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## THE EFFECTS OF TRACK AND FIELD TRAINING ON THE MOTOR ABILITIES OF SEVEN-YEAR-OLD BOYS

### UČINEK ATLETSKE VADBE NA GIBALNE SPOSOBNOSTI SEDEMLETNIH DEČKOV

#### ABSTRACT

The aim of the present study was to evaluate the effects of nine months of additional athletic training on the motor and endurance status (ME) in seven-year-old-boys. Altogether, 129 boys were divided into experimental (E; N=76), and control groups (C; N=53). The C group participated in the regular physical education curriculum, while their E peers were included in an additional 45-minute athletic training, three times weekly. The ME was observed using the 12 standard tests before (I) and after the nine-month study period (II). Multivariate and univariate analysis of the variance found significant I-II changes for each group, while analysis of the covariance proved the E program as superior to the C program. Although a combination of developmental changes and the PE curriculum influenced the ME status of the C group significantly, the additional exercise throughout the track and field program positively influenced most of the ME capacities in seven-year-olds. Positive changes are mostly observable in the function of the mechanism of movement regulation, as well as in the function of the mechanism of energy regulation. In conclusion, (1) it can be defined that for seven-year-old boys regular participation in PE classes does not provide adequate stimulation to achieve adequate effects on growth and development, and consequently on health status; (2) additional physical exercise for that age is highly recommended.

*Key words:* seven-year-old boys; kinesiological engagement; athletic training, motor abilities

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#### IZVLEČEK

Cilj pričujoče študije je bil ovrednotiti učinke devetmesečne dodatne vadbe atletike na gibalni in vzdržljivostni status sedemletnih dečkov. Skupno 129 dečkov je bilo razdeljenih v eksperimentalno (E; N=76) in kontrolno skupino (C; N=53). Skupina C se je udeleževala le rednih ur športne vzgoje, medtem ko so bili njihovi vrstniki iz skupine E trikrat tedensko vključeni še v dodatno atletske vadbo. Gibalni in vzdržljivostni status smo proučevali s pomočjo 12 standardnih testov pred in po devetmesečni vadbi. Multivariatne in univariatne analize variance so pokazale pomembne spremembe v obeh skupinah dečkov v obdobju devetih mesecev, analiza kovariance pa je pokazala, da je bil vadbeni program eksperimentalne skupine precej bolj učinkovit. Čeprav je kombinacija razvojnih sprememb in pouka športne vzgoje pozitivno vplivala na gibalni in vzdržljivostni status dečkov skupine C, pa je dodatna atletska vadba še dodatno pozitivno vplivala na večino sposobnosti sedemletnikov. Pozitivne spremembe so najbolj opazne v delovanju mehanizma regulacije gibanja kot tudi v delovanju mehanizma regulacije energije. Glede na rezultate raziskave sklepamo, da redne ure športne vzgoje sedemletnikov ne omogočajo zadostne stimulacije, s katero bi dosegli ustrezne učinke na rast, razvoj in, posledično, na zdravstveni status, zaradi česar priporočamo dodatno športno vadbo že v tem starostnem obdobju.

*Ključne besede:* sedemletniki, dečki, kineziološki angažma, atletska vadba, gibalne sposobnosti

## INTRODUCTION

One of the most important periods in a child's growth and development is his inclusion in the school system. Such a relatively new and therefore unusual way of life can positively, but also negatively, influence the following growth and maturation period (Sekulić, Krstulović, Katić, & Ostojić, 2006; Malina, & Bouchard, 1984).

It is well known that some of the motor abilities are significantly genetically influenced, while others are relatively genetically independent, and therefore quite trainable, especially using precise and adequate physical exercise (Pejčić, & Malacko, 2005; Lasan, Pažanin, Pejčić, & Katić, 2005; Bompa, 2000). In prepubescent school aged boys (7-10 years of age), significant positive influences on agility, psychomotor coordination, flexibility and aerobic capacity, by means of physical exercise are well documented (Katić, Maleš, & Miletić, 2002; Katić, 2004).

Contemporary top-level athletics (track and field-TF) requires inclusion in systematic sport training at an early age. Therefore, it is important to note that the physical exercise in TF schools is arranged with the basic aim of learning elementary motor skills and movement structures, which will additionally allow efficient training of specific TF skills and techniques.

By the means of different TF treatments performed so far, investigators have come to the conclusion that children in the initiative level of growth and maturation (6-10 years) have to be included in low-intensity and highly-diverse training programs (Katić, Pejčić, & Viskić-Štalec, 2004). Since most children are not able to adequately respond to complex and high-intensity trainings and competitions, training programs should be focused on general motor development through a multilevel training approach, rather than on sport-specific achievement. When comparing different sports and sport disciplines, TF is especially suitable for the purpose of the multidimensional motor development. In short, TF exercises, including running, sprinting, jumping and throwing, unquestionably must be considered entirely suitable means of training in such a phase of the sport development (Katić, Maleš, & Miletić, 2002; Babin, Katić, Ropac, & Bonacin, 2001; Žuvela, Maleš, & Jakeljić, 2006).

The task and the aim of this study was an analysis of the changes in some motor abilities in seven-year-old boys, under the influence of additional TF exercises.

## METHOD

### Participants

The sample of subjects comprised 129 boys; all aged seven years ( $\pm 6$  months). All subjects were first graders, and the study was conducted during the 2003/04 school year in Split, Croatia. The sample was divided into two groups: experimental (E; N=76), and control (C; N=53).

### Instruments

Motor-endurance status was assessed using the 12 standard motor tests. The variables used herein were previously frequently used and validated (Sekulić, Krstulović, Katić, & Ostojić, 2006; Katić, Maleš, & Miletić, 2002), and consisted of: side-steps (MSS), polygon backwards (MPB), sit-and-reach (MSR), shoulder flexibility (MSF), hand tapping (MHT), foot tapping (MFT), standing long

jump (MSLJ), ball throwing (MBT), 20-m run (M20R), sit-ups (MSU), bent arm hang (MBAH); and one cardiovascular endurance test of 3-min run (F3R).

## Procedures

The boys from both groups were tested twice; at the beginning (I), and at the end of the study i.e. after nine months (II). The initial measurement (I) was conducted at the beginning of the school year (October 2003), and final measurement at the end of school year (June 2004).

The C group was regularly engaged in the physical education curriculum (PE), three times a week, 45-minutes each session (3x45). During the nine-month period, a total of 105 lessons were performed. The complete volume included nine teaching segments with 34 teaching themes, totaling 200 frequencies (total repetition of all teaching themes).

The C group participated in the regularly organized, planned and programmed PE (Findak, Metikoš, Mraković, Neljak, & Prot, 1998). However, it must be stressed that the official PE plan was organized and supervised by a primary school teacher, not a PE-teacher. Therefore, we may suppose that the quality of the PE class is directly influenced by that fact.

Apart from PE, the E group performed additional exercise 3x60 minutes weekly. When compared to the C group in the nine-month experiment, the E group participated in an additional 131.25 school lessons. The overall volume of the E program was realized throughout the eight teaching segments, 27 teaching themes and 306 frequencies. Consequently, including the PE curriculum, the E group participated in an overall volume of 506 frequencies.

The I-II differences were calculated using the multivariate (MANOVA) and univariate (ANOVA) analysis of the variance for the repeated measurements, separately for each group. Next, the II differences between the groups were calculated with a univariate analysis of the covariance (ANCOVA), while controlling the I differences (covariates) between the groups. Statsoft's Statistica software was used for all calculations, and the level of the significance was set at 0.05.

## RESULTS

MANOVA revealed significant differences between groups in the Initial and Final measurements. The univariate differences are evident in the MSR (the dominance of the C group), MSS and M20R (dominance of the E group). It supports the calculation of the ANCOVA in explaining the differential influence of the E and C program in seven-year-old boys.

When observing the I-II changes, it is evident that the E (WL=0.04) and the C group (WL=0.10) improved their overall fitness capacities in all the motor-endurance variables studied (for details see Table 1).

However, because of the significant initial differences in some variables (see above), we applied analysis of the covariance (ANCOVA) in identifying differences between the groups in the final measurement while controlling their initial status. ANCOVA revealed a significant dominance of the E group in all of the measured variables, except the measures of shoulder flexibility, hand tapping, bent arm hang and polygon backwards.

Table 1. Descriptive statistics (Mean  $\pm$  Standard Deviation) and analysis of the differences

Variables	Experimental group		Control group	
	Mean $\pm$ SD Initial	Mean $\pm$ SD Final	Mean $\pm$ SD Initial	Mean $\pm$ SD Final
sit-and-reach (cm)	33.41 $\pm$ 7.40	41.53 $\pm$ 8.46*	36.22 $\pm$ 8.65 <sup>i</sup>	40.85 $\pm$ 7.33 <sup>*f</sup>
shoulder flexibility (cm)	54.15 $\pm$ 9.09	50.93 $\pm$ 8.36*	54.39 $\pm$ 8.21	49.51 $\pm$ 6.34*
polygon backwards (s)	17.94 $\pm$ 4.03	15.20 $\pm$ 3.02*	18.03 $\pm$ 2.89	16.09 $\pm$ 3.18*
side-steps (s)	13.68 $\pm$ 1.29	12.33 $\pm$ 1.16*	14.25 $\pm$ 1.79 <sup>i</sup>	14.03 $\pm$ 2.04 <sup>*f</sup>
standing jump (cm)	122.43 $\pm$ 11.53	138.86 $\pm$ 13.04*	121.31 $\pm$ 17.37	132.28 $\pm$ 15.60 <sup>*f</sup>
ball throwing (m)	10.13 $\pm$ 2.89	14.35 $\pm$ 3.83*	10.25 $\pm$ 3.33	12.61 $\pm$ 3.66 <sup>*f</sup>
hand tapping (taps/min)	18.32 $\pm$ 1.89	20.89 $\pm$ 2.08*	18.92 $\pm$ 2.10	21.08 $\pm$ 1.78*
foot tapping (taps/min)	26.44 $\pm$ 2.89	30.70 $\pm$ 3.17*	25.64 $\pm$ 1.46	28.59 $\pm$ 1.70 <sup>*f</sup>
sit-ups (per min)	25.20 $\pm$ 7.68	32.78 $\pm$ 6.41*	22.57 $\pm$ 7.91	26.92 $\pm$ 5.98 <sup>*f</sup>
bent arm hang (s)	15.20 $\pm$ 9.22	24.97 $\pm$ 14.70*	13.03 $\pm$ 7.89	18.52 $\pm$ 11.37*
20-m run (s)	4.76 $\pm$ 0.28	4.26 $\pm$ 0.24*	4.90 $\pm$ 0.44 <sup>i</sup>	4.53 $\pm$ 0.30 <sup>*f</sup>
3-min run (m)	505.59 $\pm$ 69.30	554.13 $\pm$ 75.11*	496.89 $\pm$ 67.92	515.15 $\pm$ 72.71 <sup>*f</sup>

<sup>i</sup> denotes significant differences between the groups in the Initial measurement (ANOVA calculation)

<sup>f</sup> denotes significant differences between the groups in the Final measurement (ANCOVA calculation)

\* denotes significant Initial-Final differences within groups (ANOVA calculation)

## DISCUSSION

One of the most interesting findings of our study is that we initially found the E group to be dominant in motor status when comparing them to their C peers. Accordingly, it seems that the training program offered at the beginning of the school year was chosen and participated in by those children who in preschool had already demonstrated a need for increased physical engagement. These children probably had already practiced fundamental motor skills, which consequently developed certain motor abilities previously specified as dominant in the E group. If we observe the E program we experimented with, it is logical that the elementary movement skills, as well as the specific E exercise, were natural continuation of the exercising habits for those children who were more physically active in the preschool years.

However, observing the initial-final differences, it can be concluded that the E and C group improved in all of the measured variables; furthermore, the dynamics of the positive changes were far more obvious in boys who additionally exercised in the E program during the course of the study. It once again evidently highlights the importance of the proper kinesiological engagement in the proper development of the motor and endurance status in prepubescent boys.

The observed changes in the E group are probably related to the adaptations on the E training, because of the well programmed and applied exercises aimed at the improvement of running speed and agility, mostly by the efficient application of the different exercise elements, including different types of running, jumping, hopping, throwing elements, as well as strengthening exercises. In particular, the nine-month additional E exercises undoubtedly influenced advanced improvements in motor abilities than PE exclusively. Therefore, it is clear that the C group has to be considered handicapped and that PE cannot provide a sufficient base in the motor-endurance development for the boys of such an age.

The results obtained herein are in the agreement with those previously found regarding the significant influence of additional physical exercise on aerobic endurance, flexibility, explosive, static and repetitive strength and balance (Babin, Katić, & Bonacin, 2001), while physical exercise with predominant athletic characteristics is highly effective for improvement in aerobic endurance, flexibility, static strength, sprint and balance (Maleš, Žuvela, & Jakeljčić, 2006; Katić, Maleš, & Miletić, 2002).

Based on those results, we can conclude that the additional physical exercise using the track and field program undoubtedly positively influenced most of the fitness capacities in seven-year-old boys during the course of the study. Positive changes are mostly observable in the function of the mechanism of the movement regulation, as well as in the function of the mechanism of energy regulation; all under the hypothetic hierarchical model of the motor abilities (according to Katić, Bonacin, & Blažević, 2001).

Therefore, it can be defined that for seven-year-old boys, regular participation in PE classes does not provide adequate stimulus to achieve positive effects on their growth and development, and consequently on their health status (Shepard, & Zavelle, 1994). The complete kinesiological engagement of school age children, especially of those in the first grades of elementary school, has to be arranged through play, organized physical activities (sport clubs and sport schools), and leisure time physical activities. Therefore, a multi-approachable and a variety of physical activities are necessary, assuring the appropriate growth and development dynamics for the healthy children, as well as for future top-level athletes.

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