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ARE SPECIFIC PROGRAMS A THREAT TO OVERALL MOTOR DEVELOPMENT OF PRESCHOOL CHILDREN?

ALI SPECIFIČNI PROGRAMI OGROŽAJO SPLOŠEN MOTORIČNI RAZVOJ PRI PREDŠOLSKIH OTROCIH?

ABSTRACT

Motor knowledge is considered the basis for all complex movements, from daily physical activity to sports. Higher level of motor skills is associated with higher physical activity of children and with many health benefits, especially with a reduced risk of obesity. The aim of this study was to determine the differences in motor skills in preschool children involved in organized exercise programs (multilateral exercise program, soccer program, rhythmic gymnastics program) and children that are not enrolled into organized exercising. The study was conducted on a sample of preschool children ($N = 78$), average age of 5.30 ± 1.14 years. To assess the level of acquired motor skills "Test of Gross Motor Development - Second Edition - TGMD2" was used. Results showed significant differences in motor skills between untrained children and children who exercise ($p < 0.05$). Furthermore, significant differences were found between children enrolled in different exercise programs ($p < 0.05$). Specifically, children involved in the multilateral exercise program achieved the best results in tests of manipulative motor skills. Physical activity of parents seems to be slightly related to the level of motor skills of children. Based on the results it can be concluded that children enrolled in organized exercising programs achieve better results in the measures of motor development than children that do not exercise additionally. Multilateral organized can be recommended as the best form of exercise for preschool children and shows certain advantages over specific programs of rhythmic gymnastics and soccer.

Key words: motor skills, in preschool children, organized programs

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IZVLEČEK

Motorična spretnost velja za osnovo vseh kompleksnih gibov, od vsakodnevnih fizičnih aktivnosti do športa. Višja raven motoričnih spretnosti je v povezavi z večjo fizično aktivnostjo otrok in z mnogimi koristmi za zdravje, še posebej z zmanjšanim tveganjem debelosti. Cilj te študije je bil določitev razlik v motoričnih spretnostih pri predšolskih otrocih, ki se vključeni v organizirane vadbene programe (multilateralni vadbeni program, nogomet, ritmična gimnastika) in otroci, ki se ne ukvarjajo z organizirano vadbo. Študija je bila opravljena na vzorcu predšolskih otrok ($N = 78$) povprečne starosti $5,30 \pm 1,14$ leta. Za oceno ravnih pridobljenih motoričnih spretnosti je bil v uporabi test "Test of Gross Motor Development - Second Edition - TGMD2". Rezultati so pokazali znatne razlike v motoričnih spretnostih med netreniranimi otroci in otroci, ki so vključeni v vadbo ($p < 0,05$). Še več, znatne razlike so se pokazale med otroci, vključenimi v različne vadbene programe ($p < 0,05$). Še posebej so pri testiranih manipulativnih motoričnih spretnosti dosegali najboljše rezultate otroci, vključeni v multilateralni (večstranski) vadbeni program. Fizična aktivnost staršev se zdi v neznatni/manjši meri povezana z motoričnimi spretnostmi otrok. Na osnovi rezultatov je mogoče sklepati, da otroci, vključeni v organizirane vadbene programe, dosegajo boljše rezultate pri meritvah motoričnega razvoja kot otroci, ki ne vadijo dodatno. Kot najboljšo obliko vadbe za predšolske otroke je mogoče priporočiti multilateralno organizirano vadbo, saj kaže določene prednosti v primerjavi s specifičnimi programi ritmične gimnastike in nogometa.

Ključne besede: motorične spretnosti, pri predšolskih otrocih, organizirani programi

INTRODUCTION

Fundamental movement skills (FMS) like running, jumping or throwing are considered to be foundation skills of all complex movements required in various everyday activities and specific sport skills (Morgan et al, 2013; Kirk & Rhodes, 2011). It has been found that FMS proficiency is positively associated with health benefits, increased physical activity and inversely associated with weight status (Lubans et al., 2010). It is a very common misconception that children learn them naturally and spontaneously, by themselves (Goodway & Robinson, 2006; Payne & Isaacs, 2012). Free play in early childhood settings and home environment may be fun for children, but it does not promote motor development and intentional learning of motor skills (Gagen & Getchell, 2006). FMS need to be learned, practiced and reinforced (Robinson & Goodway, 2009) through motor skill interventions consisted of planned movement activities that are developmentally and instructionally appropriate for preschool children (Logan et al., 2011). Exercise programs of preschool children are usually organized on different levels: from enriched home environments through kindergartens and preschool learning centers to sport clubs and associations. Parents are the ones who, in a greater or lesser extent, encourage the development of motor skills through their play with the child or motivation and time required to take a child to organized exercising. Kindergartens are a stimulating environment for learning motor skills, but not all children are enrolled in preschool centers nor does all centers offer the same proportion of organized vs. free play activities. Furthermore, early childhood centers need developmentally appropriate equipment, sufficient play areas, or additional investments in teacher's education (Logan et al, 2011). Preschool exercise programs in sport clubs should be conducted in accordance with the age and development, enabling a child to experience various sports and enriched environments, but sometimes specific programs are dominant and early specialization encouraged. Different approaches and orientation of preschool exercise programs disables equal opportunities for a child or employment of universal strategies to develop fundamental motor skills in early childhood. Exercise programs that are appropriate for preschoolers include a systematic sequence of fundamental movement skills that are organized through play in such a way to promote the social, emotional and cognitive development of the child (Gallahue, Ozmun, Goodway, 2012; Payne & Isaacs, 2012). Studies provide evidence of the positive results of various exercise programs (music, creative, traditional games, different motor skill programs) on the motor development of preschool children compared to free play activities or regular curriculum in early childhood centers (Vanetsanou & Kambas, 2010; Morgan et al., 2013).

The purpose of this study was to determine the differences in FMS proficiency of children enrolled in different exercising programs. Main hypothesis was that not all preschool exercise programs promote motor development and learning of FMS. In first part, we describe methods and testing motor skills and physical activity procedures. This is followed by main results - differences between motor skills and discussion on child enrollment in various sport and exercise programs.

METHODS

Seventy-eight preschool boys and girls participated in this study (mean age 5.30 ± 1.14 years). The total sample of subject was composed of four sub-groups: 1) children that *do not exercise* additionally (N = 21), 2) children enrolled in *multilateral exercise program* (N = 21), 3) children

training *rhythmic gymnastics* (N = 14), and 4) children training *soccer* (N = 22). Children that are not enrolled in an organized physical exercise besides the regular system of preschool education are considered as *children that do not exercise*. Children in the multilateral exercise program are exercising twice a week for 45 minutes and experiencing different sports and environments (football, basketball, volleyball, handball, badminton, tennis, athletics, gymnastics, orienteering, martial arts and bowling). Children in rhythmic gymnastics sport club are exercising twice a week for 45-60 minutes. Program consisted of specific rhythmic gymnastics training and contents of balance, flexibility and dance structures through a variety of games. Kids at soccer sport club are exercising 2-4 times a week for 45-60 minutes. Training consists of specific soccer practice and a relatively large proportion of running and tasks with the ball. Average duration of a child's training process prior to testing was 20 months of exercising in multilateral program or in the sport clubs.

Parents were informed on the goals and risks of research, and for the child's participation in the study, they gave their written consent. The study was in accordance with the Declaration of Helsinki, and the experimental protocol was approved by Science and Ethics Committee of the Faculty of Kinesiology University of Zagreb.

Testing procedures

Measurements were conducted in two parts. The first part consisted of fulfilling the questionnaire by the parents, and the second part consisted of children's motor skills testing. Same two measurers performed the testing and evaluation of motor skills. Before testing the children performed warm-up that consisted of a five-minute running with tasks (changes of direction, squat, jump) and dynamic and static stretching. Before performing the test, measurers gave the child standardized verbal instructions and then demonstrated the task. Children performed tasks one by one. Score was calculated based on the two performed repetitions. If task was not understandable to a child, instructions were repeated and child had an additional attempt.

Assessment of physical activity of children and parents

Parents fulfilled the questionnaire that consisted of questions about the child's development (duration of breast-feeding, age/month of developmental milestones of crawling and walking), screen time and physical activity in hours and minutes per day and information about the child's previous sports activities. The parents also fulfilled the international physical activity questionnaire (IPAQ) - a test of physical activity in which they are specified information about their own movement, sitting and performing moderately heavy and strenuous activities during the week. This questionnaire showed good psychometric characteristics and reliability within the limits of .74-.97 (Pedišić et al., 2011).

Assessment of motor skills

Motor skills are assessed using battery of tests "The Test of Gross Motor Development - Second Edition" (TGMD2) (Ulrich, 2000). It consisted of 12 tests divided into two groups. The first set of tests relates to the locomotor skills (run, gallop, hops, skip, jump and slide) and the second set of tests relates to the assessment of manipulative skills (baseball strike, dribble, catching a ball, punt, ball throw and ball roll). Each motor skill has several criteria of quality performance, and the presence or absence of specific criteria is evaluated. The range of results in each set of tests of

motor skills is from 0 to 48. Standards scores – corrected values for age and sex are calculated for locomotor and manipulative skills (Ulrich, 2000). In addition, index of total motor development (Gross motor quotient - GMQ) (Ulrich, 2000) is also calculated. TGMD2 has very good metric characteristics (Cronbach alpha values ranging from .82 to .94) (Ulrich, 2000).

Statistical analysis

Data was processed with the Statistica 12.0. software package (Statsoft, Inc., Tulsa, OK, USA). Differences between groups of children who do not exercise and the children enrolled in the multilateral, rhythmic gymnastics and soccer programs were determined using analysis of variance (one-way ANOVA). After determining the significant main differences between the groups, Bonferroni post-hoc test was conducted. The level of significance was set at $p < 0.05$.

RESULTS

Figure 1 presents the main results of this study. Analysis of variance (ANOVA) revealed significant differences in motor skills between the four groups of preschool children ($p < 0.001$). Bonferroni post-hoc test shows a significant difference of the index of total motor development in children involved in multilateral school (101.57) compared to children that do not exercise (86.43), and children involved in rhythmic gymnastics (81.79) and soccer (82.55) ($p < 0.001$).

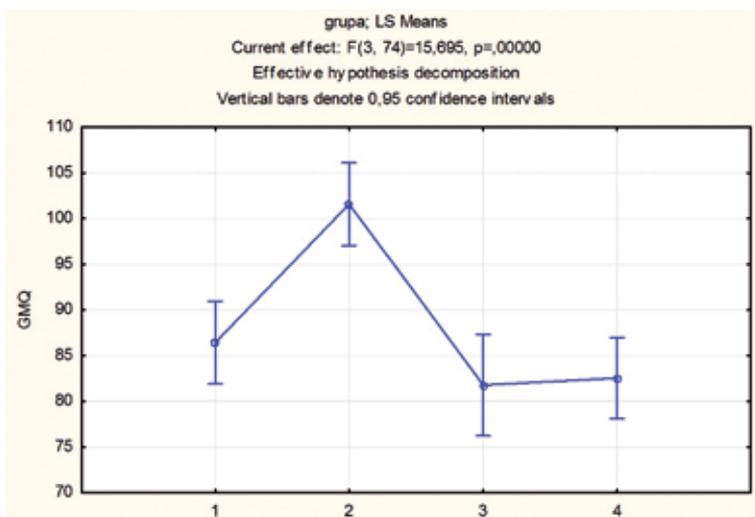


Figure 1. Differences in the overall motor development (GMQ) of preschool children involved in various training programs (1 – no-exercise; 2 – multilateral exercise program; 3 – rhythmic gymnastics; 4 – soccer)

Analysis of variance showed significant differences in values of locomotor and manipulative skills (standardized and corrected for age) of children in the different groups (Table 1). Locomotor motor skills of children are significantly different in the four groups of children ($p < 0.05$). Numerically, the children in the multilateral exercise program have the best results in tests of locomotor skills, while the other three groups (children that do not exercise, rhythmic gymnastics and soccer trainees) have similar values. Significant differences

were observed between locomotor skills of children in the multilateral program compared to children in the soccer training. The manipulative skills values were also highest in children in multilateral program compared to all other groups and exercise programs ($p < 0.001$).

Table 1. Results of locomotor and manipulative tests of motor skills in four groups of preschool children (mean \pm standard deviation)

	Level of significance	No-exercise	Multilateral program	Rythmic gymnastics	Soccer
Standardized locomotor skill values	$p < 0,05$	8,29 \pm 1,85	9,76 \pm 2,16*	8,21 \pm 1,63	8,14 \pm 1,45
Standardized manipulation skill values	$p < 0,001$	7,19 \pm 2,80	10,76 \pm 1,87**	5,71 \pm 2,64	6,05 \pm 1,36

* Significantly different from soccer ($p < 0,05$)

** Significantly different from no-exercise, rhythmic gymnastics and soccer groups ($p < 0,001$)

When considering each test of motor skills in absolute values, differences between preschool children in different environment are visible regarding locomotor skills, such as running, slide, one-leg jump and long jump, and manipulative skills, such as baseball strike, dribble, punt, ball throw and underarm roll. An analysis of individual differences in specific tests showed that children that do not exercise have particularly poor results in tests of long jump and underarm roll. Children enrolled in rhythmic gymnastics have poorer motor skills of running, dribbling, punting and hitting a ball with a baseball bat compared to individual skills of children in other training programs.

Other results show that preschool children in this study were breastfed until 10 months of age, began to crawl with 7.69 months, and 30% of the children started walking by the time they were 12 months old. Children had average screen time of 1.5 hours per day; children that are not exercising additionally had 0.75 min of screen time more than trainees. Correlation analysis showed no significant correlation of development variables or screen time to index of overall motor development. The results also showed that parents of preschool children are walking on average 45 minutes a day, sit six hours a day and have moderate or strenuous physical activity 2-3 days a week. Correlation analysis showed that the overall index of motor development of the child significantly positively associated with parent strenuous exercise variables ($r = 0.52$; $p < 0.05$) and average daily walking volume of parents ($r = 0.63$, $p < 0, 05$). Interestingly, the amount of time a child's screen time was significantly negatively correlated to father's exercise volume ($r = -0.42$; $p < 0.05$).

DISCUSSION

Gross motor skills

The main results of this study are that children enrolled in the multilateral exercise program have significantly higher levels of motor skills of children that do not exercise, children enrolled in rhythmic gymnastics and in soccer. Higher values of index of the overall motor development of children in multilateral program, shows that exposure to multilateral environment is stimulative for learning and improving fundamental movement skills of children. Compared with other studies, index of total motor development in this study achieved by the children enrolled in mul-

tilateral program is average, and indexes of children in the other groups (no-exercise, rhythmic gymnastics, soccer) is normalized as below average results (Ulrich, 2000). This points to the need to change the training programs of children in specific sports groups, as well as the inclusion of children that do not exercise into sport and programs with multilateral orientation.

The fact is that children exercising in multilateral sport schools go through various sports skills, skills that are not part of everyday free play, which affects the overall development of the child. Children who are practicing rhythmic gymnastics and soccer do not have various fundamental skills at desired level, and possibly are exposed to specific exercises and programs that can lead to premature sports specialization. Malina (2010) points out the reasons of early sport specialization: a) parents interests are mapped to the children and they are highly engaged in their activities, b) the concentration of the environment on the progress of children, c) emphasize and reward on success. However, it has been shown that early specialization does not lead to the desired results. Young athlete's training that is focused on development in just one sport can lead to problems such as unilateral muscle development, disturbed harmonious development, physical and biological imbalance, overtraining, injury, reduced mental health and motivation of children (Bompa, 2005). For some young athletes one can notice extremely rapid progress. In such cases, it is very important that the instructor, coach or parent resist the temptation of specialization training programs (Bompa, 2009). Skipping multilateral development increases the possibility of injury and limits sporting achievements. In order to get a good foundation in the beginning of the training process, exercises should be various and multilateral instead of specific (Bompa, 2009). Results of our study show how multilateral programs provide the versatility that encourages harmonious motor development, and on this basis, it seems that such programs are appropriate for development of locomotor and manipulative motor skills in preschool children. Also, it can be concluded that specific sports programs such as rhythmic gymnastics and soccer do not have a positive influence on the overall development of motor skills of the child. Children in soccer training had greater training volume (4x a week), and it did not bring the desired effects. Given the lower overall level of motor skills in children involved in specific sports programs, even in relation to children that do not exercise, it can be assumed that the specific programs and early specialization do not have positive impact on the child's overall motor development. Furthermore, since they had the same level of fundamental motor skills as children that do not exercise, it seems like (from fundamental motor skill level point) they were not learning and were exposed to early specialization. Additionally, this study showed that children that are not included in multilateral exercise program do not adopt an adequate level of motor skills naturally, by themselves. This level is compared to previous research as below average (Ulrich, 2000). Competence in the field of fundamental movement skills contribute to children's physical, cognitive and social development and is considered the basis for an active lifestyle (Lubans et al., 2010). It was previously stated that competence in the area of motor skills is associated with the perception of motor competence and health-related fitness and it is a strong predictor of physical (in) activity and consequent obesity from childhood to adulthood (Stodden et al., 2008). Research shows that competency in motor skills at an early age (3-5 years) is a predictor of future physical activity and participation in sport (Kirk & Rhodes, 2011). It can be concluded that children that do not exercise (as well as children in specific programs) are at risk of future physical inactivity and possible inability to use the health and physical well-being benefits of exercise. The higher level of fundamental movement skills is associated with higher levels of self-concept, perception of motor competence, kardiorepiratory fitness, muscular fitness,

flexibility, physical activity level, improved body weight and reduced sedentary behavior (Lubans et al., 2010). Children can naturally, by themselves, develop a rudimentary form of motor skills, but the mature form of motor skills is achieved with the appropriate training, encouragement, feedback and instructions (Gallahue & Ozmun, 1998). Children that do not learn motor skills or do not have the appropriate amount of activity and exercise can show delays in their overall motor performance (Goodway & Branta, 2003). Our study shows similar data, free play, regular pre-school education and specific sport programs do not encourage adequate motor development of children. Many countries in their strategies for development of sport and physical exercise of children emphasized the need to develop basic motor skills and are recognized as the primary goal of the quality of elementary physical education (Lubans et al., 2010). Nevertheless, the competence in basic motor skills of children in some countries is very low (Lubans et al., 2010). Some researchers and experts argue that the level of development of fundamental movement skills factor in determining individuals choice to be active or inactive. Expanding the repertoire of motor skills will enable children to find activities that they can perform well and in which they can enjoy (Stodden et al., 2008). Therefore, it is considered that the level of fundamental movement skills is very important and underrated causal mechanism responsible for health risk behaviors and physical inactivity (Stodden et al., 2008).

Locomotor and manipulative skills

An important result of this study is difference between groups in locomotor and moreover in manipulative skills in preschool children. In tests for the assessment of locomotor skills there is a significant difference between the four groups of subjects. The best results have children who are practicing in multilateral exercise program while the other three groups have similar results. These results indicate that a wide range of exercises applied in multilateral sport programs positively affects motor skills. The deficit in children soccer players and rhythmic gymnasts could be attributed to the specificity of their training, in which they possibly do not pay much attention to various movement skills like gallop or long jump. On the other hand, children in rhythmic gymnastics had lowest values in running, but higher in galloping and jumping. With the development of some, but not broad variety of locomotor skills, standard values for locomotor skills in our measurements are at low level for children in soccer and rhythmic gymnastics.

Considering the manipulative skills, groups were also significantly different: children enrolled in multilateral programs achieved better results than the children that were enrolled in soccer, rhythmic gymnastics of children that were not exercising. It also can be explained through a wide range of exercises and enrichment of multilateral programs with different environments and types of manipulations. The variety of games and sports enable children to manipulate various objects, which affect the multilateral development. Lower results in soccer players are the result of specific training or ball handling, but mostly by foot, not by hands. While in the test *kick* children in soccer were superior, in other tests, such as catching a ball or underarm roll, they did not stand out. The reason for this is the lack of manipulating the ball and objects with hands. In children enrolled in rhythmic gymnastics, extremely low scores in tests of manipulating objects are visible. Possible cause for those results is in program of training where rhythmic gymnasts at preschool age do not yet introduce specific equipment like ball, hoops, clubs and ribbons. Apparently, in sport which is quite manipulative, in early ages lack of manipulative (preferably multilateral) skill training is visible. The low level of development of motor skills such as underarm roll of baseball strike (or tennis strike) shows that multilateral manipulative exercises are not part of exercise

programs in rhythmic gymnastics in preschool age. Exercises of this type develop coordination and can recommend to incorporate into all training programs in preschool children.

The weakness of the specific exercise program is that it does not give children the multifaceted development. They are oriented to specific programs and specific exercises for the sport. Children at a certain age will achieve good results but in long term, it can cause injury and lack of further motivation. Utilization of the specific exercises can lead to irregular growth and development. Furthermore, children who cannot catch the ball or throw the ball will rarely enjoy recreational games with peers or feel motor competent. Research of Barnett and associates (2008) showed that children with higher levels of manipulative skills later become physically more fit adolescents. This study demonstrates a significant correlation of manipulative skills in childhood and cardiorespiratory fitness in adolescence (Barnett et al., 2008). Based on this research, we can see the importance of manipulative skills, and conclude that it is extremely important to develop these skills during childhood because they can be a foundation to the goal of long-term exercise and an active life.

In addition, studies have shown that athletes, before entering a sport of their highest achievements, practiced in an average of 2.4 sports (Malina, 2010). Also, a top hockey players aged 6-8 years were included in the various sporting activities, not just hockey, even three or six sports (Fransen et al., 2012) which show that early specialization should, and can, be avoided.

Several limitations of this study which should be considered in future research are selection of larger sample of subjects and diverse age groups in order to determine age and gender variations, as well as effects of training programs of different content, load and frequency on motor skills of preschool children.

CONCLUSION

The main objective of this study was to determine development of fundamental movement skills of preschoolers enrolled in different exercise programs. The process of development of fundamental movement skills is not a process that happens by itself and it takes time and the quality of instruction and practice to learn these skills. Results of this study show that the best way for the high level of fundamental motor skills inclusion of preschool children in the multilateral, versatile exercise programs. Also, research shows that children that do not exercise additionally, do not adopt an adequate level of motor skills by themselves, and for children in sport programs, positive effect of rhythmic gymnastics and soccer on the overall development of motor skills of the child is not visible. Practical significance of this study is information it offers to parents on how to choose a preschool exercise program for their child.

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