

# EFFECTIVENESS OF THE SCHOOL OF GYMNASTICS IN 7 YEARS OLD CHILDREN

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## Abstract

*The aim of this study is to determine the influence of treatment in school of gymnastics on certain motor abilities in seven-year-old boys and girls. Subjects were divided into two groups: experimental group (EG, 17 boys, 18 girls) and control group (CG, 17 boys, 20 girls). Beside regular classes of Physical education (PE) EG attended additional sport-school with gymnastics program, three training units a week for 60 minutes in a period of six months. The CG was not actively involved in extracurricular physical activity. Univariate analysis of variance has shown that experimental treatment causes positive changes in motor abilities of seven-year-old boys and girls. When it comes to boys, a significant improvement of explosive strength, dynamic and static muscular endurance, frequency of movement and flexibility was gained in EG. Girls EG improved explosive strength, dynamic and static muscular endurance, frequency of movement, balance and flexibility. CG of each gender improved only dynamic muscular endurance. There was no significant improvement of coordination in both EG which was unexpected.*

**Keywords:** motor abilities, treatment, seven-year-old children

## INTRODUCTION

There is a large number of factors like physical activity that influence the growth and development of children. Under the influence of physical exercise during growth and development, positive changes are expected especially in the area of motor abilities and stamina (Malina and Bouchard, 2004; Shepard and Zavallee, 1994; Bompá, 2000). Previous studies (Mraković et al., 1992; Katić et al., 2002) highlighted influence of exercise on agility, coordination, rhythm, balance, flexibility and aerobic endurance in the younger school age (6 to 10 years). Hence previously mentioned author suggest that children should start with regular physical exercise from early childhood and programs in sport schools should give priority to the development of fundamental motor abilities and motor-knowledge. Versatile exercise contents provided by school of basic sport like sport gymnastics are highly suitable for the development of these characteristics. It is known that well adopted basic movement patterns of children age of 6-7 years are postulate for the subsequent quality specialization (Borms, J. 1986). Therefore, this age was especially interesting to studies of various exercise treatments. For example, Jelaska (2007) concludes that pupils (7 year-old-boys and girls) who are in the PE classes and are regularly active in the universal sport school (3 times a week), show superior improvement in all motor abilities, compared to a group of pupils who attend only PE classes. Maleš et al. (2006) have also proven the same; they further indicate that there are some gender specific changes of motor abilities in seven-year-olds under the influence of athletic treatment. Nine-month judo program exercise in seven-year-old girls also contributes to improvement of their motor abilities (agility, static and dynamic muscular

endurance, flexibility) compared to girls who have not dealt with sport (Krstulović et al. 2006). On the other hand, there is lack of studies which investigate influence of school of gymnastic on basic motor abilities of seven-years-old boys and girls. The aim of this study was to determine the influence of the six-month gymnastic school treatment on some motor abilities of seven-year-old boys and girls. Specifically, coordination, balance, flexibility, movement frequency, muscular endurance and explosive strength changes are analyzed.

## METHODS

The subjects were 34 boys and 38 girls, first-grade pupils of elementary school in Mostar, (mean age  $7 \pm 6$  years). The sample was divided into two groups: experimental (EG, 17 boys, 18 girls) and control (CG, 17 boys, 20 girls).

Assessment of basic motor abilities was done by seven standard motor tests elected from test battery of Metikoš et al., 1989. The tests were: L-JUMP - long jump from place to evaluate explosive strength, TAPPING - hand-tapping to estimate the frequency of movement (60 seconds dominant hand alternate tapping of two discs placed on desk with their centers 60cm apart), SIT-UP - sit ups - to assess dynamic muscular endurance of trunk, POLYGON - polygon backwards to assess coordination (10m long polygon included backward crawling over and under obstacles placed at 3m and 6m from the starting line), SIT-REACH - sit and reach with legs astride for assessing flexibility, HANGING - flexed arm hang for estimating static muscular endurance and B-STAND - standing on balance bench on two legs transversely to assess the balance.

The EG, beside regular classes of PE, attended additional program of gymnastic school. There were three training units a week for 60 minutes in a period of six months. The CG was not actively involved in extracurricular physical activity. Experimental program was realised throughout 70 training units. First part of program consisted of methodical exercises for learning basic gymnastic elements. Second part of program focuses on mastering the basic elements on gymnastic apparatus -"C" 'program (HGS –Technical Committee, 2002).

Descriptive statistics (means and standard deviation ) were calculated for all variables separately for each gender group (control, experimental). The Kolmogorov-Smirnov test was applied to test for a normal distribution. The data were processed in a way that the pretest and posttest differences for the groups were determined with univariate analysis of variance (ANOVA). We conducted univariate analysis of variance between groups (control, experimental) in pretest and posttest separately for each gender. In order to annul the effect of the pretest differentiation of groups in some variables, differences between groups in the posttest were analyzed while controlling initial differences.

## RESULTS

**TABLE 1** Descriptive statistics (Means and Standard Deviations: SD) of pretest and posttest, and the analysis of differences between groups and between measurements in boys.

	CONTROL		EXPERIMENTAL	
	pretest Mean±SD	posttest Mean±SD	pretest Mean±SD	posttest Mean±SD
L-JUMP(cm)	117,52±16,86	120,35±15,58	122,00±14,74	138,45±17,35¥*
SIT-REACH(cm)	34,11±5,69	35,56±6,45	35,36±6,89	39,72±7,22¥*
TAPPING(f)	17,00±1,87	17,35±2,89	18,81±3,40	19,63±2,60¥*
HANGING(s)	13,76±9,24	14,06±12,94	14,84±13,61	18,68±13,18¥
SIT-UP(f)	23,17±7,70	25,21±8,65¥	24,27±7,98	31,00±9,74¥*
POLYGON(s)	19,64±5,38	18,63±4,08	18,31±4,00	17,31±4,64
B-STAND(s)	2,70±1,28	2,62±1,62	2,37±0,89	2,52±0,95

**Legend:** L-JUMP - long jump from place test, SIT-REACH-sit and reach with legs astride, TAPPING - hand tapping test, SIT-UP –sit ups test, HANGING- flexed arm hang, POLYGON - polygon backwards, B-STAND-standing on balance bench with on two legs crosswise

¥ - statistically significant difference between the measurements

\* - statistically significant difference between groups

**TABLE 2** Descriptive statistics (Means and Standard Deviations: SD) of pretest and posttest, and the analysis of differences between groups and between measurements in girls.

	CONTROL		EXPERIMENTAL		ANCOVA
	pretest Mean±SD	posttest Mean±SD	pretest Mean±SD	posttest Mean±SD	
L-JUMP(cm)	115,23±15,88	119,55±13,07	136,58±20,78*	145,66±18,27¥	0,03
SIT-REACH(cm)	40,89±9,53	41,10±6,71	42,64±10,27	47,73±10,40¥	0,04
TAPPING(f)	18,13±3,18	18,70±2,38	18,26±4,35	20,71±4,58¥	0,10
HANGING(s)	14,94±12,44	14,05±6,35	16,35±18,65	19,22±14,22¥	0,15
SIT-UP(f)	22,63±6,81	24,21±4,39¥	26,23±7,48*	30,00±6,33¥	0,01
POLYGON(s)	21,61±6,76	21,83±4,11	20,12±7,94	19,52±6,23	0,24
B-STAND(s)	2,02±1,51	2,16±1,21	1,92±1,01	2,38±0,90¥	0,56

**Legend:** L-JUMP - long jump from place test, SIT-REACH-sit and reach with legs astride, TAPPING - hand tapping test SIT-UP –sit ups test, HANGING- flexed arm hang, POLYGON - polygon backwards, B-STAND-standing on balance bench on two legs crosswise

¥ - statistically significant difference between the measurements, \* - statistically significant difference between groups, ANCOVA - analysis of covariance = statistical difference controlling (which appeared between the groups of girls in the pretest).

All variables in each sample had normal distribution which is tested by Kolmogorov-Smirnov test. There were no significant pretest differences between control (CG) and experimental (EG) group of boys in

analyzed variables (Table 1). CG improved only in the dynamic muscular endurance test of trunk (SIT-UP). There was a significant improvement of results in five variables (L-JUMP, SIT-REACH, TAPPING,

HANGING, SIT-UP) in EG. On the other hand, there has been no improvement in the variables for coordination and balance assessment (*POLYGON and B-STAND*). There were no significant posttest differences between CG and EG in tests *POLYGON and B-STAND* as well as in test of static muscular endurance (*HANGING*). When it comes to girls (Table 2), there were significant pretest differences in the test of explosive strength (*L-JUMP*) and dynamic muscular endurance (*SIT-UP*) in favor of the EG. A girl EG has made significant posttest progress in all variables except in *POLYGON*. Unlike the EG, CG did not significantly improve at any variable applied. ANCOVA shows significant posttest differences in tests scores for assessing explosive strength (*L-JUMP*), dynamic muscular endurance (*SIT-UP*) and flexibility (*SIT-REACH*).

## DISCUSSION

### Changes in boys

Out of these results we can conclude that the extra gymnastic treatment had positive influence on explosive strength, dynamic and static muscular endurance, flexibility and frequency of movements in seven-year-old boys. Changes occurred in EG are partially anticipated because gymnastics is physically complex and highly demanding sport (Cote et al. 1995). However, it was expected that this treatment would significantly and primarily affect the development of coordination (*POLYGON*) which has not been shown. It is important to note that none of the groups (EG and CG) except *POLYGON* pretest and posttest performed backward crawling over and under obstacles during the course of the study which could directly improve coordination test performance. It is hard to accept that coordination non-improvement is a result of bad choice of activity applied in treatment because it consisted of stimuli that are supposed to have coordination background. Regarding to that, types of motor knowledge (like in the case of this study: creeping, rolling, jumping in, jumping out, skipping, climbing, descending, pulling, pointing, hanging and swinging) were acquired or performed in unusual circumstances which is actually a technique that enhances the coordination (Sekulić and Metikoš, 2007). Hence, a logical conclusion remains that validity of this instrument for assessing coordination (*POLYGON*) is questionable on this sample. Supportive to our consideration, we must emphasize that the validity of this test was tested only on students (Metikoš et al. 1989) but as far as we are aware the test was never validated on younger population. Scientific literature review (e.g., Davids et al. 2001, Lemaître et al. 2009) indicates that coordination testing are generally sport specific (similar to sport movements patterns) which we missed in this work. Also we should not forget that coordination is highly genetic ability (Metikoš et al., 1989), and the slightest improvement can be considered as a significant. Almost the same can be ascertained for the balance

test. Although components of gymnastic treatment did not have direct influence on balance, transformation of this motor ability was expected. The basics for this idea were found in the work of Overlock and his colleagues (2006) who demonstrated that the level of acquisition of basic motor knowledge has a direct impact on balance, and this was expected in our study as well. We could also talk about questionable diagnostic validity of balance test on this sample. Similar can be found in work of Metikoš et al. (1989) which showed poor relationships between balance tests on bench (including *B-STAND*) and pointed out the complexity of balance testing.

### Changes in girls

Better pretest results in girls EG compared to CG could be explained with their higher motivation and predisposition for sport which was most probably recognized by their parents who involved them in gymnastics. The lack of significant progress under the influence of growth and maturation in girls and boys CG is probably the result of short period between measurements. It is not irrelevant to mention that the period of experiment includes the winter season when children played less in general because of the weather conditions. This is important because it is known that children develop psychomotor skills, primarily through the free play (Sekulic et al., 2007). The progress achieved in girl EG was in the test of explosive power, flexibility and movement frequency, dynamic and static muscular endurance and balance. The results show that applied gymnastic treatment improved all motor abilities except coordination. In the contrast to this, previous study on girls showed significant coordination tests result improvement by gymnastic treatment (eg, Dimova, 1983; Jeričević et al., 2002; Madić et al., 2008). As with boys, adequacy of test used for assessing the ability of coordination (*POLYGON*) remains questionable. The problem is also how a manifestation like this test is can represent complex ability of coordination in young gymnastic beginners. An additional problem with the performance of this test could be a body height of subjects. Thus there is a possibility that the higher respondents have an advantage in overcoming obstacles and achieve better results independently of their coordination.

Analyses between girl groups (ANCOVA) revealed that experimental treatment induced change in explosive strength, dynamic muscle endurance and flexibility but not in coordination, balance, static muscular endurance and movement frequency. Interesting fact is that there was exceptional improvement of explosive strength which has a large percentage of genetic. The reason may be partly prescribed and observed during the final measurement, where the EG children evidently improved technique of performing the test *L-JUMP*, which finally was more coordinated and therefore more effective.

## CONCLUSION

Based on the results of this study it can be concluded that treatment in gymnastic school, (independent from growth and maturation) causes positive changes in motor abilities in seven-year-old boys and girls. Precisely, six months treatment induced transformation of dynamic muscular endurance, frequency of movement and flexibility in boys and explosive strength, dynamic muscular

endurance and flexibility in girls. Coordination did not significantly change in both genders which was unexpected. As reason why these changes did not occur, the authors induce inappropriate measuring instrument which is hypothesized to represent this ability. The authors believe that the more specific test should be used for the assessing coordination. Finally, the results also confirm that physical education in schools is insufficient for significant impact on the motor status of children.

## REFERENCES

1. Bompá, O. Tudor (2000). Total Training for Young Champions. Human Kinetic Books.
2. Borms, J. (1986). The child and exercise: an overview. *Journal of Sports Sciences*, 4, 3-20.
3. Côté, J., Salmela, J.H. and Russell, S.J. (1995). The Knowledge of High-Performance Gymnastic Coaches: Competition and Training Considerations, *The Sport Psychologist*, 9, 76-95.
4. Davids, K., Lees, A., i Burwitz, L. (2001). Understanding and measuring coordination and control in kicking skills in soccer: Implications for talent identification and skill acquisition. *Journal of Sports Sciences*, 18 (9), 703 – 714.
5. Dimova, K. (1983). Uticaj jednogodišnjeg eksperimentalnog programa ritmičkosportske gimnastike na morfološko-motoričke i estetske kvalitete učenica osnovne škole od 7 do 8 godina. Doktorska disertacija, Beograd: Fakultet fizičke kulture.
6. Jelaska, Robert (2007). Utjecaj dodatnog kineziološkog tretmana univerzalne sportske škole na neka antropološka obilježja sedmogodišnjih dječaka i djevojčica. 2nd International Conference Contemporary Kinesiology, Mostar 2007.
7. Jeričević, M., Radenović, O., Horvatin-Fuckar, M., Antekolović, Lj. i Krističević, T. (2002). Differences in anthropological characteristics of children included in the sports gymnastics. 3th International Scientific Conference Kinesiology Opatija - New Perspectives, Proceedings Book, 87-90. Zagreb : Intergrafika.
8. Madić, D., Popović, B. i Tumin, D. (2008). Motoričke sposobnosti djevojčica uključenih u program razvojne gimnastike. XLVII Kongres antropološkog društva Srbije, Kruševac: Antropološko društvo Srbije.
9. Malina, R.M., Bouchard, C., Bar-Or, O. (2004). Growth, Maturation, and Physical Activity Human Kinetics-Second Edition.
10. Maleš, B., Žuvela, F., Katušić, I. (2006). Spolne razlike motoričkih sposobnosti sedmogodišnje djece prije i nakon atletskog tretmana. 1st International Conference Contemporary Kinesiology, Kupres, 2006.
11. Metikoš, D., Prot, F., Hofman, E., Pintar, Ž., Oreb, G. (1989). Mjerenje bazičnih motoričkih dimenzija sportaša. Zagreb: Fakultet za fizičku kulturu.
12. Mraković, M., Katić, R. (1992). Motoričke karakteristike učenika prvog razreda osnovne škole. *Kineziologija*, 24 (1-2), 7-14.
13. Katić, R., Maleš, B. Miletić, Đ. (2002). Effect of 6-Month Athletic Training on Motor Abilities in Seven-Year-Old Girls. *Collegium Antropologicum*, 26 (2), 533-538.
14. Krstulović, S., Blažević, S., Karninčić, H. (2006). Promjene motoričkih sposobnosti djevojčica tijekom devetomjesečnog judo programa. 1st International Conference Contemporary Kinesiology, Kupres, 2006.
15. Lemaître, F., Seifert, L., Polin, D., Juge, J., Tourny-Chollet, C., i Chollet, D. (2009). Apnea training effects on swimming coordination. *Journal of Strength Conditioning Research* 23(6), 1909-1914.
16. Overlock, J. A., Yun, J. (2006). The relationship between balance and fundamental motor skills in pre-school children. *Journal of Human Movement Studies* 50 (1) 29-46.
17. Sekulić, D. and Metikoš, D. (2007). Uvod u osnovne kineziološke transformacije-Osnove transformacijskih postupaka u kineziologiji. Split: Fakultet prirodoslovno-matematičkih znanosti i kineziologije.
18. Shepard, R. J., Zavellee, H. (1994). Changes of physical performance indicators of the response to enhanced physical education. *Journal of Sports Medicine and Physical Fitness*, 34, 323-335.

## UTJECAJ ŠKOLE GIMNASTIKE NA SEDMOGODIŠNJAKE

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### **Sažetak**

Cilj ovoga rada bio je utvrđivanje utjecaja tretmana škole gimnastike na neke motoričke sposobnosti kod sedmogodišnjih dječaka i djevojčica. Uzorak ispitanika činile su dvije skupine i to eksperimentalna (ES; 17 dječaka, 18 djevojčica ) i kontrolna (KS; 17 dječaka, 20 djevojčica). ES osim redovne nastave TZK-a dodatno je pohađala program škole gimnastike 3 puta tjedno po 60 minuta u trajanju od šest mjeseci. KS nije bila aktivno uključena u izvannastavne tjelesne aktivnosti. Univarijatna analiza varijance ukazala je kako eksperimentalni tretman izaziva pozitivne promjene motoričkih sposobnosti sedmogodišnjih dječaka i djevojčica. Dobivene su značajne transformacije eksplozivne snage, dinamičke i statičke mišićne izdržljivosti, frekvencije pokreta i fleksibilnosti kod dječaka. Djevojčice ES poboljšale su eksplozivnu snagu, dinamičku i statičku mišićnu izdržljivost, frekvenciju pokreta, ravnotežu i fleksibilnost. KS kod oba spola napredovala je samo u mišićnoj izdržljivosti. Neočekivan je bio izostanak značajnog poboljšanja koordinacije kod obje ES što su autori objasnili upitnom dijagnostičkom valjanosti primijenjenog testa kojim se procijenjivala ova sposobnost.

**Ključne riječi:** motoričke sposobnosti, tretman, sedmogodišnjaci

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