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Influence of different modalities of fitness training on leg strength and speed of adolescent boys

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Abstract
The aim of this study was to find out the influence of different modalities of fitness training on leg strength and speed. To achieve the purpose of this study, sixty novice adolescent boys were selected and were were divided into four groups consisting of 15 in e ach. They were trained using different modalities of fitness training, namely, aerobic training, step aerobics training kettlebell training. The subjects were measured of their leg strength through vertical jump test and speed through 50 M run tests. The selected modalities of fitness trainings were administered to the subjects. After the completion experimental period of 12 weeks, the subjects were measured of their leg strength and speed. The results proved significant improvement in leg strength and speed of the adolescent boys due to different modalities of fitness training. Comparing among the experimental groups, there was no significant difference on speed and as for leg strength step aerobics tand kettlebell training It was concluded that different modalities of fitness training can beneficially alter the leg strength and speed of adolescent boys.

Keywords: Fitness, adolescent, leg strength, speed, kettle bell.

Introduction
According to Telama R: (2009) [8] "fitness and physical activity are important for health, growth and development during childhood and adolescence. Adolescence is a critical period for the acquisition of health-related behaviours and behaviours learned in childhood are known to track into adulthood". However, "physical inactivity is now a major public health problem reportedly responsible for 9% of premature mortality worldwide in 2008. Despite the health benefits of physical activity there has been evidence of decreasing levels in recent decades." (Merrick *et al*. (2005) [6] Likewise, evidence shows that fitness has been declining over recent decades. Poor fitness is associated with increased risk of cardiovascular disease in children. Despite a growing emphasis on the importance of physical activity and physical fitness in childhood and adolescence, factors promoting fitness remain unclear (Merrick *et al*. (2005) [6]. Physical activity is a multi-factorial behaviour influenced by psychological, social, environmental and demographic variables. The prevalence of adolescents not meeting the current physical activity guidelines has been estimated at 80.3%. Research to date has shown that socio-economically deprived, ethnic minority children and girls have lower physical activity rates and that activity declines with age (Lammle, Worth and Bos (2012) [13]. Active travel to school and opportunities for physically active play are declining and sedentary activities are increasing. (Kwan *et al*. (2012) [2].
The correct selection of exercises and optimum distribution of the intensity of individual exercise that the athlete will enjoy the unrestricted improved of the potential at the age within the most favourable period for good performance achievement. Physical Education is a process of which favourable adaptation and learning of organic, neuromuscular intellectual, social, cultural, emotional and esthetic result from and proceed through selected and fairly vigorous physical activities. (Freeman 1982) [11]. These different activities were considered into different modalities of fitness training. Ultimate aim of exercise is achieving the highest possible individual performance in a given even on discipline. Specialised is one event or any other discipline should not be equated with one sideness of training. On the contrary exercise should be performed in combination with certain special exercises. These exercises should help directly or indirectly to improve the performance in the given event so that the usefulness of each individual exercise should be carefully considered. The different modalities of fitness training were selected for this study, such as aerobic training, step aerobic training and kettlebell training.

Haotian Zhao *et al*. (2022) [1] conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) and included 13 eligible RCTs. And found resistance training can significantly improve muscle strength and muscle quality in addition, moderate-intensity resistance training using elastic bands may be the best training. Viskić, *et al*. (2007) [9] analyzed the impact of special programmed physical education including dance, aerobics and rhythmic gymnastics on the development of motor and functional abilities and morphological characteristics and found selected training modalities influence the development of coordination/agility and specific rhythm coordination, functional aerobic ability, repetitive and explosive strength and flexibility, along with significant reduction of overweight and adipose tissue. Lewis (2005) [4] had conducted a study to determine the effects of a home exercise program of combined aerobic and strength training on fitness and found Improvements in submaximal heart and respiration rates, aerobic performance, muscle strength and endurance, gross motor skills, and anaerobic power were observed for this subject. Body weight and flexibility were unchanged. Improvements in submaximal heart and respiration rates, aerobic performance, muscle strength and endurance, gross motor skills, and anaerobic power were observed for this subject. Body weight and flexibility were unchanged. Obert, P. *et al*. (2001) [7] had conducted a study on the effect of a 13 week aerobic training programme on the maximal power developed during a force velocity test in prepubertal boys and girls. It was concluded that aerobic training in prepubertal children actually altered the anaerobic performance factors of force and power production. Aerobic training in children influences anaerobic performances. Mahdiabadi J *et al*. (2013) [5] compared the effect of aerobic continuous and interval training on the left ventricular structure and function. Comparing the two groups, only the value of the interventricular septum thickness was significant ($p \leq 0.05$). In general, eight-week aerobic continuous and interval training can affect left ventricular structure and function.

The theoretical foundation based on previous researches proved there were several attempts made to find out isolated effects of aerobic training, step aerobic training and kettlebell training on fitness parameters of different groups. However, there seems to be further scope for research to find out the comparative influence of different modalities of fitness training on leg strength and speed of adolescent boys.

Methodology

To achieve the purpose of this study, sixty novice adolescent boys were selected randomly from different schools in Annamalai Nagar, who were not participated in any sports and games and novice for introduction of fitness training in the age group of fifteen to seventeen years. The subjects were divided into four groups consisting of 15 in each. They were trained using different packages of physical activities, namely, aerobic training, step aerobics training kettlebell training. The subjects were measured of their leg strength through vertical jump test and speed through 50 M run tests. The selected subjects were divided into four groups, namely, Group I – Aerobic fitness training group, Group II – Step aerobic fitness training group, Group III Kettlebell training group and Group IV controlR group which will not undergo any special training. The selected modalities of fitness trainings were administered to the subjects. After the completion experimental period of 12 weeks, the subjects were measured of their leg strength and speed and results analysed for meaningful interpretation and discussions based on initial and post experimental period scores.

Result

Table 1: Descriptive statistics on effect of different modalities of fitness training on leg strength and speed

Groups	Test	Mean	Standard Deviation	Range	
				Min	Max
Leg Strength					
Aerobic training	Initial	1.98	0.09	1.84	2.16
	Final	2.07	0.07	1.96	2.26
	Adjusted Mean	2.08			
Step aerobic training	Initial	1.99	0.17	1.73	2.30
	Final	2.18	0.08	2.10	2.34
	Adjusted Mean	2.19			
Kettlebell training	Initial	2.03	0.22	1.73	2.30
	Final	2.21	0.09	2.10	2.34
	Adjusted Mean	2.20			
Control Group	Initial	1.98	0.13	1.83	2.18
	Final	1.85	0.14	1.62	2.15
	Adjusted Mean	1.86			
Speed					
Aerobic training	Initial	7.66	0.32	7.22	8.12
	Final	7.45	0.16	7.20	7.70
	Adjusted Mean	7.52			
Step aerobic training	Initial	7.73	0.30	7.24	8.34
	Final	7.49	0.28	7.09	8.09
	Adjusted Mean	7.51			
Kettlebell training	Initial	7.81	0.49	7.16	8.56
	Final	7.62	0.42	7.12	8.32
	Adjusted Mean	7.57			
Control Group	Initial	7.81	0.31	7.20	8.20
	Final	7.84	0.28	7.40	8.20
	Adjusted Mean	7.79			

The obtained mean differences were subjected to statistical treatment through ANCOVA as shown in Table 2.

Table 2: Ancova results on effects of different modalities of fitness training on leg strength and speed

	Source of Variance	Sum of Squares	Df	Mean Squares	Obtained F
Results on leg strength					
Pre Test Mean	Between	0.02	3	0.01	0.23
	Within	1.44	56	0.03	
Post Test Mean	Between	1.18	3	0.39	40.38*
	Within	0.55	56	0.01	
Adjusted Post Test Mean	Between	1.11	3	0.37	57.11*
	Within	0.36	55	0.01	
Results on speed					
Pre Test Mean	Between	0.25	3	0.08	0.62
	Within	7.45	56	0.13	
Post Test Mean	Between	1.39	3	0.46	5.21*
	Within	4.97	56	0.09	
Adjusted Post Test Mean	Between	0.77	3	0.26	24.30*
	Within	0.58	55	0.01	

Required $F_{(0.05),\,(df\ 3,55)} = 2.17$

* Significant at 0.05 level of confidence

The statistical analysis through ANCOVA to find out the significance of the differences in means proved significant F values and to test the paired mean comparisons to find the effects of different modalities of training post hoc analysis was made and results presented in Table 3.

Table 3: Post Hoc Analysis of Paired Mean Comparisons on the Effects of different modalities of fitness training on Leg Strength and Speed

Aerobic training Group	Step aerobic training Group	Kettle bell training Group	Control Group	Mean Diff	C.I
On leg strength					
2.08	2.19			-0.11*	0.08
2.08		2.20		-0.12*	0.08
2.08			1.86	0.22*	0.08
	2.19	2.20		-0.01	0.08
	2.19		1.86	0.33*	0.08
		2.20	1.86	0.34*	0.08
On speed					
7.52	7.51			0.01	0.11
7.52		7.57		-0.05	0.11
7.52			7.79	-0.27*	0.11
	7.51	7.57		-0.06	0.11
	7.51		7.79	-0.28*	0.11
		7.57	7.79	-0.22*	0.11

***** Significant at 0.05 level.

Discussions

The results proved that pre-test mean on leg strength of aerobic training group was 1.98, step aerobic training group was 1.99 kettlebell training group was2.03 and control group was 1.98. After the 12 weeks experimental treatments, the post-test means aerobic training group was 2.07, step aerobic training group was 2.18 kettlebell training group was 2.21 and control group was 1.85 As for speed pre-test mean on aerobic training group was 7.66 step aerobic training group was 7.73 kettlebell training group was 7.81 and control group was 7.81. The post test scores on speed showed that mean aerobic training group was 7.45 step aerobic training group was 7.49 kettlebell training group was 7.62 and control group was 7.84. Taking into consideration of the pre-test means and post-test means, adjusted means, analysis of covariance was done. The obtained F value on adjusted means on leg strength was 57.11 and speed was 24.50. Thus, it was proved that different modalities of fitness training, aerobic training, step aerobic training and kettlebell training significantly improved leg strength and speed of the adolescent boys. The paired adjusted mean comparisons proved all the three experimental groups, namely, aerobic training, step aerobic training and kettlebell training were significantly greater than control group on leg strength and speed Comparing between treatment groups, step aerobics and kettlebell training were significantly better than aerobic training in improving leg strength.

Viskić, *et al*. (2007) [9] analyzed the impact of dance, aerobics and rhythmic gymnastics on the development of motor and functional abilities and morphological characteristics and found selected training modalities influence the development of coordination/agility and specific rhythm coordination, functional aerobic ability, repetitive and explosive strength and flexibility,

The increase in leg strength and speed was due mainly to force production and altered the leg strength and speed performance factors of force because of 12 weeks training on different modalities of fitness training. No changes were noted in the control group.

Conclusion

It was concluded that different modalities of fitness training can beneficially alter the leg strength and speed of adolescent boys.

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