Research article

THE DEVELOPMENT OF MOTOR ABILITIES OF YOUNG ATHLETES AND GYMNASTS IN THE INITIAL PREPARATION PHASE

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Abstract. *The aim of this study is to determine the effect of sports gymnastics and athletics training on the development of athletes' motor abilities in the initial preparation phase. The study was conducted on a sample of 81 girls and boys of about 9 years of age, who train athletics (N=34) and gymnastics (N=47). A total of 9 variables were observed, three to assess anthropometric characteristics (body height, body mass and the body mass index) and 6 to assess the participants' motor abilities (explosive leg power, repetitive power, agility, power endurance, flexibility, cardiorespiratory endurance). The one-sample t-test was used to compare the results with mean values of the general population of the same age, whereas a univariate ANOVA was used to compare the results between the athletes and the gymnasts of different genders. The results show that the level of motor development in girls is significantly higher than in the general population, while in boys, significant progress was not registered in power endurance and cardiorespiratory endurance, regardless of the sport they are engaged in. Regardless of gender, gymnasts have better flexibility compared to athletes, while athletes have significantly higher explosive power and agility.*

Key words: *Power, Endurance, Agility, Flexibility, Children*

INTRODUCTION

Modern sport and trends in its development impose the necessity of a constant improvement of all factors that influence the outcome. Long-term planning concepts considering the overall sports career of an athlete from the beginning of a training process until the end of the sports career emerged a long time ago and have been developing ever since through the Long-Term Athlete Development model (LTAD). Given that the unique biological and psychosocial development of an individual is one of the basic goals of sport as a social phenomenon it is important to consider the overall career of an athlete, which additionally gains in significance. A sports career involves several linked and interdependent stages, with its own goals, that an athlete goes through. Various models according to which a career is divided into smaller parts consider the issue associated with the beginning of sports engagement in a relatively similar way. This period is very important and sensitive since it represents the beginning of a long-term process, where possible errors cannot later be corrected even with great effort. It is a basic training period and a period of basic instructions (Wilke & Madsen, 1986), a non-specific training period (Lazlo, 1986), a period of preliminary sports preparation and basic training (Vorontsov, 1998), or an initial preparation phase and previous base (Platonov, 1999), i.e., initiation phase (from 6 to 10 years of age) and period of sport fitness (up to 14 years of age) (Bompa, 2009).

The initial preparation phase implies diverse and interesting training sessions lasting up to 60 minutes 2 to 4 times a week. The training is not oriented towards a specific sport or sports discipline, but primarily towards a specific child. In this sense, the training sessions are much like physical education classes organized at schools (and they are even complementary), that affect versatile and harmonious child development by encouraging and stimulating natural child development and defect correction. According to the aforementioned LTAD model, the initial preparation phase includes training and development through play and fun ("FUNdamental") as one of the key processes, where the sports disciplines belonging to the group of basic sports provide the basic abilities necessary for all other sports and they are athletics, gymnastics and swimming (Balyi, 2001).

It is of utmost importance to develop most motor abilities in the initial preparation phase, i.e., to provide a good motor base for a further sports development by encouraging the development of these abilities timely during certain sensitive periods. Specifically, the work should be done to develop all the motor abilities whose sensitive period is current during this phase and special attention should be paid to those abilities that are crucial to success regarding a specific sports discipline. Thus, an athlete's body should be prepared for what follows in the upcoming phases of their sporting career. Physical activity aimed at motor ability development is most efficient between the ages of 7 and 17 (Malina, Bouchard, & Bar-Or, 1991), and the period between the ages of 9 and 12 has been referred to by many authors as the most important interval in child motor development (Rushall, 1998; Viru et al., 1998; Balyi & Hamilton, 2004).

Since the development of young athletes' motor abilities represents a priority in the initial preparation phase and given that the contents of basic sports are recommended for such a development, the aim of this study is to determine the effect of sports gymnastics and athletics training on the development of athletes' motor abilities in the initial preparation phase. Specifically, this paper includes an analysis of the development of young athletes and gymnasts' motor abilities in the initial preparation phase, i.e., during the period of the children's first contact with organized sports, by comparing the mean values of the general population of children in the Republic of Serbia (Milanović & Radisavljević, 2015).

<div align="center">METHODS</div>

This research is of a transversal character conducted on a sample of children of both genders who are engaged in athletics and gymnastics. The children's motor abilities and the parameters of their physical development were assessed and then compared with the reference values of the population of boys and girls of the same age.

The sample of participants

This study was conducted on a sample of 81 girls and boys aged 9 years with training experience of 1-2 years. The participants are members of the Athletics Club "Crvena Zvezda", Belgrade (N=34) or the sports Gymnastic Club "DIF", Belgrade (N=47) for 60 minutes per training, 3 times a week according to the official program of the Gymnastics Association of Serbia (www.gssrb.rs) and the program of the athletics school of the Athletics Club "Crvena Zvezda" (www.akcrvenazvezda.rs). The total sample is divided into four groups according to gender and the sports they are engaged in as follows: male gymnasts (♂G; N=19), male athletes (♂A; N=16), female gymnasts (♀G; N=28) and female athletes (♀A; N=18).

Experimental protocol

All the measurements were carried out in the morning hours, in the sports facilities where the children practice, i.e. in the gym of the Faculty of Sport and Physical Education in Belgrade (gymnasts) and in the Indoor Athletics Hall in Belgrade (athletes). A total of 9 variables were examined, 3 variables to assess the participants' anthropometric characteristics and 6 variables to assess their motor abilities. The participants' physical characteristics were measured first and then their motor abilities were tested.

Measurement of physical characteristics

Body height (BH) and body mass (BM) were measured to assess the physical growth and body composition and Body Mass Index (BMI, in $kg \cdot m^2$) was calculated using the obtained data. A Martin type stadiometer (Seca Instruments Ltd., Hamburg, Germany) was used to measure body height, and a Tanita Inner Scan Model BC-578 scale (Tanita Europe GmbH., Sindelfingen, Germany) was used to measure body mass.

Testing of motor abilities

The following tests were used to assess motor abilities: the Standing long jump (LJ in cm) to assess explosive leg power, 30 seconds sit-up test (SU30 in repetitions) was used to assess repetitive power, 4x10 m agility shuttle run test (4x10 in s) to assess agility, the Flexed-arm hang test (FH in s) used to measure power endurance, the Sit and reach test (SnR in cm) used to assess flexibility, and the 20 m progressive shuttle run test (SR20 in s) to assess cardiorespiratory endurance. The selected motor tests correspond to the battery of tests used in the study which was conducted on a sample of about 12.000 participants to test the specified motor abilities and physical characteristics of children aged 9-14 and the obtained results have been set as the parameters for this population (Milanović & Radisavljević, 2015).

The testing of motor abilities was preceded by a standard warm-up procedure lasting 7-10 minutes which consisted of different variants of a running and shaping workout. Prior to carrying out each test, the participants were instructed in detail on how the test should be performed, and each participant was allowed one attempt, except in the case of the 20 m progressive shuttle run test. The same examiner carried out all the measurements within one test.

The Standing long jump (LJ) was carried out on a flat non-slip surface which contains the take-off line clearly marked and a metal tape set up along the landing area to measure the jump distance. The participant's task was to jump as far as possible using a two-foot take-off and landing. The test result is the distance between the take-off line and the nearest point of contact with the ground on the landing. The results are given with an accuracy of 0.01m. The participant is allowed three attempts and the best score is taken into account for the analysis.

Sit-ups in 30 seconds (SU30) was performed on a gym mat where the participant is lying on his/her back, knees bent at an angle of 90° and feet flat against the floor at the hips width, hands behind the head while the legs are firmly fixed by an assistant. The participant's task is to perform as many sit-ups as possible within a period of 30s. The result is expressed by the total number of correct sit-ups completed in 30s.

The 4×10 m Agility shuttle run test (4×10) was performed on a 10m-long track marked with two lines of 1.2 m in length. At the end of the track, behind the line, there were two sponges. The participant's task was to run along a distance of 10 m four times as quick as possible. At the examiner's signal the participant sprints as fast as possible to the opposite side, places one foot across the marked line, takes one sponge and then runs backwards to the start line, crosses it with one foot and leaves the sponge. Then the participant repeats the same task once again, but with another sponge in their hand and sprints over the starting line. The test result is the time in which the participant performs the entire task and it is expressed with an accuracy of 0.1 s. If the participant fails to perform the test correctly, i.e. fails to step across the line with their foot every time, the measurement should be repeated.

The Flexed-arm hang test (FH) was performed on a horizontal bar with a stool placed beneath it, which enables the participant to assume the initial position easily. The participant stood on the stool and gripped the overhead bar using an underhand grip, hands placed at shoulder width, while the chin is placed above the overhead bar or at the height of the bar. The participant, having assumed the correct initial position, the stool was removed and the examiner started timing. The participant's task was to hang for as long as possible and the timing was stopped when the participant's chin fell below the bar level. The participant's body must not swing during the test and the legs must be hanging straight. The test result is the total hanging time and is expressed with an accuracy of 0.1 s.

The Sit and reach test (SnR) was performed using a wooden box (0.45 m × 0.35 m × 0.32 m), a ruler and a slider on the top edge of the box (0.6 m × 0.35 m). The participant sat in front of the box, barefoot, legs stretched out in front of the box and both feet flat against the front end of the test box. The top edge of the box was fixed so that 0.15 m of it extended over the front end and this extension was positioned over the participant's legs. Holding this position, the participant leaned forward and reached out with their arms outstretched and their hands on top of each other and pushed the slider as far as possible. The result was read out using the ruler and was expressed in centimeters. The participant performed the test twice, and the better score was taken for analysis.

The 20m progressive shuttle run test (SR20) was performed on a 20m-long track, where the participants ran following the pace given by a sound signal, i.e. beep. The participant's task was to run as far as possible, i.e., to run at the given pace as long as possible. The initial speed was 2.36 m/s (8.5 km/h) and it increased by 0.14 m/s (0.5 km/h) every minute. As a rule, before the beep, the participant had to be standing with both feet behind the marked line. The test was over when the participant could no longer follow the given pace, i.e., if the participant failed to cross the line three times in a row before the beep sound or if he/she gave up voluntarily. The test result was recorded as the total time run expressed in seconds.

Statistical data processing

All the data obtained by the tests performed were processed by statistical procedures using the programs SPSS version 20.0 and Excel. Arithmetic means (Mean) and standard deviation (SD) were determined as descriptive indicators. The one sample t-test was used to compare the obtained results with the mean values of the general population of the same age, whereas a univariate ANOVA was used to compare the results between the athletes and the gymnasts of different genders.

RESULTS

Table 1 shows the descriptive indicators of the physical characteristics and motor abilities of the studied athletes and gymnasts as well as the reference values of the general population of boys and girls of the same age.

Table 1 Physical characteristics and motor abilities (arithmetic mean±standard deviation)

Variables	Boys			Girls		
	Sports gymnastics (N=19)	Athletics (N=16)	Reference values	Sports gymnastics (N=28)	Athletics (N=18)	Reference values
BM (kg)	29.0 ± 3.2	34.2 ± 6.3	35.8 ± 8.4	27.9 ± 3.9	33.1 ± 4.9	35.2 ± 8.4
BH (m)	1.3 ± 7.2	1.4 ± 0.1	1.4 ± 0.1	79.4 ± 64.1	1.4 ± 0.1	1.4 ± 0.1
BMI (kg·m^2)	16.9 ± 1.4	17.1 ± 2.6	18.1 ± 3.2	16.1 ± 1.5	17.0 ± 1.9	17.9 ± 3.3
LJ (cm)	143.6 ± 22.8	156.8 ± 20.5	130.0 ± 22.0	135.7 ± 14.1	162.1 ± 13.8	118.0 ± 19.0
SU30 (reps.)	21.7 ± 5.5	23.0 ± 3.2	18.7 ± 5.0	20.8 ± 4.4	23.2 ± 2.4	16.7 ± 4.7
4x10 (s)	14.0 ± 1.1	11.6 ± 0.8	13.4 ± 1.4	14.5 ± 0.7	11.4 ± 0.6	14.0 ± 1.4
FH (s)	24.4 ± 17.9	21.5 ± 12.6	20.0 ± 17.0	27.0 ± 19.8	25.1 ± 18.9	14.0 ± 13.0
SnR (cm)	21.5 ± 4.1	15.0 ± 6.6	18.3 ± 6.0	25.3 ± 6.2	23.9 ± 3.4	20.5 ± 5.8
SR20 (s)	206.8 ± 82.5	210.2 ± 75.2	200.0 ± 94.0	191.1 ± 56.4	216.3 ± 90.0	157.0 ± 66.0

Legend: BM-body mass; BH-body height; BMI-body mass index; LJ-long jump; SU30-sit-ups; 4 × 10-agility shuttle run 4×10 m; FH-flexed-arm hang; SnR-sit and reach; SR20-20 m progressive shuttle run test

Table 2 shows the results of the t-test which compared the physical characteristics and motor abilities of the young athletes and the general population of boys and girls of the same age. The indicators of physical development have shown a significantly lower growth, lower body mass and BMI in the boys and girls who are engaged in sports gymnastics in relation to the general population. The girls engaged in both sports disciplines

achieved better results in all the tests measuring motor abilities in relation to the girls of the same age belonging to the general population. The boys showed a better developed explosive power, repetitive power and agility and the gymnasts were found to have even better flexibility in relation to the boys of the same age of the general population.

Table 2 Comparing the physical characteristics and motor abilities of the gymnasts and athletes of both genders in relation to the mean values of the general population of the same age

| Variables | Boys | | | | | | Girls | | | | | |
| | Sports gymnastics | | | Athletics | | | Sports gymnastics | | | Athletics | | |
	Mean Diff.	t	p	Mean Diff.	t	p	Mean Diff.	t	p	Mean Diff.	t	p
BM (kg)	-6.84	**-9.42**	0.000	-1.58	-1.00	0.331	-7.26	**-9.78**	0.000	-2.14	-1.86	0.081
BH (m)	-0.064	**-5.41**	0.000	0.016	0.99	0.334	-0.106	**-8.43**	0.000	-0.004	-0.28	0.784
BMI (kg·m^2)	-1.64	**-5.50**	0.000	-1.02	-1.58	0.135	-1.43	**-4.61**	0.000	-0.92	-2.02	0.059
LJ (cm)	13.61	**2.61**	0.018	26.81	**5.23**	0.000	17.7	**6.64**	0.000	44.11	**13.57**	0.000
SU30 (n)	2.98	**2.37**	0.029	4.3	**5.30**	0.000	4.12	**4.96**	0.000	6.52	**11.70**	0.000
4×10 (s)	0.62	**2.39**	0.028	-1.83	**-8.63**	0.000	0.55	**3.99**	0.000	-2.58	**-17.14**	0.000
FH (s)	4.43	1.08	0.296	1.54	0.49	0.633	13.01	**3.47**	0.002	11.11	**2.50**	0.023
SnR (cm)	3.23	**3.45**	0.003	-3.3	-2.02	0.062	4.79	**4.07**	0.000	3.39	**4.24**	0.001
SR20 (s)	6.84	0.36	0.722	10.19	0.54	0.596	34.14	**3.20**	0.003	59.33	**2.80**	0.012

Legend: Mean Diff.-arithmetic means difference; BM-body mass; BH-body height; BMI-body mass index;
LJ-long jump; SU30-sit-ups; 4×10-agility shuttle run 4x10 m; FH-flexed-arm hang; SnR-sit and reach;
SR20-20 m progressive shuttle run test

The comparison of the physical characteristics (Figure 1) and motor abilities (Figure 2) of the gymnasts and athletes of different genders has been presented only for those variables for which the ANOVA showed that there were differences between the groups: BM (F=9.143), BH (F=17.604), LJ (F=9.964), 4x10 (F=75.849), SnR (F=13.566); the significance for all the variables was set at the level $p<0.0001$. The gymnasts of both genders had a lower body mass and body height compared to the athletes of both the same or different gender, whereas the differences between the gymnasts of opposite genders were not found to be significant.
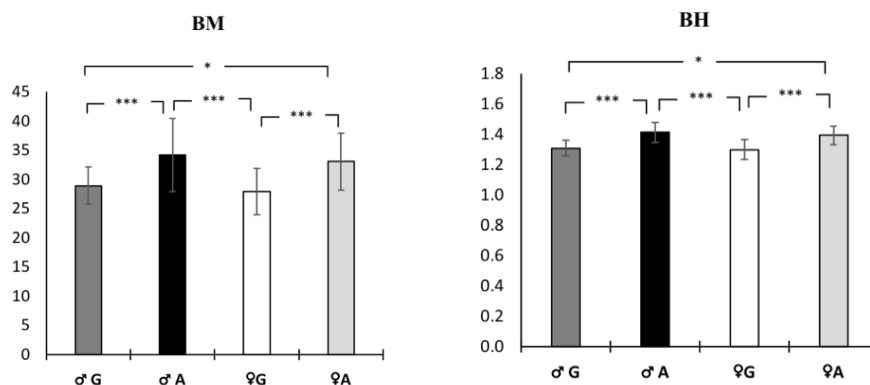

Fig. 1 Comparison of the results of the anthropometric characteristics of the gymnasts and athletes of different genders (Univariate ANOVA) - *p<0.05, ** p<0.001, *** p<0.0001 (♂G-male gymnasts, ♂A-male athletes, ♀G-female gymnasts, ♀A-female athletes)

According to gender, the differences between the groups in the Long jump test were found in the girls, in favour of the female athletes (Figure 2). There were no differences between the genders within the same sport found in the results achieved on this test, whereas the differences were determined between the boys and girls engaged in different sports and they were in favour of the athletes of both genders. In the 4x10 test, the athletes of both genders scored better than the gymnasts of both genders. Within the same sports discipline there were no differences in the results achieved on this test between the genders. Similar to the Long Jump test, the analysis of the results achieved by the boys and girls engaged in different sports has shown that the athletes of both genders achieved better results. In the SnR test, the gymnasts of both genders achieved better results than the boys engaged in athletics, while there were no differences determined in comparison with the female athletes. Within the same sports discipline, the differences in the SnR test were observed only between the boys and girls engaged in athletics, in favour of the girls.
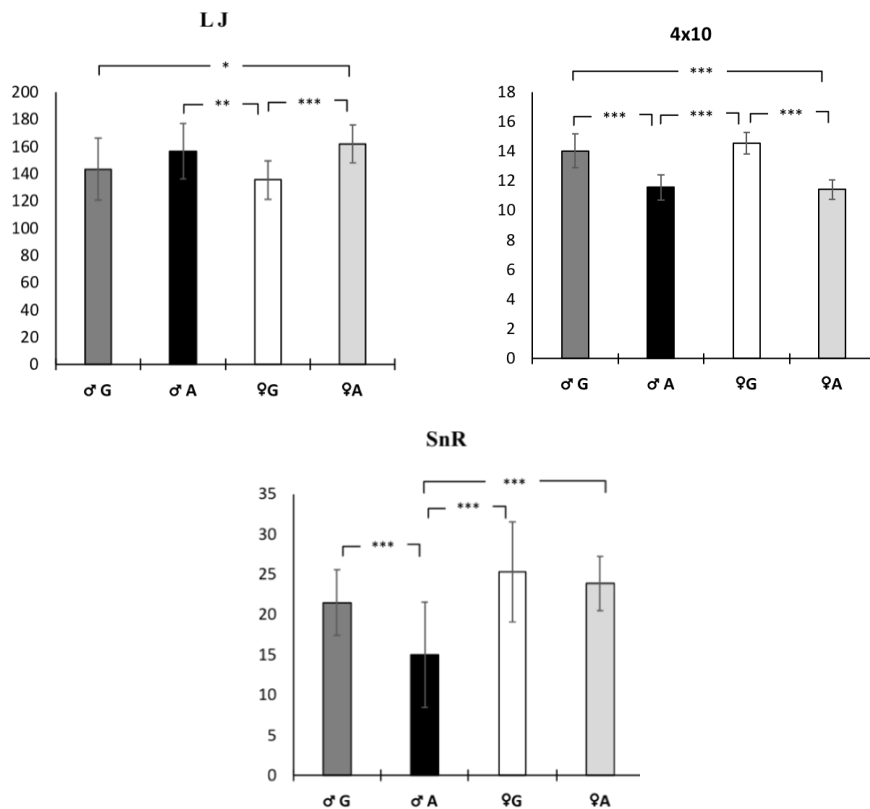

Fig. 2 Comparison of the results of the motor abilities of the gymnasts and athletes of different genders (Univariate ANOVA) *p<0.05, ** p<0.001, *** p<0.0001
(♂G- male gymnasts, ♂A- male athletes, ♀G- female gymnasts, ♀A- female athletes)

DISCUSSION

In this paper, the physical characteristics and the development of motor abilities of young athletes in the initial preparation phase were analysed in order to determine the effect of training on the studied physical and motor qualities of young athletes during this phase of their sporting careers.

The results of the analysis of anthropometric characteristics have shown that the gymnasts had significantly lower values of BM and BH compared to the average population of children of the same age. Sports gymnastics belongs to the sports of an early specialization (Balyi, 2001), which indicates the need to single out individuals who fit the model of an athlete relevant for this sports discipline, according to their physical characteristics through preliminary selection (Atiković, Kalinski, & Čuk, 2017). Specifically, after a one-year training experience, the nature of this sports discipline may have resulted in a certain selection, i.e., a possible dropout, due to a more directed program that is more easily realized by shorter practitioners. Also, it may be assumed that the parents themselves involve their children in exercise primarily according to the model of physical characteristics of the athletes engaged in a specific sports discipline. When it comes to athletics, the observed anthropometric characteristics have not shown significant deviations from the mean values of the population of children of the same age. It should be noted that the program including initial selection in athletics implies work on the basic technical elements belonging to various events (running, jumping, throwing), that the selection of competitors per specific event is carried out during the later phases of the sporting career, as well as that children have not spent enough time participating in sports to develop their sport specific qualities (Opstoel et al., 2015). The differences in the anthropometric characteristics found between the athletes and the gymnasts of the same gender are exactly in line with the aforementioned statements, since these athletes' characteristics showed no deviations from the mean values of the population of children of the same age, whereas they were significantly different in the gymnasts. Having analysed the results of the BMI, it may be concluded that BM is affected by BH and not by any another factor.

A higher degree of development of motor abilities in athletes and gymnasts was noticed in almost all observed abilities compared to the average population of children of the same age, which is in line with previous studies that observed the development of these abilities at the same stage of sports career development (Dobrijević, Moskovljević & Milanović, 2015; Paunović, Đurović, Veličković, Živković, & Stojanović, 2019; Stanković, Veljković, Marković, & Herodek, 2020). The period between 9 and 12 years of age is the most important phase in child motor development (Rushall, 1998; Viru et al., 1998; Balyi & Hamilton, 2004), and the sensitive periods regarding the development of most motor abilities occur somewhat earlier in girls (Gužalovski, 1984; Drabik, 1996). Thus, it can explain why the girls made more progress in all motor tests compared to the general population of the same age, whereas it was not the case with the boys. Namely, the boys did not show any significant progress in cardiorespiratory endurance and power endurance regardless of the sports discipline, i.e., they showed no differences in these motor abilities in relation to their peers belonging to the general population.

The gymnasts and athletes of both genders had a higher level of development of explosive power compared to the general population of the same gender and age, which was confirmed by the findings of previous studies (Paunović et al., 2018). Similar findings on a sample of female rhythmic gymnasts of the same age (Dobrijević et al., 2015) have indicated that in the

period between the ages of 9 and 10 work should be done to develop explosive power by applying various contents in order to timely initiate the development and create the favorable conditions for its expansion during the sensitive period which occurs in the following years. The gymnastics training program in the first year of training implies the preparation to master the technique elements in several different events, which partly requires a major engagement of the hands (horizontal and hanging apparatuses) and partly the use of the legs (floor, vault) so that the training sessions are dominated by exercises for the development of various motor abilities. Therefore, a training volume directed towards the development of explosive leg power during the initial preparation phase is smaller in relation to the athletes since work is simultaneously done to develop te explosive power of the arms and shoulders, coordination, flexibility.

Repetitive power has been indicated as a significant motor ability for both sports disciplines, so that both the gymnasts and the athletes proved to be superior in relation to the average population, whereas the differences between them were not significant. Similar results compared to the average population were shown by girls who take part in rhythmic gymnastics (Dobrijević at al., 2015); therefore, such results support the findings of the study which has pointed out that the power of the upper body is a characteristic determinant of gymnasts (Pion et al., 2014). This indicates the fact that the programs of basic sports, to which the aforementioned sports disciplines belong, imply work on the development of this motor ability which is of multiple significance both for mastering specific techniques of these sports disciplines as well as for proper child growth and development, especially in the period of their intense physical growth and development.

The age of 9-10 years is considered to be very sensitive for the development of agility in children (Caspersen, Pereira, & Curran, 2000; Bijelić & Simović, 2005); therefore the appropriate stimulation of its development can quickly lead to visible results regarding progress. According to the findings of this study, it may be concluded that athletics training represented a significantly better stimulus for the development of this motor ability than gymnastics training. This motor ability is not crucial for achieving results in sports gymnastics so it may be the reason why its development is not emphasized in the training process. Moreover, the findings of our study have indicated that the gymnasts of both genders showed a lower level of the development of this motor ability compared to the general population of children of the same age, which indicates that this ability has been neglected for the benefit of the development of some other athlete's qualities. Observing the results achieved by children of different genders within the same sport, it was noticed that there were no differences between them, which is contrary to some previous studies that support a higher level of development of this ability among boys (Lazarević, Milosavljević, Lazarević, Marković, & Savić, 2018).

Flexibility, as a motor ability, is inherent to the female gender (Valdivia, Ortega, Rodríguez, & Sánchez, 2009; Mier & Shapiro, 2013), which has been confirmed by the findings of this study as well, since the girls mostly showed better results on the Sit and Reach Test compared to the boys. This difference was not recorded between the gymnasts of different genders, which may be attributed to the specificity of the sport and its requirements regarding the development of this motor ability in both genders (Pion et al., 2014).

CONCLUSION

In the initial preparation phase, training is not primarily oriented towards a specific sport or sports discipline, but it is aimed at the general preparation; therefore, in this sense, a timely development of motor abilities and the preparation of an athlete's body for the next training phase is crucial. Athletics and sports gymnastics, as the basic sports, represent a good stimulus for the development of most motor abilities during this phase. It is characteristic of the girls to enter the sensitive periods of the development of most motor abilities earlier, so that athletics and gymnastics training sessions have contributed to a significantly higher level of motor development in relation to the general population, whereas, in the case of the boys, a significant progress is not recorded in power endurance and cardiorespiratory endurance, regardless of the sport they are engaged in. According to the sports disciplines, gymnasts were dominant compared to athletes in their manifestation of flexibility, while the athletes showed a significantly more developed explosive power and agility, regardless of gender.

Such studies can provide useful information which may help experts in physical education and sport as well as parents to guide their children through sports, so that specific results can be expected in later phases of their sports development. In this regard, such studies should be conducted on a sample of children engaged in other sports. Certainly, it should be added that this study is of a transversal character, so that further research should examine the effects of these training sessions and/ or training sessions in some other sports in a study with a longitudinal character.

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RAZVOJ MOTORIČKIH SPOSOBNOSTI MLADIH SPORTISTA I GIMNASTIČARA U POČETNOJ FAZI PRIPREME

Cilj ove studije je da se utvrdi efekat sportske gimnastike i atletskog treninga na razvoj motoričkih sposobnosti sportista u početnoj fazi pripreme. Studija je sprovedena na uzorku od 81 devojčice i dečaka uzrasta 9 godina koji treniraju atletiku (N=34) i gimnastiku (N=47). Ukupno je praćeno 9 varijabli, tri za procenu antropometrijskih karakteristika (telesna visina, telesna masa i indeks telesne mase) i 6 za procenu motoričkih sposobnosti ispitanika (eksplozivna snaga nogu, repetitivna snaga, okretnost (agilnost), izdržljivost u snazi, fleksibilnost, kardiorespiratorna izdržljivost). U komparaciji srednjih vrednosti ispitanika istog uzrasta korišćen je t-test, dok je ANOVA metod korišćen za poređenje rezultata između sportista i gimnastičara različitog pola. Rezultati ukazuju da je nivo motoričkog razvoja devojčica znatno veći nego u opšte populacije, dok kod dečaka nije zabeležen značajan napredak u izdržljivosti u snazi i kardiorespiratornoj izdržljivosti, bez obzira na sportsku disciplinu kojom se bave. Bez obzira na pol, gimnastičari imaju bolju fleksibilnost u poređenju sa atletičarima, dok atletičari poseduju znatno veću eksplozivnu snagu i okretnost.

Ključne reči: *snaga, izdržljivost, okretnost, fleksibilnost, deca*