

The Effect of Exercise Training on Perceptual Motor Skills and Physical Fitness Factors in Preschool Children

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Abstract: The aim of the present research was to describe the effect of an exercise training (combined training) on perceptual motor skills of preschool children. To carry out the research, all the preschool centers in Zanzan Province (Iran) were taken into account from which 50 children were randomly chosen and participated in the research after testimonials were obtained from their parents. The Lincoln-Oseretsky test was used in the pretest and posttest levels in order to measure the cognitive-motor skills of children participating in the present research. In order to assess physical fitness factors, the 540-meter run, a scaled board known as flexibility board, pull-ups test, sit-ups test, the 20-meter sprint and Sergeant jump test were used. After taking the pretest, subjects were randomly divided into an experimental and a control group. The experimental group performed the combined training program (strength, aerobic and anaerobic exercises) for eight weeks and three sessions a week, each session lasting 45 minutes. During this period the control group was busy with their daily activities and participated in the usual sports programs of the preschool center. Descriptive statistics test and correlated and independent t-tests were used in SPSS 16 and at the significance level of 0.05 in order to analyze the research findings. At the pretest level, there was no significant difference between cognitive-motor skills and physical fitness factors of the two groups. Using t-test for independent samples, the physical fitness factors and cognitive-motor skills of preschool children were compared between the two groups at the posttest level and it was revealed that there is a significant difference between the two groups in all the factors except for speed and flexibility. It seems that conducting regular training periods during preschool years has a positive effect on the cognitive-motor skills of students and thus it is recommended that the experts in these educational centers and schools develop and implement specific programs and by improving these factors, recognize talented individuals and introduce them to different sports teams.

Key words: Physical fitness • Exercise training • Cognitive-motor skills

INTRODUCTION

Human movement starts before birth and continues until death. In the beginning years of their lives, human beings can become familiar with their environment and communicate with it through movement. Such a communication enables humans to gain meaningful experiences from their interactions with environmental phenomena. Thus, movement provides the child with situations based on which they can explore their surrounding world [1].

Motor development varies across life and psychomotor changes can be observed along with motor development changes; thus, paying attention to the

motor development of a child is actually parallel to their general development. If this development receives enough attention by practitioners of education as well as officials and physical education teachers, it can play a significant role in promoting social and individual health, fostering sports talents and achieving championship [2]. Research studies show that there is a relationship between cognitive-motor skills and educational progress and thus,

understanding the factors influencing cognitive-motor skills of children during school years and even prior to that has been a point of interest for researchers [3].

Physical health and physical activity in schools were studied in the US in 2000 and the results revealed that the

schools enjoy a favorable condition for enhancing physical activity and physical fitness among students. This has made the US

Academy of Sciences support the efforts made to enhance physical activity and health in the educational curriculum [4].

In fact the most basic behavioral response of a child is of sensory-motor type and with the help of these motor behaviors the child can understand themselves and their surrounding world; these experiences are the foundations of awareness and learning and bring about the all-embracing development of the child [5].

One of the goals of physical education in elementary schools is to develop general physical fitness and cognitive-motor skills; the participation of adults in physical fitness programs is meant to increase and enhance their health with regular training, a complete and appropriate diet, abandoning detrimental habits` and optimal use of stress-prevention strategies. Finally, an older individual who participates in physical fitness programs specific to senior citizens may receive assistance from experts for increasing the flexibility they need for their daily activities [6].

In previous studies, researchers have underlined the importance of physical activities in the elementary stages. In this regard, Rimmer *et al.* (2005) measured gross motor skills in preschool children with learning disabilities. They carried out two different programs on children including a physical exercise program and an occupational therapy program; meanwhile a third group was evaluated to determine how much maturational effects were involved in gross motor development. The results suggested that the physical exercise program managed to make a dramatic progress in motor development of subjects [7]. Emanuel *et al.* (2007) showed that the most appropriate training method for developing motor skills of children is the combined method where 50 days of training - during 20 weeks - were conducted among children above ten years using a variety of individual- social, simple-complex` and games- orientation training [8]. Edward (2008) showed that participation in sports activities lead to mental progress and development and that mental development, as an aspect of general development, accompanies motor development and the effect of games and sport activities has been well observed in it [9].

The effect of physical education course curriculum in school and preschool years is highly important, for besides helping the improvement of motor development, it will give direction and purpose to different aspects of motor development and will help the individual in

achieving the future steps toward physical and psychological health and enjoying a lifetime of health and joyfulness. It can also guide and help those individuals who pursue championship through movement and physical education [10].

Therefore, it is imperative to have plans for systematic motivation and encouragement of children to engage in physical activities. Further, physical education programs must be planned and implemented with regard to various scientific, attitudinal` and skill requirements and its essential prerequisite is to recognize the effect of different sports programs on cognitive-motor factors of children during school and preschool years. Thus, the purpose of the present research was to describe the effect of a sports program (combined training) on cognitive-motor skills of preschool children.

Research Methodology: The design of the present research was semi-empirical. To carry out the research, all the preschool centers in Zanjan Province were taken into account from which 50 children (5.06 years of age, 85.56 cm height` and 19.45 kg weight) were randomly chosen and participated in the research after testimonials were obtained from their parents. The Lincoln-Oseretsky test (a special form related to 36 aspects of cognitive-motor skills of children) was used in the pretest and posttest levels in order to measure the cognitive-motor skills of children participating in the present research [11]. Before taking this test, the preferred foot of subjects was determined using a test of shooting the football. In order to assess physical fitness factors, the 540-meter run (measuring cardiopulmonary endurance on a scale of minutes and seconds), a scaled board known as flexibility board (measuring flexibility on a scale of centimeters), pull-ups test (measuring the endurance and strength of shoulder girdle muscles on a scale of numbers), sit-ups test (measuring the endurance and strength of abdominal muscles on a scale of numbers), the 20-meter sprint (measuring speed on a scale of seconds and milliseconds)` and Sergeant jump test (measuring the strength of lower limbs on a scale of centimeters) were used [12]. After taking the pretest, subjects were randomly divided into an experimental and a control group. The experimental group performed the combined training program (strength, aerobic` and anaerobic exercises) for eight weeks and three sessions a week, each session lasting 45 minutes. During this period the control group was busy with their daily activities and participated in the usual sports programs of the preschool center. Perhaps one of the limitations of the present research was

that the control group participated in sports activities planned by the center; however, it was not ethically right to prevent this group from activity at this age and besides the program devised by the center was merely for the sake of playing games and was not meant to improve the physical fitness factors and cognitive-motor skills of children. Descriptive statistics test and correlated and independent t-tests were used in SPSS 16 and at the significance level of 0.05 in order to analyze the research findings.

RESULTS

At the pretest level, there was no significant difference between cognitive-motor skills and physical fitness factors of the two groups (Table 1).

Using t-test for independent samples, the physical fitness factors and cognitive-motor skills of preschool children were compared between the two groups at the posttest level and it was revealed that there is a significant difference between the two groups in all the factors except for speed and flexibility (Table 2).

Again, using t-test for independent samples revealed that there is no significant difference between the pretest and posttest in all the measured factors in the control group as well as trunk flexibility and speed in the experimental group ($p > 0.05$), but the data of the experimental group in the posttest suggested a significant improvement in factors such as endurance of shoulder girdle muscles ($p = 0.000$), endurance of abdominal muscles ($p = 0.004$), cardiopulmonary endurance ($p = 0.007$), and strength of lower limb muscles and Lincoln test ($p = 0.006$).

DISCUSSION

The purpose of the present research was to examine and describe the effect of a period of training on cognitive-motor skills and physical fitness factors of preschool children. The results of the research was consistent with previous findings, which indicated the significant effect of conducting training periods on improvement of cognitive-motor skills and some physical fitness factors [7-9] and showed the significant effect of performing combined training on the mentioned factors.

The effect of performing regular training on the increase of cardiorespiratory endurance, endurance of shoulder girdle muscles and abdominal muscles, strength of lower limb muscles and cognitive-motor skills can be attributed to training type, training duration, training volume and the age and fitness of subjects. The subjects of the present research underwent a training period consisting of aerobic, anaerobic and strength exercises. Moreover, the exercises were performed with average intensity in an eight-week-period and considering the age of subjects, we can say that the intensity and duration of exercises applied sufficient training load on the subjects. Cardiovascular endurance increases with age [13]. However, there was a greater increase in the group performing regular training and it appears that this increase is first due to the increase of blood volume and then, the ability of muscles to take up oxygen which in any case is a proper achievement for the children of this age [14]. It is recommended that aerobic exercises start at this age in order to improve the cardiovascular ability of children. The results of previous studies almost

Table 1: Mean and standard deviation of the data of the two groups at the pretest level N=50

Group Variable	Control N=50	Experimental N=50	T-Value	P-Value
Cardiopulmonary Endurance	3.10±0.11	3.09±0.21	2.08	0.06
Local Endurance of Shoulder Girdle Muscles	5.30±0.31	5.27±0.54	3.21	0.07
Local Endurance of Abdominal Muscles	17.32±2.31	16.22±3.21	2.43	0.08
Trunk Flexibility	24.42±3.36	23.22±2.61	1.32	0.11
Speed	6.42±1.01	6.32±0.94	2.43	0.10
Strength of Lower Limb Muscles	18.12±2.74	17.62±2.91	1.81	0.09
Lincoln Test	107.82±6.82	105.32±8.09	2.34	0.13

Table 2:- Mean and standard deviation of the data of the two groups at the posttest level N=50

Group Variable	Control N=50	Experimental N=50	T-Value	P-Value
Cardiopulmonary Endurance	3.99±0.31	2.66±0.16	6.32	0.000
Local Endurance of Shoulder Girdle Muscles	5.50±0.41	7.47±0.38	7.28	0.000
Local Endurance of Abdominal Muscles	18.34±2.52	23.02±2.07	6.28	0.000
Trunk Flexibility	24.52±3.62	25.11±2.07	2.71	0.09
Speed	6.09±1.01	5.37±1.94	3.01	0.06
Strength of Lower Limb Muscles	19.12±3.09	23.02±0.61	5.31	0.000
Lincoln Test	110.6282±7.09	135.13±6.73	8.39	0.000

unanimously report the improvement of the function of the cardiovascular system in children after performing sports exercises [15].

Regarding the increase in the endurance of shoulder girdle muscles, we can say that performing strength training as well as aerobic and anaerobic exercises have been effective in increasing muscle endurance and the issue that muscle endurance increases with age has been reported in previous studies as well [16]. However, the experimental group of the present research experienced a greater increase and thus performing sports exercises has been effective in improving muscle endurance of the children of this age, while performing physical activities in the form of games and the lack of a proper goal and regular performance of these activities has had no effect on muscle endurance and cardiovascular endurance.

Regarding the improvement in lower limb muscle strength of subjects, we can mention that this improvement is due to strength exercises in the form of combined training, because muscle strength is a combination of the two factors of speed and strength [17]. In the present research, the speed of subjects showed no significant change and thus the improvement of muscle strength can be attributed to the increase in their strength. Previous research studies also report that as a result of training, children experience an increase in strength without any increase in speed [8].

- The lack of any increase in speed and flexibility can be discussed in two ways:
- Speed is a genetic factor that is mostly determined by inheritance and its changes due to training is very little and this little change to a large extent depends on the intensity of training [18]. Thus, we can say that the training performed in the present research has not been sufficient for making any change in the speed factor of subjects. Of course, conducting intense training in the preschool years involves many ethical restrictions and it is not recommended under any circumstances.
- Unlike speed, flexibility is to a large extent affected by training and in some cases, a significant improvement in the flexibility of subjects has been reported after performing a training session [19]. Now, the reason why the subjects of the present research did not experience a significant improvement in flexibility can be attributed to their muscle flexibility and joint range of motion in the pretest level, since they are effective and decisive factors in the basic fitness training of

subjects. The subjects of the present research were preschool children and did not have hard tissues in the muscles and joint structures of their bodies, since it is with the increase of age that hard tissues deposit in joints and sometimes in muscles and decrease the elasticity of muscles and the tissues within joint structure [20]. Therefore, we can say that subjects had high flexibility and perhaps a more intense training with a much longer period is required to make any changes in their flexibility.

Observing the results related to the Lincoln test, we can come to the conclusion that the chosen training program has had a significant effect on the cognitive-motor performance of preschool children and these effects have been positive. In other words, the average score of the cognitive-motor performance of subjects in the experimental group has increased in the posttest compared to the pretest which can be due to the chosen program, for it has led to the development of fundamental factors of cognitive-motor skills including balance, strength, accuracy, time of coordination control and movement speed of fingers and wrist. Besides, as it was observed the average cognitive-motor performance of the control group increased in the posttest as compared to the pretest, but this increase is not as great as the increase in the experimental group. The reason for such an increase could be attributed to the effect of congenital and environmental factors that are decisive factors in the potential abilities of the individual [21]. Yet the environmental factors determine the degree and level of achievement of the individual in putting these potentials into effect.

To sum, we can conclude that the necessity of the presence of physical education experts and providing the facilities necessary for motor development and physical and mental health of children are undeniable facts. It must be noted that the sports program which were conducted in preschool centers in the form of games was much similar to the program of many educational centers across the country and in most preschool centers or even schools in the country, sports programs are implemented with no particular purpose and thus they do not have the same effect as a regular training period. However, the same period of time but with a proper program will lead to the improvement of physical fitness factors and cognitive-motor skills of children.

It seems that conducting regular training periods during preschool years has a positive effect on the cognitive-motor skills of students and thus it is

recommended that the experts in these educational centers and schools develop and implement specific programs and by improving these factors, recognize talented individuals and introduce them to different sports teams.

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