

Effect Of Interval Training And Altitude Training On Blood Pressure Among Middle Distance Runners

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ABSTRACT

The purpose of this study was to investigate the effect of interval training and altitude training on blood pressure among middle distance runners. Sixty male athletes (age 17–21 years) were randomly divided into three equal groups: Interval Training Group (n = 20), Altitude Training Group (n = 20), and Control Group (n = 20). The experimental groups underwent 12 weeks of systematic training, while the control group did not receive any specific intervention. Blood pressure was assessed through Mean Arterial Pressure (MAP) during pre-test and post-test.

The pre-test mean values of MAP were 99.70 mmHg (Interval Training), 98.30 mmHg (Altitude Training), and 98.90 mmHg (Control). Post-test mean values decreased to 96.25 mmHg (Interval Training) and 94.50 mmHg (Altitude Training), whereas the Control group increased to 100.50 mmHg. ANCOVA results revealed a significant difference among the groups ($F = 95.26$, $p < 0.05$). Post hoc analysis indicated significant improvements between Interval Training vs. Control (MD = -4.92) and Altitude Training vs. Control (MD = -5.50), while no significant difference was observed between Interval Training and Altitude Training groups (MD = 0.58).

The findings suggest that both interval training and altitude training significantly reduce blood pressure levels in middle distance runners, enhancing cardiovascular efficiency and promoting long-term athletic performance. Coaches and trainers may utilize either method to optimize training outcomes and cardiovascular health in athletes.

Keywords: Interval training, altitude training, blood pressure and middle distance runners.

INTRODUCTION

Middle distance running (800m–1500m) is one of the most physiologically demanding athletic events as it requires both aerobic and anaerobic energy systems. During competition, the cardiovascular system is under constant pressure to deliver oxygen efficiently to working muscles while simultaneously maintaining hemodynamic stability. Blood pressure, a key indicator of cardiovascular function, plays a vital role in determining both health status and performance capacity of athletes. Regular monitoring and training adaptations that influence blood pressure are therefore crucial for middle distance runners.

Interval training has been widely recognized as an effective training modality to enhance cardiovascular efficiency. By alternating bouts of high-intensity exercise with short recovery periods, interval training improves cardiac output, vascular compliance, and blood pressure regulation. Studies suggest that athletes undergoing interval training experience reductions in resting blood pressure and improvements in exercise-induced hemodynamic responses. These adaptations are vital for middle distance runners, as they help sustain performance while reducing cardiovascular risk.

Altitude training has also gained significant importance in middle distance running, primarily because of the hypoxic environment it provides. Exposure to reduced oxygen levels stimulates physiological adjustments such as increased red blood cell production, capillary density, and improved oxygen transport capacity. Additionally, altitude training has been shown to influence blood pressure regulation through autonomic nervous system adaptations and vascular remodeling. These changes contribute not only to enhanced endurance but also to the maintenance of optimal cardiovascular function during strenuous activity.

When combined, interval training and altitude training offer a dual benefit to middle distance athletes. Interval training strengthens the heart and improves vascular reactivity, while altitude training enhances systemic oxygen delivery and regulates blood pressure in hypoxic conditions. The interaction between these training modalities could potentially optimize cardiovascular adaptations, allowing runners to sustain high-intensity efforts with improved blood pressure control. This combined effect is particularly significant for athletes who frequently compete under varied environmental and physiological conditions.

Despite several studies highlighting the cardiovascular benefits of interval and altitude training independently, limited research has been conducted on their combined effects on blood pressure among middle distance runners. Since blood pressure regulation directly impacts both performance and long-term cardiovascular health, investigating this relationship is highly relevant for athletes, coaches, and sports scientists. Therefore, the present study aims to examine the effect of interval training and altitude training on blood pressure among middle distance runners, contributing to the existing knowledge base on athletic performance optimization.

EXPERIMENTAL DESIGN

Find out the study Effect of interval training and altitude training on Blood pressure among middle distance runners .The study was formulated as a true random group design consisting of a pre-test and post test. The subjects (N=60) were randomly assigned to three equal groups of twenty and their age ranged between 17-21 years . The selected subjects were divided into three groups randomly. Experimental Group I was considered as interval training group, experimental group II was altitude training group and control group was not involved in any special treatment. Pre test was conducted for experimental Groups I and II and the control group on Blood pressure. Experimental groups underwent the respective training for 12 weeks. Immediately after the completion of 12 weeks training, all the subjects were measured of their post test scores on the selected criterion variable. The difference between

the initial and final scores was considered the effect of respective treatments. To find out statistical significance of the results obtained, the data were subjected to statistical treatment using ANCOVA. In all cases 0.05 level was fixed to test the significance of the study.

RESULTS ON MEAN ARTERIAL BLOOD PRESSURE

The statistical analysis comparing the initial and final means of Mean Arterial Blood Pressure due to interval training and altitude training on Blood pressure among middle distance runners is presented in Table I

Table I
ANCOVA RESULTS ON EFFECT OF INTERVAL TRAINING AND ALTITUDE TRAINING COMPARED WITH CONTROLS ON MEAN ARTERIAL BLOOD PRESSURE

	INTERVAL TRAINING	ALTITUDE TRAINING	CONTROL GROUP	SOURCE OF VARIANCE	SUM OF SQUARES	df	MEAN SQUARE	OBTAINED F
Pre Test Mean	99.70	98.30	98.90	Between	19.73	2	9.87	0.28
				Within	2002.20	57	35.13	
Post Test Mean	96.25	94.50	100.50	Between	380.83	2	190.42	7.20*
				Within	1507.75	57	26.45	
Adjusted Post Test Mean	95.64	95.06	100.56	Between	365.08	2	182.54	95.26*
				Within	107.32	56	1.92	
Mean Diff	-3.45	-3.80	1.60					

Table F-ratio at 0.05 level of confidence for 2 and 57 (df) =3.16, 2 and 56 (df) =3.16.

*Significant

As shown in Table I, the obtained pre test means on Mean Arterial Blood Pressure on interval training group was 99.70, altitude training group was 98.30 was and control group was 98.90. The obtained pre test F value was 0.28 and the required table F value was 3.16, which proved that there was no significant difference among initial scores of the subjects.

The obtained post test means on Mean Arterial Blood Pressure on interval training group was 96.25, altitude training group was 94.50 was and control group was 100.50. The obtained post test F value was 7.20 and the required table F value was 3.16, which proved that there was significant difference among post test scores of the subjects.

Taking into consideration of the pre test means and post test means adjusted post test means were determined and analysis of covariance was done and the obtained F value 95.26 was greater than the required value of 3.16 and hence it was accepted that there was significant differences among the treated groups.

Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table II.

Table II
Multiple Comparisons of Paired Adjusted Means and Scheffe's Confidence Interval Test Results on Mean Arterial Blood Pressure

MEANS				Required C I
interval training Group	altitude training Group	Control Group	Mean Difference	
95.64	95.06		0.58	1.10
95.64		100.56	4.92*	1.10
	95.06	100.56	5.50*	1.10

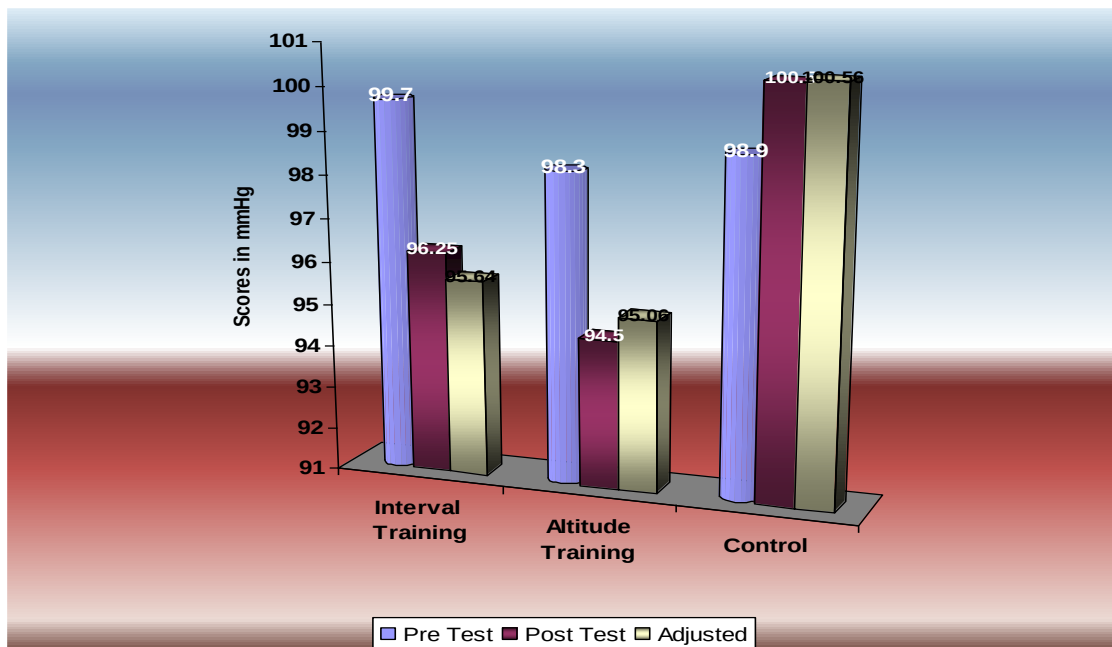
* Significant

The post hoc analysis of obtained ordered adjusted means proved that there was significant differences existed between interval training group and control group (MD: -4.92). There was significant difference between altitude training group and control group (MD: -5.50). There was no significant difference between treatment groups, namely, interval training group and altitude training group. (MD: 0.58).

The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Figure I.

Figure I

BAR DIAGRAM SHOWING PRE TEST, POST TEST AND ORDERED ADJUSTED MEANS ON MEAN ARTERIAL BLOOD PRESSURE



DISCUSSIONS ON FINDINGS ON MEAN ARTERIAL BLOOD PRESSURE

In order to find out the effect of interval training and altitude training on Mean Arterial Blood Pressure the obtained pre and post test means were subjected to ANCOVA and post hoc analysis through Scheffe's confidence interval test.

The effect of interval training and altitude training on Mean Arterial Blood Pressure is presented in Table I. The analysis of covariance proved that there was significant difference between the experimental group and control group as the obtained F value 95.26 was greater than the required table F value to be significant at 0.05 level.

Since significant F value was obtained, the results were further subjected to post hoc analysis and the results presented in Table II proved that there was significant difference between interval training group and control group (MD: -4.92) and altitude training group and control group (MD: -5.50). Comparing between the treatment groups, it was found that there was no significant difference between interval training and altitude training group among middle distance runners. Thus, it was found that

interval training and altitude training were significantly better than control group in altering Mean Arterial Blood Pressure of the middle distance runners

CONCLUSION

The findings of the present study clearly demonstrate that both interval training and altitude training produced significant reductions in mean arterial blood pressure among middle distance runners when compared to the control group. The improvements observed can be attributed to cardiovascular adaptations such as enhanced vascular compliance, improved autonomic regulation, and greater efficiency in oxygen utilization, which are stimulated by the respective training modalities.

Importantly, while both training methods independently yielded significant benefits in lowering blood pressure, no statistically significant differences were found between interval training and altitude training groups. This indicates that either form of training can be effectively incorporated into the conditioning programs of middle distance runners to improve cardiovascular health and performance.

The results support the use of structured interval training to promote cardiac efficiency and vascular health, while altitude training remains a valuable strategy to induce hypoxic adaptations and enhance systemic oxygen delivery. Together, these methods represent powerful non-pharmacological approaches to managing blood pressure and optimizing endurance performance in athletes.

Coaches and sports scientists may therefore consider including either interval training or altitude training within systematic training plans for middle distance runners to maximize performance benefits while safeguarding cardiovascular well-being. Future studies with larger sample sizes, longer training durations, and diverse athletic populations are recommended to further explore the combined and long-term effects of these training strategies on blood pressure regulation and performance outcomes.

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