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The effect of eight weeks rope-jump on leg muscles strength and resting heart rate of 10-11 years old female students.

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ABSTRACT

Many children are grown in large cities, apartments and very small kindergartens. On the other hand, school environment does not encourage and make them to attempt for learning by movement. That is why the programs that do not require a lot of places and facilities are noticed. One of this exercise is rope jump that is a component of the Ministry of Education's programs in fourth grade of students in elementary school. Therefore, the aim of this study was to evaluate the effect of eight weeks rope jump on leg muscles strength and resting heart rate in fourth grade of female students in elementary school. This study consisted of two groups (rope jump training and Control group) with pre-test and post-test was conducted on fourth grade of female students in elementary school. Rope jump training group has exercised for eight weeks (three times per week for 50 minutes) and control group did not perform certain exercise. At the end of eight weeks, leg muscles strength and heart rate primary tests (post-test) were taken in both groups again. The results showed that after eight weeks of rope jump training, there were statistical significant between their pre and post- tests leg muscles strength and resting heart rate measurements ($P \leq 0/05$). According to the results of this study, eight weeks rope jump training increases leg muscles strength and reduces the resting heart rate of students.

Keywords: Rope jump, Strength, Heart rate, Students

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INTRODUCTION

Unfortunately, the complexity of modern society often forbids the growth of many motor abilities. Today, children grow up in the environment that is so complex and dangerous. On the other hand, they are banned constantly of touching and situations where give them many useful movement and information. Therefore, today children's environment is very passive and sedentary. Many children are grown in large cities, apartments and very small kindergartens. On the other hand, school environment does not encourage and make them to attempt for learning by movement. Children lose lots of experiences that require to develop their motor abilities. The children who spend their time watching TV or playing with computers, they develop sedentary and passive habits in their life. The lack of experience of various motion, postpones motor development [1]. Beads on the large number of students and few facilities, school could not be able to implement any kind of activity that requires a lot of facilities and financial resources. In fact, the curriculums of schools are very limited. One of the most useful exercises that can be done with very little cost in a small space is jumping rope [2]. Based on previous researches in America, ten minutes of rope jump training equals to 30 minutes of running with 5/7m/h. In this regard, if a person with 150 pounds weight jumps rope 120 times per minute, his body burns 12 Kilo Calories every each minute [2,3]. According to the definition of public sports federation, rope jump training consists of many skills in demonstration section as one, two persons or groups by short and tall rope and one, two or more rope [4,5]. Jumping rope has been around for many years as a recreational activity for kids and for physical exercise e.g. in warm-ups and cardio for boxers [6]. So that, rope jump has been current for a long time as a game and pastime exercise between different ages. Consequently, this exercise has been utilized by other athletes to increase endurance, balance, neuromuscular coordination and physical fitness. Moreover, the low cost of rope jump, its effective, easy to learn, enjoyable, and applicable sport in restricted spaces is one of the advantages of this sport. In this regard, Dashti's research on body composition and heart rate of male students showed that aerobic exercise reduces resting heart rate [7]. Partavi also stated that 7 weeks rope jump training improves cardiovascular endurance and agility in middle school student boys [6]. Therefore, Sohrabi et al reported that rope jump training increases physical fitness of 9 to 10 years old female students [8]. On the other hand, some studies suggested that with effective exercise prescriptions involving jumping rope, individuals demonstrated an improvement in cardiovascular function, body composition, flexibility, and muscular strength and endurance, with further contributed to advancements in health-related physical fitness [6]. Since in the Ministry of Education's curriculum, rope jump is compulsory for fourth grade of elementary students, it seems necessary that due to scientific support effect of physical activity on these students, the importance of this project and its impact on students is explained. In this study, the mean of rope jump is individual game that implement in different forms. Therefore, the aim of this study was to evaluate an effect of eight weeks rope jump on leg muscles strength and resting heart rate in fourth grade of female students in elementary school.

MATERIALS AND METHODS

This study consisted of rope jump training group (n=30) and control group (n=30) with pre-test and post-test that was conducted. The population of this study included all fourth grade of female students in elementary school (N=353) who were studied in 2015 in Firoozabad city province of Fars. Sample statistical study was determined by Cochran formula that were 60 students. To collect information from all participants in the pre-test leg muscles strength and resting heart rate was measured. To measure the strength, manual dynamometer type (Lafayette, USA) and through Ireland et al method was used. Furthermore, resting heart rate was measured at eight o'clock in the morning, after 15 minutes complete resting and in sitting position. This measurement was conducted by digital timer pulse unit (model 16 MBO, Digimad, British). Rope jump training group has exercised for eight weeks (three times per week for 50 minutes). This exercise included warm-up for ten minutes and the primary activity was eight cycles of jumping rope for two minutes with two minutes of rest between their cycles and at the end, ten minutes recovery was carried out. The schedule of training from the first to eighth weeks is shown in table 1. After eight weeks, past-test of resting heart rate and power of both (rope jump training and control) groups were conducted. In order to evaluate of modification distribution of data, Kolomogorov-Smirnov test was used. Moreover, to assess differences between the two groups independent t-test was utilized ($P > 0.05$). The obtaining results of final test in the rope jump training group were compared with the pre- test by dependent t-test and in order to analyze the statistical data, SPSS 16 software was used.

		Exercise duration		
Week	Intensity (jumps/min)	Warm-up (10 min)	Exercise	Cool-down (10 min)
1	60	Stretching	120 rep×2min with 2min rest (5 repetition)	Stretching
2	60		120 rep×2min with 2min rest (5 repetition)	
3	70		140 rep×2min with 2min rest (6 repetition)	
4	70		140 rep×2min with 2min rest (6 repetition)	
5	80		160 rep×2min with 2min rest (7 repetition)	
6	80		160 rep×2min with 2min rest (7 repetition)	
7	85		170 rep×2min with 2min rest (8 repetition)	
8	85		170 rep×2min with 2min rest (8 repetition)	

Table 1: Rope jump training protocol

RESULTS

The results showed that significant differences were found in resting heart rate and leg muscles strength test and T-test between rope jump training and control groups ($P \leq 0/05$). The values of studied variables with average and standard deviation illustrated in table 2. The eight weeks rope jump training significantly improves leg muscles strength and decreases resting heart rate compared to control group.

Variable	Group	Pre-test	Post-test
Resting heart rate (b/min)	Rope jump training	81.12±4.3	72.31±1.8
	Control	80.05±7.2	80.26±5.6
Leg strength muscles(kg)	Rope jump training	13.54±±1.55	15.01±1.61
	Control	14.08±1.91	13.95±1.87

Table 2: Mean and Standard deviation of Resting heart rate and Leg muscles strength

DISCUSSION

The findings of this study showed that eight weeks of jumping rope training reduces resting heart rate and increases leg muscles strength in fourth grade of female students in elementary school. These findings are matched with previous studies reported that jumping rope training significantly improved cardiovascular endurance and muscles strength [6,9,10,11]. In this regard, Dashti, illustrated that selective program exercises decreases resting heart rate and increases cardiovascular endurance [7]. According to various researches, getting more blood volume and increasing the contractile force of heart in blood pumping is caused regular physical activity that could be the reason for the decreasing in resting heart rate.

Therefore, the results of this study are consistent with results of Dadashpoor's et al research. This study revealed that a period of physical activity increases muscles strength in the lower body; so that, it causes to reduce skeletal deformities in this part [12]. Chao and Lins added that heart rate is a main physiological indicator that can be used to monitor the effect of exercises training and helps in directing training programs

[3]. Chao-Chien, C., & Yi-Chun, pointed out to the possibility of using heart rate to determine the time of returning back to the normal state after physical effort [9]. Fletcher et al, pointed out that practicing exercise regularly leads to decreasing heart rate during rest because of the effect of exercise on increasing the heart muscle volume and muscle adduction ability and the response of vagus nerve that helps in slowing the heart rate[13]. Quirk and Sinning, demonstrated that the value of rope exercises lie in its simplicity as a way to develop the physical efficiency and capacity for individuals who do not have much time to practice a regular sports activity. In addition, rope exercises help in developing Vo₂max [14]. Many researchers American College of Sports Medicine; Yukselen et al, had pointed out that regular and continuous exercise with appropriate intensity, such as walking, dancing, jumping rope, biking, swimming, skating, stair climbing, trampoline exercise, rope spinning, leaping over obstacles, and stair stepping effectively improved cardiovascular endurance[15]. It is informed in the literature that jumping with rope has positive effects on cardiovascular system [16]; and it is a significant implementation in developing and maintaining the muscle strength and cardiovascular system, and it improves foot movements as a support for the preparation for sports branch [17]. It is indicated that resting heart rate values are expected to be lower in well-trained athletes in comparison to the healthy but untrained individuals [18], and in another research it is reported that heart rate has decreased 4 to 9 pulses in one minute by means of exercising [13]. Pate et al, in his study demonstrated that in the basketball players between ages 13-14, resting heart rate has showed significant difference before and after training being respectively 84.67 ± 13.94 pulse/min. and 74.33 ± 11.24 pulse/min [19]. At the end of the quick power and plyometric trainings applied to basketball players between ages 15-16, significant difference is determined in the resting heart rate of quick power group [20]. Even though significant decrease in resting heart rate of both groups in comparison to the value before training is thought-provoking, this situation may arise from the metabolic adaptation of basketball training that is applied routinely excluding the rope training and that is similar contextually [13]. On the other hand, the results of this study are not consistent with the results of Takai's study that during a period of strength training on the subjects, did not observe a significant effect [21]. This discrepancy is probably due to differences in their training protocol. In fact, it can be stated that after a period of neuromuscular training adaptation, muscles strength increase as a result of exercise; consequently, the power productive in the muscles enhance. Consequently, the current findings indicate that 8 weeks rope jump training is a feasible and safe training method for decreasing resting heart rate and increasing leg muscles strength in fourth grade of female students in elementary school.

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