THE EFFECTS OF AN ELEVATION TRAINING MASK ON VO_2MAX OF MALE ROTC CADETS

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Abstract

PURPOSE: The purpose of this study was to investigate the effects of an elevation training mask (ETM) on the VO_2max of male Reserve Officers' Training Corps (ROTC) cadets. **METHODS:** Fourteen male ROTC cadets (mean ± SD age = 20.00 ± 1.8 years, 174.35 cm ± 3.1 cm height, 76.75 kg ± 11.09 kg weight, 13.88 % ± 4.62 % body fat) participated in this study to investigate the effect of ETM training on VO_2max. After completion of the pre-test, collection of all documentation, and cessation of the familiarization period, the test subjects were randomly placed in either the control (C) or experimental group (E), respectively. The training period, which included the standard ROTC physical fitness program, lasted seven weeks with each subject participating in three sixty-minute sessions per week. The post-test was administered four days after the final training session. RESULTS: A *t*-test for independent samples was utilized to determine statistical significance ($p \leq 0.10$) in VO_2max scores between C vs. E ($p = 0.34$). Additionally, a *t*-test for dependent samples was calculated to compare pre-test and post-test scores for E ($p = 0.08$). **CONCLUSIONS:** The results of this study determined statistical significance between pre-test and post-test VO_2max scores for E ($p \leq 0.10$). **PRACTICAL APPLICATIONS:** The results of this study indicate that ETM should be considered as a possible training tool to increase VO_2max in ROTC populations. However, it should be noted that there is a particular amount of time in which an individual must be exposed to a hypoxic environment before any physiological adaptations leading to acclimatization is achieved. It is suggested that further research be conducted to investigate the increase in the frequency of exposure to an ETM, as well as an increase in the length of the training period.

Introduction

As of late, simulated altitude training has become increasingly popular due to its convenience and also because high altitudes are likely to be cold, often to the extreme. Along with the cold temperature, the oxygen pressure is lower and the terrain is significantly harsher, which may result in an increasing strain to perform physical work (1). There have been other apparatuses designed for simulating higher altitude conditions. However, it is desirable to have an economical device which can easily be worn while the user engages in physical activity that possibly facilitates acclimatization prior to entering higher altitude. With correct application, breathing devices such as an ETM may decrease oxygen levels in the body during training. This, in turn, could possibly produce an increase in oxygen levels in the body over time as a result of training, as well as produce profound effects on long- term endurance, speed of recovery from training, and ultimately increase VO_2max.

Purpose

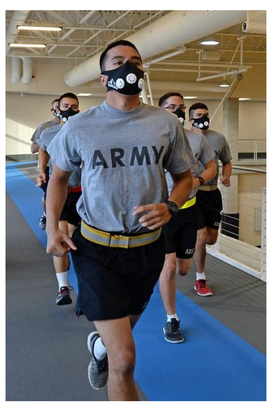
The purpose of this study was to investigate the effects of an Elevation Training Mask (ETM) on VO_2max of male ROTC cadets. A null hypothesis was stated that there will be no significant difference in VO_2max scores between the cadets that implemented the ETM during the training period and those cadets that did not.

Methods

In order to participate, each cadet's pre-test VO_2max must have met the baseline score of 45 mL/kg/min^{-1}. Upon meeting the requirement, informed consent and PAR-Q forms were filled out by each participant. Also, before the training period of the study began, each subject was taken through a familiarization period to gain an understanding of the Elevation Training Mask's purpose, numerous resistance levels, and progression in which the resistance would be increased. Due to the true experimental design, after completion of the pre-test, collection of all documentation, and cessation of familiarization period, the test subjects were randomly placed in either the C or E group. The training period of the study covered seven weeks with each subject participating three consecutive days per week. The post-test was performed four days after the last training session to reduce any chance of diminishing adaptations that may have occurred during the training period.

Subjects: Fourteen ($n = 14$) male ROTC cadets (age 20.00 ± 1.8 years, height 174.35 cm ± 3.1 cm, weight 76.75 kg ± 11.09 kg, body fat 13.88% ± 4.62%) from Texas A&M University-Corpus Christi participated in this study to determine if an ETM is a viable training tool to increase VO_2max.

Statistical Analysis: Data was analyzed using Microsoft Excel and SPSS 19 software. A *t*-test for independent samples was calculated to determine any differences between the control and experimental group's pre-test and post-test V0$_2$max scores. Additionally, a *t*-test for dependent samples was calculated to compare the combined pre-test and combined post-test scores for both groups. Also, E pre and post test was compared. Statistical significance was accepted at $p \leq 0.10$.



Results

Control group			Experimental group		
Volunteer ID#	VO_2pretest (mL/kg/min^{-1})	VO_2posttest (mL/kg/min^{-1})	Volunteer ID#	VO_2pretest (mL/kg/min^{-1})	VO_2posttest (mL/kg/min^{-1})
1	51.96	51.01	3	51.08	51.56
2	49.94	53.30	4	45.60	46.54
5	50.85	51.48	6	44.55	48.09
8	49.60	51.08	7	50.70	50.16
11	46.18	46.75	9	50.17	51.64
12	46.24	44.32	10	52.95	52.87
14	44.08	46.75	13	52.79	54.34

Group averages	VO_2pretest (mL/kg/min^{-1})	VO_2posttest (mL/kg/min^{-1})	Absolute change in VO_2 (mL/kg/min^{-1})	Relative % change in VO_2
Control	*48.41 ± 2.91	*49.24 ± 3.28	0.83 ± 0.37	0.017 ± 0.13
Experimental	*49.69 ± 3.33†	*50.74 ± 2.71‡	1.05 ± 0.62	0.02 ± 0.19
Control vs. Experimental			1.50 ± 0.03	0.235 ± 0.57

* Values are reported as mean ± *SD*

**Control = did not receive treatment; Experimental = received treatment

† Experimental group shows no significant difference from control group after pretest ($p = 0.46$)

‡ Experimental group shows no significant difference from control group after posttest ($p = 0.34$)

Conclusions

There is a particular period of time required to allow physiological adaptations to occur. In conjunction with the lack of exposure during the 7-week training period, a small sample size may have affected the results. Also, the subject's level of motivation was considered another limitation Over time, studies such as this may influence the potential development of other devices that simulate training at higher elevations, allowing individuals to decide which particular instrument will be the most user-friendly and beneficial for their specific demands.

Practical Application

Although there were increases in VO_2max, the changes may be enhanced if there is an increase in frequency of exposure to an ETM during the same amount of training time. Also, there may be an increase in diaphragm strength, which could possibly lead to more efficient breathing. This, in turn, could benefit any individual, regardless of task.

Acknowledgements

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