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EFFECTS OF PHYSICAL EXERCISE BY THE MODEL OF THE FACULTY OF EDUCATION`S SCHOOL OF SPORTS ON CHANGES IN CHILDREN`S MOTOR SKILLS

Summary

Pre-school age is characterized by an intense development of motor skills, where the first emphasis is on speed and coordination, while durability, strength, precision, flexibility and balance develop somewhat later. The sample of respondents included 80 respondents aged 5 to 6 years (+/- 6 months), who were fully equally represented. All participants at the moment of assessment of motor skills were participants of the group JU Kindergarten "Čika Jova Zmaj" from Bijeljina (Control group) and School of Sport of the Faculty of Education (Experimental group). The differences are expressed in four variables, all for the benefit of the experimental group: Polygon backward, Standing long jump, Sediment pretension multiplied in favor, Lifting hull for 60 s. Pre-school age is a sensitive period for the development of motoring in every child, and inactivity in this period leaves negative consequences in later life.

Key words: *School of Sport of the Faculty of Education, pre-school age, motor skills, children;*

INTRODUCTION

The results of the study in recent years show that physical activity in children progressively decreases **(Pate, Corbin, Simons-Morton, & Ross, 2009; Chiodera et al., 2007; Biddle, Gorelyn, & Stensel, 2004; Tomkinson, Olds, & Gulbin, 2003; Boreham, & Riddoch, 2001).** The manifestation of motor abilities takes place mutually, since one ability compensates for the other and the child expresses his complex motor skills in different situations and tasks (**Nićin, 2000**). The level of motor skills directly influences the growth and development of the child **(Buišić, Cvejić, Živković, Pejović, 2013**).

Regardless of whether we will become top athletes or not, our motor skills are transformed and changed from year to year, and in order to better understand these transformations, it is necessary to continuously monitor and study motor skills (**Metcalfe, Clark, 2002**). In pre-school age children the general motor factor is explained by strength and coordination (**Katić, Zagorac, Živičnjak and Hraski, 1994**). Understanding the development of motor abilities is not a small challenge, and over the past century, researchers discovered a great deal of facts and relations about when and how motor skills appear, as well as factors that affect not only motor skills but also their development. Motor development is progressive and is characterized by lifelong adaptation of what is learned by changes in the structure (or function) of the body (**Smith, & Baltes, 1999**).

The ideal state of motor skills is the ultimate goal of any kinesiologist and sports worker (Hatfield, Hillman, 2001). This goal depends on the success of achieving an effective system or program that can respond to the requirements of a particular task by saving effort and reducing body stress. Children having less developed motor skills during their growth and development **will** not have much success in sports activities throughout their lives (**Gallahue, Donnelly, 2003; Payne, Isaacs, 2007**).

The inheritance factors are most significant for neuromuscular aging, the rate of growth and the longitudinal dimension of the skeleton (**Malina, Bouchard, & Bar-Or, 2004**).

Over the past few decades there has been an alarming increase in the prevalence of obesity in childhood (**Ogden, et al., 2006; Ogden, Carroll, Flegal, 2008**), and the health consequences of obese children include asthma, diabetes, cardiovascular problems and many others . **Jaffe, Kosakov**, **(1982)** cited a significant correlation between overweight and delay in motor development in children. Children with better motor skills tend to be more physically active (**Carroll, Loumidis 2001; Barnett et al., 2009; Barnett et al., 2011**). The lack of movement is compensated for by concentrated exercises (sports, recreational activities, games), which points to the importance of organized, systematic exercising, not only for the purpose of entertaining and meeting the need for socializing, leisure and good looks, but for the preservation of health and the survival of the human species as such (**Obradović, 2011**).

Pre-school age is characterized by an intense development of motor skills, where the first emphasis is on speed and coordination, while durability, strength, precision, flexibility and balance develop somewhat later (**Malina, Bouchard, & Bar-Or, 2004**). The physical activity of children decreases from year to year, not only in our country, but also in the environment (**Šiljeg i sar., 2008; Strel i sar., 2009**), as well as in the countries of the developed world (Janz et al., 2000; Tomkinson et al. , 2003; Wedderkopp et al., 2004). Programmed transformation processes are a precondition for effective impact on the development of children and on later achievement of top sports results (**Burton, & Miller 1998**).

Today Sports Schools are becoming increasingly represented in the world, with the aim of engaging children from the earliest age, in order to prevent obesity and the occurrence of deformities and to influence proper growth and development of children, as well as sports technical achievements.

The aim of this paper is to examine the effect of exercising according to the model of the School of Sport at the Faculty of Education on changes in motor skills in children.

METHOD

The research used empirical and statistical methods. The research was of a longitudinal character, with the use of a draft with non-equivalent groups and pretest - posttest. A 12-week experimental treatment was conducted on a sample of pre-school children from Bijeljina.

The sample of respondents included 80 respondents aged 5 to 6 years (+/- 6 months), who were equally represented by gender. All participants at the moment of assessment of motor skills attended Kindergarten "Čika Jova Zmaj" from Bijeljina (Control group) and School of Sport at the Faculty of Education (evaluation from the moment when they joined the School of Sport until the first transit measurement after 3 months of programmed exercising), (Experimental group). The research was conducted from October 1, 2017 until January 1, 2018 with two classes of 45 minutes per week. Great attention is focused on motivation in order for children to achieve maximum results in the tested variables.

The program is primarily based on performing simple tasks first and then complex, motorized ones. The children first mastered the basic techniques of movement before switching to multiple performance techniques.

Table 1. An experimental treatment plan

Experimental program for motor development	Number of hours
1. exercises for development of speed of running	4
2. exercises for the development of agility	4
3. exercises for the development of coordination	4
4. exercises for the development of repetitive power	4
5. exercises for the development of explosive power	4
6. exercises for the development of equilibrium	4
7. PNF - proprioceptive neuromuscular facilitation	after each treatment
Total treatment:	**24**

For the assessment of motor abilities in pre-school children, standard motor tests by Bala model, Stojanović M. V., Stojanović M. (2007), were used and a battery of seven motor tests was applied:

1. To estimate the movement structuring factor:
   - reorganization of stereotypes of movement: 1. Polygon backward (0.1 s),
   - full body coordination: 2. Standing long jump (cm),
   - running speed: 3. Running 20 m from high start (0.1 s).

2. To evaluate the factors of functional synergy and tonus regulation:
   - speed frequency: 4. Hand tapping (frequency),
   - flexibility: 5. Seated forward bend (cm),

3. To estimate the factor of duration of excitation of motor units:
   - Repetitive body strenght: 6. Body lifting for 60 s (frequency),
   - Static arm and shoulder strength: 7. Hold in the fold(0.1 s).

For all variables, basic descriptive statistics for initial and final measuring were determined: arithmetic mean (AS), standard deviation (S), minimum (MIN) and maximal measurement results (MAX), skewness - distribution symmetry measure (SKEW) and kurtosis – measure for homogeneity of distribution (KURT). The distribution normality was tested for all variables by Kolmogorov-Smyrnov's tests on initial and final measuring. The existence of statistically significant differences between the groups of subjects on initial measuring for all analyzed variables using multivariate (MANOVA) and univariate (ANOVA) variance analysis was tested.

RESULTS WITH DISCUSSION

Table 2. Basic descriptive indicators for motor variables on initial measuring for the experimental and control group

	Variable	AS	SD	MIN	MAX	SKEW	KURT	pKS
E -group	Polygon backward (0,1 s)	252,7	64,24	175	382	0,55	0,21	0,12
	Standing long jump (cm)	101,5	33,4	48	133	-0,08	-0,32	0,35
	Running 20 m from h. start (0.1 s)	58,5	9,93	42	86	1,22	1,40	0,23
	Hand tapping (frequency)	12,32	4,75	5	19	0,54	0,43	0,25
	Seated forward bend (cm)	43,33	6,54	23	57	0,31	0,09	0,81
	Body lifting for 60s (frequency)	14,23	3,18	0	25	0,42	-0,52	0,74
	Hold in the fold (0,1 s)	22,30	8,52	0	54	2,31	2,22	0,26
C - group	Polygon backward (0,1 s)	248,44	74,23	182	578	1,59	2,34	0,94
	Standing Long jump (cm)	98,65	16,87	56	130	0,29	-0,20	0,52
	Running 20 m from h. start (0.1 s)	62,45	8,42	48	88	0,52	0,39	0,42
	Hand tapping (frequency)	11,28	3,12	6	18	0,58	-0,29	0,62
	Seated forward bend (cm)	39,73	7,43	18	55	-0,46	0,98	0,27
	Body lifting for 60s (frequency)	11,34	3,67	0	21	0,55	0,62	0,33
	Hold in the fold (0,1 s)	27,22	12,75	0	72	0,97	0,31	0,40

Legend: Min - Minimum measured values; Max - Maximum measured values; AS - Arithmetic mean; SD - Standard Deviation; Skew - skewness - distribution symmetry measure; Kurt - kurtosis - measure of homogeneity of distribution, p - KS - statistical significance of Kolmogorov Smirnov test.

Based on the data in Table 1, where the values of the basic descriptive indicators for the experimental and control group at the initial measuring are shown, it can be noted that there is a good discrimination regarding that in all the analyzed variables three standard deviations stand in one arithmetic mean. Values of the measuring of skewness and kortosis distribution patterns show slightly elevated results in two variables (Running 20 m from high start, Hold in the fold) in the experimental group and in one variable (Polygon backward) in the control group.

By analyzing the Kolmogorov Smirnov test, one can conclude that no variable showed the statistical significance of the K-S test, and could be accessed by parametric data processing.

Table 3. Basic descriptive indicators for motor variables in final measuring for the experimental and control group

	Variable	AS	SD	MIN	MAX	SKEW	KURT	pKS
E -	Polygon backward (0,1 s)	214,22	56,24	164	403	0,22	-0,42	0,783
	Standing long jump (cm)	117,43	30,23	52	147	0,20	-0,54	0,309
	Running 20 m from h.	52,25	6,85	41	73	0,42	0,43	0,524

	start (0,1 s)							
	Hand tapping (frequency)	16,64	4,38	6	22	0,39	-0,32	0,814
	Seated forward bend (cm)	46,24	8,52	25	65	0,35	0,58	0,605
	Body lifting for 60s (frequency)	19,48	6,27	3	34	-0,03	0,31	0,240
	Hold in the fold (0,1 s)	62,49	14,7	0	65	0,41	1,74	0,221
C- group	Polygon backward (0,1 s)	241,53	54,18	175	450	-0,56	0,36	0,587
	Standing long jump (cm)	102,41	20,54	59	135	0,64	0,48	0,760
	Running 20 m from h. start (0,1 s)	59,86	4,24	42	80	-0,35	-0,08	0,803
	Hand tapping (frequency)	13,14	4,21	7	21	-0,50	-0,41	0,244
	Seated forward bend (cm)	40,55	9,18	21	59	-0,84	0,30	0,717
	Body lifting for 60s (frequency)	12,59	3,98	2	23	,34	,34	0,452
	Hold in the fold (0,1 s)	36,29	13,42	0	78	1,23	2,26	0,120

Legend: Min - Minimum measured values; Max - Maximum measured values; AS - Arithmetic mean; SD - Standard Deviation; Skew - skewness - distribution symmetry measure; Kurt - kurtosis - measure of homogeneity of distribution, p - KS - statistical significance of Kolmogorov Smirnov test.

By inspecting the results in Table 2, where the basic descriptive indicators are shown in the final measuring, there is a good discriminatory measuring in all variables, except in the variable for estimating the static strength of the arm and shoulder belt (Hold in the fold). The result range is within normal values for all variables.

The dimensions of the distribution of skewness and kurtosis have slightly increased results in the test for estimating the static strength of the arm and shoulder (Hold in the fold) where we have a pronounced grouping of results around the arithmetic mean as can be seen based on the kurtosis coefficient. It is noticeable that based on the values of the skewness, a significant distribution asymmetry in the Hold in fold variable is seen.

Table 4. Differences in final measuring between the experimental and control group in motor abilities at the multivariate and univariate level.

Variables	f	p
Polygon backward(0,1 s)	1,727	**0,005**
Standing long jump (cm)	2,545	**0,004**
Running 20 m from h. start (0,1 s)	0,348	0,547
Hand tapping (frequency)	0,328	0,756
Seated forward bend (cm)	3,284	**0,000**
Body lifting for 60 s (frequency)	1,994	**0,002**
Hold in the fold (0,1 s)	2,311	0,421

F=4,770 ; P=**0,000**

Legend: F-value of multivariate Wilks F test; P- statistical significance of multivariate Wilkes F test; f-value of the f ratio for the univerative test; p-statistical significance of the univariate f test.

By the projection of the results in Table 3, on the basis of the value of the multivariate Wilks F test and its statistical significance, it can be concluded that there is a statistically significant difference in the total tested motor space. Differences are found in variables for estimating the movement structuring factors: Polygon backward and Standing long jump, as well as variables for assessing the factors of functional synergy and tone regulation: Sediment pretension multiplied in favor of the experimental group and variables for estimating the factor of the excitation of motor units lifting hull for 60 s. This can also be determined by inspection of their arithmetic meanings shown in the tables of descriptive statistics. Obviously, the experimental exercise exercise program caused positive changes in the analyzed variables for the experimental group.

CONCLUSION

Pre-school age is a sensitive period for the development of motor skills of every child. Inactivity in this period leaves negative consequences in later life. Basic motor skills and physical inactivity in adolescence and childhood are mutually connected (Fulton, et al., 2001; McKenzie, Sallis, Broyles, 2004). Researchers agree that physical activity is of the highest importance for the health and wellbeing of children (Strong, et al., 2005). Physical activity in pre-school age is important not only for the prevention of overweight and the avoidance of chronic health problems, but for other aspects of the physical, social and psychological development of a young child (Timmons, Naylor, Pfeiffer, 2007).

Experimental treatment by the model of the School of Sports at the Faculty of Education, implemented over a period of 12 weeks, caused positive changes in four of the seven variables. Those are variables for estimating the movement structuring factor: *Polygon backward* and *Standing long jump*, as well as variables for the estimation of the factor of functional synergies and tonus regulation: *Seated forward bend*, then variables for assessing the duration of motor excitation lifetime *Body lifting* for 60 seconds. It is also necessary to carry out checks of this and similar programs in future research in order to monitor their effectiveness, but only on a larger sample of respondents. The urgency to stop the epidemic of hypokinesia in children and the illnesses that accompany it must guide political subjects and processes to change the environment by changing public policy in order to preserve the health of our children.

REFERENCES:

Barnett, L. M., Morgan, P. J., Van Beurden, E., Ball, K. & Lubans, D. R. (2011) A reverse pathway? Actual and perceived skill proficiency and physical activity. *Medicine and Science in Sports and Exercise, 43*, 898–904

Barnett, L. M., Van Beurden, E., Morgan, P. J., Brooks, L. O. & Beard, J. R. (2009) Childhood motor skill proficiency as a predictor of adolescent physical activity. *The Journal of Adolescent Health, 44*, 252–259.

Biddle, S. J. H., Gorely, T., Stensel, D. J. (2004).Health-enhancing physical activity and sedentary behaviour in children and adolescents. *Journal of Sports Sciences, 22*(8), 679- 701.

Boreham, C., Riddoch, C. (2001). The physical activity, fitness and health of children. *Journal of Sports Sciences, 19*(12), 915-929.

Burton, A. W., & Miller, D. E. (1998). *Movement skill assesment*. Champaign: Human kinetics.

Carroll, B. & Loumidis, J. (2001). Children’s perceived competence and enjoyment in physical education and physical activity outside school. European Physical Education Review, 7, 24–43.

Chiodera, P., Volta, E., Gobbi, G., Milioli, M., Mirandola, P., Bonetti, A., Delsignore, R., Bernasconi, S., Anedda, A., Vitale, M. (2007). Specifically designed physical exercise programs improve children's motor abilities. *Scandinavian Journal of Medicine & Science in Sports, 18*(2), 179-187.

Fulton, J. E., Burgeson, C. R. Perry, G. R. Sherry, B., Galuska, D.A., Alexander, M.P., Wechsler, H., Caspersen, C.J. (2000). Assessment of physical activity and sedentary behaviour in pre-school age children: priorities for research. *Pediatrics Exercise Sci*ence, 13, 113–126.

Gallahue, D.L., Donnelly, F.C. (2003). *Developmental physical education for all children*. Champaign, IL: Human Kinetics.

Hatfield, B.D., Hillman,C.H. (2001). *The psychophysiology of sport: a mechanistic understanding of the psychology of superior performance*. In R.N. Singer, H.A. Hausenblas, & C.M. Janelle (Eds.), Handbook of sport psychology (pp. 362-388). New York: John Wiley.

Jaffe, M., Kosakov, D. (1982). The motor development of fat babies. *Clinical Pediatrics,21*, 619- 621.

Janz, K. F., Dawson, J. D., & Mahoney, L. T. (2000). Tracking physical fitness and physical activity from childhood to adolescence: the Muscatine study. *Medicine & Science in Sports & Exercise, (32)*, 1250-1257.

Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, Maturation, and Physical activity*. Champaign: Human Kinetics.

McKenzie, T. L., Sallis, J. F. Broyles, S. L. (2004). Childhood movement skills: predictors of physical activity in Anglo American and Mexican American adolescents? *Research Quarterly for Exercise and Sport*, 73, 238–244.

Obradović, J. (2011). Fizička priprema odbojkaša, *Diplomski rad*. Novi Sad: Fakultet sporta i fizičkog vaspitanja.

Ogden, C.L., Carroll, M.D., Curtin, L.R., McDowell, M.A., Tabak, C.J., Flegal, K.M. (2006). Prevalence of overweight and obesity in the United States, 1990- 2004. *JAMA, 295*:1549-1555.

Ogden, C.L., Carroll, M.D., Flegal, K.M. (2008). High body mass index for age among US children and adolescents, 2003-2006. *JAMA, 299*, 2401-2405.

Okely, A. D., Booth, M.L., Patterson, J. W. (2001). Relationship of physical activity to fundamental movement skills among adolescents. *Medicine Science and Sports Exerc*ise, *33*, 1899–1904.

Pate, R., Corbin, C., Simons-Morton, B., Ross, J. (2009). Specifically designed physical exercise programs improve children's motor abilities. *Journal of School Health*, *57*(10), 445-450.

Payne, V., Isaacs, L.D. (2007). *Human Motor Development: a Lifespan Approach*. 7th edition McGraw Hill Companies, Blacklick, OH

Smith, J., & Baltes, P. B. (1999). *Life-span perspectives on development*. In M. H. Bornstein & M. E. Lamb (Eds), Developmental psychology: An advanced textbook (4th ed., pp. 47- 72). Mahwah, NJ; Erlbaum.

Strel, J., Bizjak, K., Starc, G. i Kovač, M. (2009). Longitudinalna komparacija razvoja nekih telesnih karakteristika i motoričkih sposobnosti dve generacije dece i omladine od 7 do 18 godina starosti u slovenačkim osnovnim i srednjim školama u razdobljima od 1990- 2001. i 1997-2008. U Zbornik radova Međunarodne naučne konferencije, "*Teorijski, metodološki i metodički aspekti fizičkog vežbanja`09*" (21- 33). Beograd: Fakultet sporta i fizičkog vaspitanja.

Strong, W.B., Malina, R.M., Blimkie, C.J., Daniels, S.R., Dishman, R.K., Gutin, B., et al. Evidence based physical activity for school-age youth. *Journal Pediatr*ics, *146*(6), 732-7.

Šiljeg, K., Zečić, M., Mrgan, J. i Kević, G. (2008). Praćenje trenda promjene morfoloških i aerobnih sposobnosti srednjoškolaca od 2001. do 2006. godine. U Zbornik radova 17 ljetne škole kineziologa Republike Hrvatske, "*Stanje i perspektiva razvoja u područjima edukacije, sporta, sportske rekreacije i kineziterapije`08*" (206-212). Zagreb: Hrvatski kineziološki savez.

Timmons, B.W., Naylor, P.J., Pfeiffer, K.A. (2007). Physical activity for preschool children- how much and how? *Canadian Journal of Public Health*, *98*(2), 122-34.

Tomkinson, G. R., Olds, T. S., & Gulbin, J. (2003). Secular trends in physical performance of Australian children: Evidence from the talent Search program. *Journal of sports medicine and physical fitness, 43*, 90-98.

Wedderkopp, N., Froberg, K., Hans, H. S., Andersen, L. B. (2004). Secular trends in physical fitness and obesity in Danish 9-year-old girls and boys: Odense School Child Study and Danish substudy of the European Youth Heart Study. *Scandinavian Journal of Medicine & Science in Sports, 14*, 150-155.

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