Effect of Stair Climbing and Sand Dune Running on Selected Physiological Variables among Football Players

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Abstract

Stair climbing and sand dune running trainings are suitable exercises to burn fat and improves the condition of heart and lungs. They are creative, fun and very challenging patterns of movement, that is, on and off stair case can challenge the legs, foot steps and arms also. The aim of this research is to find out the effect of stair climbing and sand dune running on selected physiological variables. For this purpose, randomly selected thirty football players from different colleges of Chennai were divided into three groups, stair climbing, sand dune running and control group. Stair climbing exercise group after a warm up for 5 minutes underwent climbing stairs having 18 steps with vertical height of 3 meters with variation of slow, medium, high, medium and slow speed walk and sprints alternatively and finished each session with cool down exercises. Sand Dune running group, after a warm up for 5 minutes underwent climbing sand dune with vertical height of 4 meters and elevation at 45o with variation of slow, medium, high, medium and slow speed running alternatively and finished each session with cool down exercises and the sessions lasted for 40 minutes in each day, on alternate days, forming three days a week. Statistical analysis of pre and post test means through ANCOVA and Scheffe's post hoc test proved that there was significant improvement in selected physiological variables such as vital capacity and tidal volume due to stair climbing training. Sand dune running made significant improvements in tidal volume and failed to significantly influence vital capacity. It was concluded that stair climbing can be better utilized for improving physiological variables than sand dune running, especially among football players.

Key words: Stair climbing, Sand dune running, Vital capacity, Tidal volume.

Introduction

"Physical Fitness provides capacity for doing all types of activities" Willgoose(1961). Currently there is wide interest to identify the most effective methods of training for strength and endurance development and this is of special significance for physical education programmes in schools and colleges. Training is usually defined as systematic process of repetitive, progressive exercise or work involving the learning process and acclimatization. (Lawrence Gray Kumar, 2002). Evidences show the difference between the trained and untrained individuals that the former is able to increase the cardiac output and transport oxygen to the working muscles at a higher rate than the latter.(Clark and Albert, 1952)

Stair climbing training is a suitable exercise to burn fat and improves the condition of heart and lungs. Lejeune , et.al. (1996) reported that walking or

running on sand, has a profound effect on the mechanics and energetic of locomotion. Walking on sand requires 2.1-2.7 times more energy expenditure than does walking on a hard surface at the same speed; while running on sand requires 1.6 times more energy expenditure than does running on a hard surface.

Muramatsu, et.al. (2006) investigated the energy expenditure of jumping on sand and on a firm surface and found the energy expenditure of jumping in the sand condition was equivalent to 119.4 +/- 10.1% of the one in the firm surface condition, which ratio was less than in walking and close to in running.

Moritz and Farley (2006) found that humans simultaneously adjust leg compression magnitude and timing, as well as mechanical work output, to conserve center of mass dynamics on damped surfaces, hence runners may use similar strategies on natural energy-dissipating surfaces such as sand, mud and snow for improved strength endurance.

Hetzler, et.al. (2010) examined a modification of the Margaria-Kalamen test for football players. The football stair climb test (FST) protocol used in this study increased the vertical displacement and found the test reliable for measuring peak anaerobic power in collegiate football players, which, theoretically, should provide more accurate measures of peak power caused by increased vertical displacement and longer duration. Meyers , et.al. (2002) examined the effective use of stair climbing as an alternative to cycling for knee rehabilitation in an actual injured sport population and confirmed the use of stair climbing as a viable adjunct/alternative to cycle ergometry in ACL-injured athletes.

Dreher, et.al. (2008) aimed to assess different pathophysiological changes between walking and stair-climbing in COPD patients and found stair-climbing resulted in more prolonged hyperinflation of the lungs, higher blood lactate production and more dyspnea than walking. Pollock , et.al. (1993) evaluated the use of symptom-limited stair climbing as a simple method to estimate the peak oxygen uptake (VO2) and minute ventilation (VE) and found a symptom-limited maximal stair climb helps estimate peak VO2 and VE in patients with CAO. Bolton , et.al. (1987) reported that the stair climb can be used as a reliable screening test of pulmonary function.

The purpose of this research is to find out the effect of stair climbing and sand dune running on selected physiological variables among football players.

Methodology

To achieve the purpose pre and post test random group research design was adapted and thirty football players from various colleges in Chennai, were randomly selected and their age group was between 18 to 23 years. The were divided into

three groups (n = 10) as Group I, Group II and Group III, in which Group I underwent stair climbing and Group II underwent sand dune running for a period of six weeks and Group III acted as control group. Stair climbing exercise group after a warm up for 5 minutes underwent climbing stairs having 18 steps with vertical height of 3 meters with variation of slow, medium, high, medium and slow speed walk and sprints alternatively and finished each session with cool down exercises. Sand Dune running group, after a warm up for 5 minutes underwent climbing sand dune with vertical height of 4 meters and elevation at 45o with variation of slow, medium, high, medium and slow speed running alternatively and finished each session with cool down exercises and the sessions lasted for 40 minutes in each day, on alternate days, forming three days a week.

.The investigator selected vital capacity and tidal volume, measured through Spirometer, as physiological variables. The collected data prior to and after completion of the experimental period on selected variables were statistically examined by applying Analysis of Covariance (ANCOVA). In all the cases to test the significance, 0.05 level of confidence was fixed. Since three groups were involved, whenever significant results were found, Scheffe's post-hoc test was used to find out the significant difference between the paired means of groups.

Results

Table-I
Results on Calculation of Analysis of Covariance on Physiological Variables

Calculation of Analysis of Covariance on Vital Capacity								
Mean	**Stair Climbing Group**	**Sand Dune Running Group**	**Control Group**	**Source of Variance**	**Sum of Squares**	**df**	**Mean Squares**	**Obtained F**
Pre Test	3730	3800	3760	Between	24667	2	12333	0.08
				Within	4125000	27	152778	
Post Test	3940	3910	3790	Between	126000	2	63000	0.52
				Within	3242000	27	120074	
Adjusted Post Test	3969	3879	3793	Between	154208	2	77104	9.35*
				Within	214326	26	8243	
Mean Diff	210	110	30					
Calculation of Analysis of Covariance on Tidal Volume								
Pre Test	500.00	491.50	487.00	Between	871.7	2	435.83	0.80
				Within	14712.5	27	544.91	
Post Test	531.50	529.50	491.50	Between	10160.0	2	5080.00	18.10*
				Within	7577.5	27	280.65	
Adjusted Post Test	527.26	530.29	494.95	Between	7454.8	2	3727.40	39.88*
				Within	2429.9	26	93.46	
Mean Diff	31.50	38.00	4.50					

Required F(0.05) (2,27) = 3.354, F(0.05), (2,26) = 3.369 *Significant

Table-II

Scheffe's Post Hoc Analysis Results

Post Hoc Analysis for vital Capacity				
Stair Climbing Group	**Sand Dune Running Group**	**Control Group**	**Mean Difference**	**Reqd. C.I**
3968.56	3878.59		89.97	105.40
3968.56		3792.86	175.70*	105.40
	3878.59	3792.86	85.73	105.40
Post Hoc Analysis for Tidal Volume				
527.26	530.29		3.03	11.22
527.26		494.95	32.31*	11.22
	530.29	494.95	35.34*	11.22

*Significant

Discussions

The results presented in Table 1 proved that the adjusted mean differences of vital capacity among the groups, stair climbing, sand dune running and control was significant as the obtained F value 9.35 was greater than the required table F value of 3.369. The Scheffe's post hoc analysis (Table 2) proved that vital capacity of the stair climbing group was significantly better than sand dune running and control group. However, the results on tidal volume showed that though the both the experimental treatments significantly improved tidal volume comparing to control group, there was no significant difference between the treatment groups.

Dreher , et.al. (2008) found that stair-climbing resulted in more prolonged hyperinflation of the lungs, higher blood lactate production and more dyspnea than walking. In sand dune running, though the subjects were asked to run, in practice due to elevated and sandy surface their exercise movements were very slow and hence, the vital capacity had not been improved among sand dune running group at par to the stair climbing group. However, the exercise settings in stair climbing and sand dune running brought significant improvement in tidal volume of the subjects as found in this study. Hence, it was found that the findings of this research in agreement with the findings of Dreher (2008).

Gottschall et.al. (2010) recommend for double step stair climbing for improved metabolic and muscular strength. Koegelenberg , et.al. (2008) was of view that stair climbing may replace formal exercise testing at much lower costs. The findings of this study are in agreement with the theoretical knowledge cited in respect of stair climbing and sand dune running.

Conclusions

It was concluded that stair climbing can be better utilized for improving physiological variables than sand dune running, especially among football players.

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