abilities that have different developmental curves. In one group we find all those abilities that require great muscle strength, and their development continues after adolescence. In the second group we find abilities that do not require greater muscular exertion, such as orientation in space, the accuracy of movement, coordination and management of movement duration, and their development lasts only until the ages of 13 and 14, and after that their increase suddenly slows or stops.

According to Farfelj (1972), there are differences in the development curves of certain motor abilities between boys and girls, as follows: running speed and muscular leg strength of the girls ends at the ages of 13-14, while in boys it continues to see a slight increase.

The physical abilities of female pupils change with age, generally improving up to the age of 12-13, when they reach their maximum. After that they stagnate, and after two years their decline begins so that nineteen-year-old girls in their physical abilities are like girls of 11-12 years old. Acceleration of growth is observed in girls before the age of ten (Bailey, Malina, & Mirwald, 1986; Jürimäe & Jürimäe, 2000).

There are numerous studies in our country (Ivanić, 1996; Ivanić & Ivanić, 1999; Gajović, 2009) and abroad (Telama, Naul, Nupponen, Rychtecky & Vuolle, 2002; Hraste & Donđivić, 2006; Malina, 2007; Tomkinson, Olds & Borms, 2007; Strel, Bizjak, Starc & Kovač, 2008; Badrić, Sporiš, Trklja & Petrović, 2012) in which the authors track the physical development and physical abilities of different age groups of children and young people of both sexes, which showed mixed results. Most of these studies notified a downward trend in the level of the motor abilities of students from each upcoming generation (Gadžić & Vučković, 2012). However, it should be noted that studies with participants aged 14 to 18 are less frequent.

The problem of motor ability observation requires the exact determination of their levels in years, because the results in the field of physical training (education) are not complete if the control and monitoring of these processes are not performed, with the objective evaluation of their effects. The aim of the study was to determine the differences in the development trend of motor abilities for students aged 14 to 18.

METHOD

The sample of participants

This study was conducted on a sample of 710 high school girls ranging from freshmen to seniors, divided into four sub-samples (1st, 2nd, 3rd and 4th grade of high school), 180 female freshmen, 177 female sophomores, 177 female juniors and 176 female seniors.

Motor abilities are of a latent character and they cannot precisely be measured but only estimated (Bala, Stojanović & Stojanović, 2007). In this study, we applied 11 tests to measure motor abilities for assessing speed, explosive strength, repetitive strength, static strength, flexibility, balance and coordination. The testing of motor skills was done during regular physical education classes in a properly equipped physical education gymnasium. The team of measurers that was formed at the beginning of the testing procedure conducted the testing of motor abilities of the entire sample.

Instruments and procedures

The testing of motor abilities was carried out based on the reduced model from Kurelić and associates (1975). These tests have been applied in a number of studies (Bala & Madić, 2002; Bala, Erne, & Popović, 2005; Doder, Malacko, Stanković, & Doder, 2011; Drid et al., 2013) and they evaluate the following hypothetical dimension of the reduced model in this study:

1) Coordination

MCOR – Coordination with a baton - the task is performed using a 100 cm-long stick and mat. The candidate stands upward with his feet together in the middle of the mat. He holds the baton with both hands at the ends in front of himself. At the whistle signal he turns 180 degrees, sits, lies down on his back, slides his hand between his legs and gets up into an upright position with feet together and raised arms straight out at shoulder height in front of him. The result is the elapsed time from the start signal of the measurer until finishing in still an upright position holding the baton in front of him. This task is performed three times, and only the best result is recorded.

MS3M – Slalom with three medicine balls - the task is performed using three 2 kg medicine balls and 5 wooden stands. The stands are arranged in a straight line at a distance of 2 m. The first stand is at a distance of 1m from the start line. The candidate stands behind the starting line. In front of him are three medicine balls. Between the candidate and the medicine ball is the starting line. The candidate has to handle all three balls, rolling them with his legs and arms, between the stands to the rear stand and return the same way. The task is repeated two times. The result is the time in seconds, and the better of the two performances is registered.

MPBA – Polygon backwards – the test is done in the space of 12m where a line is drawn from the starting line at 1m, and the other one at 4m from the starting line. A frame of a vaulting box is placed on that line, i.e. the top padded part of it. The second frame is placed at 7m from the starting line transversely with the wider side. In the end, the line at 4m is drawn, which, when crossed, is the end of the test. The candidate is positioned on all fours with the use of the hands, feet placed on the 1m line. At the signal "now" he begins with the movement in the quadruped position, without lifting and turning. The candidate passes the first part of the vaulting box without lifting, runs through the frame of the box and after his hands and feet cross the finish line the time is recorded.

The test is performed two times and the better result is registered.

2) Balance

MSBR – Standing on one foot on the balance rail – the candidate stands barefoot on one leg perpendicular to the balance rail as his other foot touches the ground. He keeps his hands next to his body, palms placed against his hips. The measurement starts when the candidate lifts his leg off the ground and stays still on one foot with his hands at his hips, as long as he can. The test lasts no longer than 20 seconds. It is repeated three times.

3) Speed

M20H – the 20m run with a high start - the test is carried out at a distance of 20m. The start and finish line are marked to be recognizable from the surface. The candidate is in the high start position behind the starting line, but his toes must not cross the line. The measurer is at the finish line and on the command "now" the candidate runs down the marked sections as fast as possible. The test is done twice and the better result is registered.

M45H – the 4 × 5m run with a high start – the candidate is directly behind the starting line facing the location of the test performance. At the sign "now " he runs ahead to the stand where he switches to sideway running until the line on the side of the stand. When he crosses the line, without stopping and changing body stance, he returns the same way to the stand, where he changes his body stance and runs backwards to the starting line. When the candidate's whole body passes the starting line, the stopwatch stops.

MTAP – Plate tapping - equipment: a board with two fixed round plates with a diameter of 20 cm, 61 cm apart from each other (the closest parts), a table, chair, stopwatch with 1/10 seconds. The candidate places his "weaker" arm midway between the plates and his "stronger" arm on the board from the opposite side. In a time of 20 seconds he tries to touch as many times as possible one plate to the other alternately. The total number of touches the timekeeper has counted for 20 seconds is recorded, but two touches are worth one point.

4) Flexibility – for the evaluation of flexibility we used the following test:

MSFB – Standing forward bend – the task is performed on a bench with a height of 40 cm, on whose side we find a vertical wooden lath fixed with a tape measure 80 cm in length, starting from the top to the end on the floor. The candidate stands barefoot on a bench, feet together, straight legs with toes directly behind the lath. Bending along the lath, the candidate with crossed hands tries to reach as low as possible and to the greatest possible value on the meter scale mounted on the lath. The result is the furthest reached value expressed in centimeters. The test is repeated three times with short breaks for up to 15 seconds, and the best result is recorded.

5) Strength – for the evaluation of explosive strength we used:

MSBJ – the standing broad jump – the candidate pushes off vigorously with both feet and jumps as far as possible off the reverse end of the springboards and lands on the mat with feet together. Three jumps are performed, and improperly performed jumps are repeated. The longest jump measured in cm is recorded. The candidate performs jumps barefoot. A double push off is not allowed. The candidate is allowed to raise up on his toes before pushing off.

To estimate repetitive strength we used:

MDPB – Dips on parallel bars – this task is performed on parallel bars with adjustable shoulder width. The candidate begins with both hands fully extended on the bar with his body supported by his hands and suspended. He gets down until his shoulders touch the measurer's hand placed on the bar. The measurer with one hand prevents the sway of the candidate, and with the second hand (placing a hand on a bar) controls the amplitude of movement, or the lowest position. The candidate performs the maximum number of pushups until failure. The registered result is the number of candidate's fully executed push-ups. A complete push-up is one lowering and lifting of the body. This task is performed once.

For the assessment of static strength we used:

MBAH – the bent arm hang - this task is performed using the horizontal bar. The candidate gets to the starting position of a pull-up with a chin at bar level with the measurer's assistance. The measurer stands on a chair so that his face is at the height of the horizontal bar. All the time he encourages the candidate to endure as long as he can in the previously described initial position. The stopwatch is stopped when his chin drops below the upper edge of the bar. The result is the time in seconds during which the candidate kept the described position.

Statistical analysis

Given that the main problem and the goal of the study was to determine differences in the development trend of motor abilities for students aged 14 to 18, it was necessary to choose procedures that are believed to correspond to the nature of the problem and not to put too much of a limitation of the basic information. The characteristics of variables and sample size allowed us to process the results with the univariate analysis of variance and multivariate statistical method of factor analysis.

RESULTS

In order to gain insight into the problem of the present study, the quantitative and qualitative changes that occur during the development of fourteen to eighteen-year-old female students were analyzed.

Table 1 The means and univariate analysis of variance for schoolgirls of the first to the fourth year of high school

Variable	M_1	M_2	M_3	M_4	F
MTAP	22.81	22.43	21.88	21.71	8.63*
MSBR	215.66	218.27	184.74	186.35	6.58*
MSFB	35.41	33.89	32.63	32.64	12.36*
MPBA	162.47	163.47	166.00	172.00	6.16*
MCOR	70.77	71.58	72.57	73.21	2.64*
MS3M	289.00	288.79	287.36	291.56	0.39
M20H	40.76	41.16	41.41	41.35	1.25
M45H	88.88	89.31	89.68	89.79	0.78
MSBJ	170.63	165.70	162.94	163.68	8.08*
MBAH	208.77	202.31	184.35	181.06	6.72*
MDPB	16.75	16.17	16.51	15.05	3.83*

for $P \leq 0.05$ with DF1 = 3 and DF2 = 706 $F \geq 2.62$

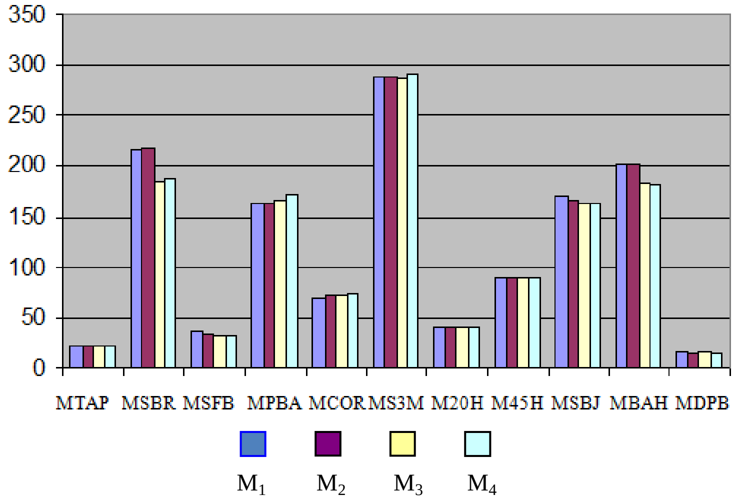

Fig. 1 Arithmetic means of motor abilities tests for the female students

Analyses of the values of arithmetic means are presented in Table 1. Figure 1 shows uneven growth in some abilities during the period of development from the age of 14 to 18. For most of the motor abilities tests, the students achieve the best results at the age of 15, and then they halt or slightly decline. The largest decline was noted in the test of balance (MSBR) and static strength test (MBAH), a slightly smaller decline was in the flexibility test (MSFB), which can probably be explained by the inactivity of the female population at this age, and it is known that flexibility is maintained and developed mostly by exercise. This is supported by Farfelj's (1972) findings that proved that in the active population (competitive athletes) there is no such decline in these abilities. These results are consistent with Farfelj's physiological theory of development, who claims that development of most motor abilities of girls finishes within the ages of 13 and 14.

Table 2 Matrix of principal components of motor abilities for first-year students

	Lv-1	Lv-2	h^2
MTAP	.64	-.32	.52
MSBR	.32	-.27	.18
MSFB	.46	-.18	.24
MPBA	-.68	.10	.47
MCOR	-.49	.29	.33
MS3M	-.65	.16	.45
M20H	-.69	.36	.60
M45H	-.62	.22	.44
MSBJ	.43	-.32	.29
MBAH	.26	-.13	.08
MDPB	.25	-.03	.06
Lambda	4.73	2.49	
%	23.7	12.5	
Cum. %	23.7	36.2	

A factor analysis of the motor abilities of the first-grade high school girls revealed two factors which explained 36.2 % of the common variance. The matrix of the principal components and communalities are presented in Table 2. The first principal component is defined by the variables of speed and coordination. The second principal component was defined with a somewhat lower bipolar coefficients of the variables for speed and explosive strength estimation. The values of communalities indicate that most variables have a moderate part in defining the system. Rather low communalities were found in the variables of repetitive and static strength and flexibility.

Table 3 The matrix of principal components of motor abilities for second-year students

	Lv-1	Lv-2	h^2
MTAP	.55	-.07	.31
MSBR	-.30	-.04	.09
MSFB	.55	.06	.31
MPBA	-.45	.43	.39
MCOR	-.43	.28	.27
MS3M	-.37	.55	.44
M20H	-.42	.58	.53
M45H	-.30	.47	.31
MSBJ	.70	-.04	.50
MBAH	.26	-.46	.28
MDPB	.57	.21	.37
Lambda	5.47	2.31	
%	27.4	11.6	
Cum. %	27.4	38.9	

The results from Table 3 show the coefficients of the principal components matrix for second-grade female students' motor abilities. The factor analysis extracted two factors that accounted for 38.9 % of the variance of all the selected motor variables. The first principal component was mostly defined with explosive strength, followed by repetitive strength, speed of alternating movements and flexibility. The second component was best represented by the speed test (M20H) and a coordination test (MS3M). The communalities were of fairly moderate and low values.

Table 4 The matrix of principal components of motor abilities for third-year students

	Lv-1	Lv-2	h^2
MTAP	.24	-.40	.21
MSBR	.13	-.47	.24
MSFB	.22	-.55	.35
MPBA	-.19	.55	.34
MCOR	-.22	.32	.16
MS3M	-.38	.37	.28
M20H	.19	.58	.38
M45H	-.10	.13	.02
MSBJ	.13	-.79	.64
MBAH	-.21	-.25	.10
MDPB	-.46	.01	.21
Lambda	5.32	3.20	
%	26.6	16.0	
Cum. %	26.6	42.7	

The factor analysis of the motor abilities for third-year high school students extracted two significant factors that account for 42.7 % of the total variance. The first component was defined by repetitive strength and coordination, while the second component had one distinguished loading from explosive strength followed by speed (M20H), coordination (MPBA) and balance (MSFB). The communalities were of quite low values, except for explosive strength.

Table 5. The matrix of principal components of motor abilities for fourth-year students

	Lv-1	Lv-2	h^2
MTAP	-.10	-.31	-.11
MSBR	.17	.60	.39
MSFB	.21	-.30	.14
MPBA	.32	-.63	.50
MCOR	-.21	-.15	.07
MS3M	.08	-.24	.06
M20H	-.51	.17	.29
M45H	-.48	.10	.25
MSBJ	-.23	-.00	.05
MBAH	-.14	-.08	.02
MDPB	.55	.23	.35
Lambda	4.07	1.75	
%	20.4	8.8	
Cum. %	20.4	29.1	

The results from Table 5 depict the principal components of motor abilities for fourth-year students. Two principal components were extracted and they accounted for just 29.1 % of the total variance. The first component was defined by repetitive strength (MDPB) and speed (M20H and M45H). The second component had two significant loadings from variables that estimated coordination (MPBA) and balance (MSFB). The communalities had low values, except for coordination (MPBA). Tables 2 to 5 show the results of the factor analysis for each age group of high school students. These results indicate that female students of different ages are a heterogeneous system when viewed from the standpoint of their motor skills. Although just two factors explained the common variance of the analyzed variables, it is evident that different motor abilities define these factors for each age group. Therefore, it is clearly indicated that certain changes exist in the structure of motor abilities during the development of the population of female high school students.

DISCUSSION

Monitoring the development of motor abilities in adolescents is of great importance for teachers, pedagogues and psychologists, yet it is a fairly neglected topic in our country. While determining the development of motor abilities, the obtained results show considerable fluctuations in the literature attributed to the genetic limitations and lack of exercise (Mraković & Findak, 1997). The results of our study are consistent, to a certain extent, with the results obtained by other authors. In their research, Hraste & Donđivić (2006) followed the developmental trend of anthropometric characteristics and motor abilities of nine generations (from 1997 to 2005) of high school girls. The authors noted considerable alterations in motor variables estimating flexibility, static and repetitive strength. They found that the static strength test (bent arm hang) had the most notable decline which is similar to our findings. Strel *et al*. (2009) performed a longitudinal comparison of the body characteristics and motor abilities of two generations of Slovenian students aged 7 to 18. The authors found out that the students' motor abilities gradually declined over a course of time and they attributed that to the constant increase in body weight and lack of physical activity. The most significant decline of the results for girls was in static strength (bent arm hang) and slightly less in flexibility, making these findings fairly congruent with our results. Loko *et al*. (2000), conducted a cross-sectional study aimed at establishing the smooth curves of motor performance status in 10 to 17-year-old Estonian girls and they identified statistically significant differences of all the studied motor abilities between the age groups of 10-12. That difference was somewhat smaller between the age groups of 13 and 12. At the age of 14, the performance was not higher than at 13, except in the vertical jump and quintuplet jump. From the ages of 14 to 16, the differences reappeared in almost all the applied tests, except in the 30 m dash and standing long jump. Similar to our findings, these authors believed that the final stabilization of motor abilities occurred from the age of 16. Ekblom, Oddsson, & Ekblom (2005) conducted a study with the aim of obtaining reference data on the physical performance in the Swedish children and adolescents aged 10, 13 and 16 years, respectively. These authors found that in girls all motor abilities increased with age, except for balance where, similar to our study, the greatest decline was registered. On the other hand, Moliner-Urdiales *et al*. (2010) analyzed the secular trends in health-related physical fitness in Spanish adolescents between 2001-2002 and 2006-2007. Two representative population studies were conducted 5 years apart and in both studies they used the same tests to assess physical fitness: the handgrip strength, bent arm hang, standing broad jump, 4x10 m shuttle run and 20 m shuttle run tests. The authors also obtained ambiguous results and found that the levels of both speed/agility were higher in 2006-2007 than in 2001-2002, whereas muscular strength components were lower in 2006-2007.

All these results confirmed two major findings: alterations in motor ability development and a gradual decline of motor abilities in this population. Unfortunately, a negative trend in motor abilities of students exists for such a long time that almost the same results were obtained by Leskošek *et al*. (1979) who explored the development of the students' physical abilities aged 8 to 18, from Serbia. More recent are data of the Serbian Institute of Sport and Sports Medicine (Gajević, 2009), and they indicate that the secular trend in the development of motor abilities of students is going in a negative direction, i.e. a reduction of the motor abilities occurs at the elementary school level, so that the results of this study are not surprising. It is obvious that such a trend exists in other countries as well (Telama et al., 2002; Corder, van Sluijs, Ekelund, Jones, & Griffin, 2010; Runhaar et al., 2010; Dumith, Gigante, Domingues & Kohl, 2011; Badrić, Sporiš, Trklja & Petrović, 2012). The authors found an explanation for these results in the generally reduced level of physical activity of students, inadequate effects of physical education and insufficient engagement of society in general to solve these problems.

CONCLUSION

In accordance with the purpose of this study, to determine changes in the level and structure of motor abilities of girls aged between 14 and 18, 11 tests for the assessment of motor abilities selected from the reduced model of motor skills, defined by Kurelić *et al*. were applied (1975). The following motor abilities were assessed: explosive strength, repetitive strength, static strength, speed, flexibility, balance and coordination. The analysis of the obtained results suggests the following conclusions: the development of motor abilities in girls ends at the age of 13-14 (which is in line with Farfel's claims of the physiological theory). Students achieved best results in almost all motor tests (except flexibility) in the first year of high school, and later, in the fourth grade, these results remained the same, or slowly declined.

Considering that in our country there is no organized system of monitoring the development of motor abilities in the teaching of physical education, the importance of this research is to obtain feedback from the process of teaching in physical education, as well as determining the effects. This information is needed in order to create adequate planning of the teaching process, which is the main precondition for the improvement of the physical abilities of students, and that topic is certainly not sufficiently explored at this age.

The reasons for such results should be sought in the engagement of the PE teachers in the physical education teaching process and in the level of high school students' motivation to actively participate in sport in high school. Adolescents are facing highly turbulent changes in their psycho-somatic state, and this requires additional motivation to exercise, as an integral part of growth and development. It is possible that one period in development can be a suppressor in the realization of movement and manifestation of motor abilities in girls.

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RAZVOJNE KRAKTERISTIKE MOTORIČKIH SPOSOBNOSTI SREDNJOŠKOLKI

Ovo istraživanje je sprovedeno na uzorku od 710 učenica srednjih škola od prvog do četvrtog razreda, raspoređenih u četiri subuzorka prema uzrastu, i to 180 učenica prvog, 177 drugog, 177 trećeg i 176 četvrtog razreda. Cilj rada je bio da se utvrde razlike u trendu razvoja motoričkih sposobnosti kod učenica od 14 do 18 godina starosti.

Testiranje motoričkih sposobnosti je izvršeno za vreme redovnih časova fizičkog vaspitanja pomoću 11 testova motoričkih sposobnosti koji su procenjivali brzinu, snagu, gipkost, ravnotežu, koordinaciju. Karakteristike varijabli i veličina uzorka su omogućili da se rezultati obrade uz pomoć univarijantne analize varijanse i multivarijantne metode faktorske analize. Rezultati istraživanja su pokazali neravnomeran rast nekih sposobnosti u uzrastu od 14 do 18 godine. Na većini testova motorike učenice su postigle najbolje rezultate na uzrastu od 15 godina, a onda dolazi do zastoja ili do laganog opadanja. Najveće opadanje razultata je na testu ravnoteže (MSUK) i testu statičke snage (MVIS), a nešto neznatnije opadanje je na testu fleksibilnosti (MDPK), što je verovatno posledica smanjene fizičke aktivnosti ženske populacije u ovom uzrastu (evidentiran trend u više istraživanja), a zna se da se fleksibilnost razvija i održava isključivo vežbanjem. Objašnjenje ovakvih rezultata može biti u generalno smanjenom nivou fizičke aktivnosti učenika, nedovoljnim efektima nastave fizičkog vaspitanja i nedovoljnom angažovanju društva uopšte u rešavanju ovih problema.

Ključne reči: *motoričke sposobnosti, razvoj, struktura.*