ORIGINAL RESEARCH PAPER

Volume-7 | Issue-8 | August-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECT OF ALTITUDE TRAINING ON BODY COMPOSITION, VITAL CAPACITY AND 1500 Mts PERFORMANCE AMONG TEEN AGE BOYS

Physical Education

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ABSTRACT

The purpose of the study was to find out the effect of altitude training on vital capacity, 1500 mts performance and body composition among teen age boys. To achieve this purpose, 45 male students were randomly selected. The age of the subjects were ranged from 15 to 18 years. The subjects were further classified at random into three equal groups of 15 subjects each namely Group - I (Control), group - II (EXP-I -underwent endurance training at altitude) and group - III (EXP-II-underwent endurance training at sea level) for five days per week for eight weeks. The selected criterion variables namely vital capacity,1500 mts performance and body composition were assessed before and after the training period. The collected data were statistically analysed by using Analysis of Covariance (ANCOVA). When the F ratio of the adjusted post test mean was found to be significant, Scheffe's post hoc test was employed to find out the paired mean difference. All the data were analyzed using SPSS statistical package. From the results of the study it was found that there was a significant improvement on vital capacity, 1500 mts performance and significant reduction in body weight and BMI among the experimental groups when compared with the control group.

KEYWORDS

Altitude Training, Vital capacity, middle distance performance

Introduction

Success in elite level middle- and long-distance running involves both aerobic and anaerobic metabolism (Brandon and Boileau 1992). Consequently, middle- and long-distance runners use a variety of training methods that lead to different adaptations (Rabadán et al. 2011). As running velocity increases over a longer distance there is a greater reliance on ATP production via oxidative phosphorylation (Bassett and Howley 2000). As a result, the consumption, delivery and utilisation of oxygen during prolonged submaximal exercise become a marker of the rate at which ATP is generated, and therefore energy provided to the muscle. Acclimatisation to environmental hypoxia initiates a series of metabolic and musculo-cardio-respiratory adaptations that influence oxygen transport and utilisation. Scientific investigation has focused on the optimisation of the theoretically beneficial aspects of altitude acclimatisation, which include increases in blood haemoglobin concentration, elevated buffering capacity, and improvements in the structural and biochemical properties of skeletal muscle. The favourable physiological responses to moderate altitude exposure, include decreases in absolute training intensity (Stine et al.,1992), decreased plasma volume (Young an Young,1998), depression of haemopoiesis and increased haemolysis (Szygula,1990), increases in sympathetically mediated glycogen depletion at altitude, and increased respiratory muscle work after return to sea level (Levine et al.,1992). Through completed research it is understood that several important parameters related to aerobic performance were enhanced with altitude training (Bassett and Howley,2000; Conley and Krahenbuhl,1980; Daniels,1998). One such parameter was running economy , which can be beneficial to the success of endurance athletes (Conley and Krahenbuhl,1980) as running economy has been shown to have a positive effect on running performance (Williams and Cavanagh). The oxygen carrying components of the blood also affect the performance or RE of endurance athletes. Elite and recreational endurance athletes routinely seek strategies to enhance sea level (SL) performance and altitude training continues to be an appealing approach. The primary purpose of this study was to measure the effect of an endurance training program at moderate altitude on body composition, vital capacity and 1500 mts performance among teen age boys and comparing its outcome with a similar program conducted at sea level for similar population.

Materials and Methods

Forty five teen age boys studying in different schools in Kozhikode volunteered to act as subjects of this study and their informed consent was obtained. A written explanation of the experimental procedure and potential risk factors were given to each subject. The age of the subjects were ranging from 15 to 19. The 45 subjects were randomly assigned to one of the three groups namely control Group ('CON', No: 15,) , experimental group-I, ('EXP-I',No: 15,) and experimental group-I, ('EXP-II',No: 15,). Physical examination and medical check up at the initiation of the study yielded normal results in all the subjects and none of the subjects received any medication during the period of the study. The experimental group-I underwent a endurance training program at a place of moderate altitude (900 mts above sea level), experimental group-II underwent a endurance training program at sea level (30-42 mts above sea level) for a period of 8 weeks, whereas the control group maintained their regular routine activities. The criterion variables selected for this study were body weight, body mass index (BMI), vital capacity and 1500 mts performance. The training protocol was planned keeping in the mind the subject's age, fitness level, and the environmental and climatic conditions. The type of activities included in the training program comprises of 10 min warm up, 10- 15 min free hand exercise, stretching, rotation activities, 25-40 min endurance development activities (repetition, slow continuous and varied pace methods) and 10 min of warm down. Even though no intensity was fixed, the subjects were asked to do their best within their safer limits and this process was repeated on a broader basis. Every training session started with instructions and motivation aiming towards getting the best results from the subjects. The duration of the training sessions were planned in such a way that there is a gradual increase in the training duration as the program progresses. At the start of the program it was 55 min and at end of the program it was 90 min per session including a 30 min warm up and flexibility routine and a 10 min warm down phase. The volume rather than the intensity of the training program was considered of prime importance to induce beneficial changes in the subjects. The selected variables were assessed by using standard measuring techniques four days before departure to altitude and the day after the return to sea-level for all the three groups. The conditions for both the pre and post training tests were nearly identical. The data collected from experimental and control groups prior to and after completion of the training period on selected variables were statistically examined for significant differences if any, by applying Analysis of Covariance (ANCOVA). As both the groups (EXP and CON) were selected from the same population and no attempt was made to equate the groups on the selected dependent variables or any other common variables, initial differences may exist, and there is a possibility of affecting the posttest mean. For eliminating any possible influence of pre test means the adjusted posttest means of experimental and control group were tested for significance by using ANCOVA. When the F ratio of the adjusted post test mean was found to be significant, Scheffe's post hoc test was employed to find out the paired mean difference. All the data were analyzed using SPSS statistical package. The level of confidence was fixed at 0.05 level of significance as the number of subjects was limited and also as the selected variables might fluctuate due to various extraneous factors.

Results and Discussion

Table-I Analysis of Covariance For The Selected Variables Among Experimental Group I.II& Control Groups.

Bodyweight		Control Group	Experimental Group-I	Experimental Group-II	F-Ratio
	PRE TEST	50.73(6.75)	52.87(8.11)	56.80(10.19)	1.98
	POST TEST	50.80(6.64)	51.23(7.60)	54.53(9.60)	0.97
	AD PO TEST	58.60	56.01	38.47	92.65(P>0.05)
BMI	PRE TEST	18.10(1.48)	19.43(1.78)	19.62(2.51)	2.64
	POST TEST	18.12(1.42	18.83(1.63)	18.84(2.34)	0.74
	AD PO TEST	19.10	18.48	18.31	49.22(P>0.05)
Vital Capacity	PRE TEST	3687(389)	3475(428)	3668(366)	1.32
	POST TEST	3733(386)	3723(414)	3797(369)	0.16
	AD PO TEST	3657	3857	3740	398.7(P>0.05)
1500 mts Performance	PRE TEST	6.13(0.46)	6.15(0.40)	6.13(0.41)	0.02
	POST TEST	6.25(0.52)	5.52(0.34)	5.85(0.45)	6.83(P>0.05)
	AD PO TEST	6.26	5.51	5.86	22.02(P>0.05)

The pre test and post test means of the three groups (Con. Exp-I, Exp-II) for body weight does not show any significant difference as the obtained F-ratio of 1.98 and 0.97 is less than the required value of 4.08 whereas the adjusted post test for body weight among the groups shows a significant difference (92.65;P>0.05). The pre test and post test means of the three groups (Con. Exp-I, Exp-II) for BMI does not show any significant difference as the obtained F-ratio of 2.64 and 0.74 is less than the required value of 4.08 whereas the adjusted post test for body weight among the groups shows a significant difference (49.22;P>0.05). For vital capacity there is no significant difference at the pre test and post test levels as the obtained F-ratio of 1.32 and 0.16 is less than the required value of 4.08 whereas the adjusted post test means shows significant differences (398.70; P>0.05). As far as 1500 mts performance is concerned there is no significant difference at the pre test level whereas the post test as well as the adjusted post test means shows significant differences (6.83 and 22.02; P>0.05) as the obtained F-ratio was higher than the required value of 4.08.

Table-II The Pre and Post Test Means of Experimental Group I.II and Control (CON) Groups with Percentage Of Gain

Bodyweight		PRE TEST	POST TEST	Gain	Percentage Of Gain
	Control	50.73(6.75)	50.80(6.64)	+0.07	0.13% ↑
	Experimental-I	52.87(8.11)	51.23(7.60)	-2.07	3.91% ↓
	Experimental-II	56.80(8.11)	54.53(9.60)	-2.27	-4.00%↓
BMI	Control	18.10 (1.48)	18.13±1.42	+0.03	0.17↑
	Experimental-I	19.43(1.78)	18.84(1.63)	-0.59	3.04↓
	Experimental-II	19.62(2.51)	18.84(2.34)	-0.78	3.97↓
Vital Capacity	Control	3687(389)	3733(386)	+46	1.24↑
	Experimental-I	3475(428)	3723(414)	+248	7.14↑
	Experimental-II	3668(366)	3797(369)	+129	3.52↑
1500 mts Performance	Control	6.13(0.46)	6.25(0.52)	+0.12	1.96↑
	Experimental-I	6.15(0.40)	5.52(0.34)	-0.63	10.24↑
	Experimental-II	6.13(0.41)	5.85(0.45)	-0.28	4.6↑

Table-III The Scheffe's test for differences between the adjusted post test paired means

	Adjusted Post test mean difference			Confidence Interval
	Con Vs Exp -I	Con Vs Exp -II	Exp-I Vs Exp-II	
Bodyweight	2.03	1.59	0.44	2.09
BMI	0.53	0.71*	0.17	0.70
Vit- Capacity	199.21	82.41	116.80	199.68
1500 mts Per	0.76	0.40	0.36	0.79

As the F ratio of the adjusted post test mean was found to be significant, Scheffe's post hoc test was employed to find out the paired mean difference for all the variables. But the results of the test revealed that none of the three paired mean differences (Con Vs Exp –I, Con Vs Exp –II and Exp –I Vs Exp –II) for all the variables (except for BMI) namely body weight, vital capacity and 1500 mts running performance were less than the required confidence interval of 2.09, 199.68 and 0.79 respectively. Only the mean difference between Control group and experimental group-II for BMI shows a significant difference as the obtained value of 0.71 is greater than the required confidence level of 0.70.

Discussion

A high altitude environment produces physiological stress in humans and these changes can occur even at moderate altitude (Bartsch, et al., 2008). The most important factors to this stress are: hypoxia, high solar, low temperature, low humidity, high winds, limited nutritional base and rough terrain (Frisancho, 1993). The hypoxy conditions prevailing at places of altitude places additional demand for energy and most of which is derived through fat metabolism which is supported by earlier findings (Salah et al.,2012). The reduction in body weight and the corresponding reduction in BMI noticed in this study may be mainly due this. Aerobic training leads to improvement in the maximum oxygen uptake (MCGuirre, et al., 2001; Seal & Chase,1998; Blomgvist & Saltin,1983) due to, at least in part, an increase of cardiac output from an increase in the systolic volume and the increase in vital capacity observed in this study can be attributed to the increase in VO2 maximum due to training at altitude. Earlier studies further supports training at altitude helps to improve running performance (Daniels,1998; Saunders et al.,2012; Saunders et al.,2004) and similar increase in 1500 mts performance was noted in this study which is supported by the findings of McConell and Romer,(2004) and Roohollah and Shadmehr (2016).

Conclusion

It is concluded from the obtained results and interpretations that endurance training at moderate altitude resulted in a significant reduction in bodyweight, BMI and a significant increase in vital capacity and 1500 mts performance among teen age boys.

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