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Effect of 12 Weeks of Endurance Training at Moderate and Low Altitude on Selected Hematological Variables

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Abstract – The purpose of the study was to determine the effect of endurance training at moderate and low altitude on selected hematological variables. For this purpose 12 runner from sports hostel Pithoragarh which is situated at moderate altitude (above 1500 meter) and 12 runners from sports hostel Dehradun which is situated at low altitude (below 600 meter), age ranging between (14 to 17) were purposively selected. Participants were tested on the selected hematological variables i.e. Hemoglobin and RBC. To assess the effect of endurance training, all the selected subjects from both the altitude participated in 12 weeks of training programme at their respective place. The testing of hematological variables was carried out in a pathology laboratory. The data was tested by applying the analysis of covariance and level of significance was set at 0.05. The result of the study indicated that the training program is having a positive influence at both the altitude and there is a significant improvement on Hemoglobin and RBC level at moderate altitude training group as compared to the low altitude training group in terms of the mean values.

Keywords – Hemoglobin, RBC, Moderate and Low Altitudes

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INTRODUCTION

These days, one of the standard training protocol has been recognized as altitude training in mostly aerobic sports in order to enhance aerobic capacity at lower levels or in case where one has to compete at lower levels of ground **(Wilber L, 2007).** After the Olympics were held in 1968, one of the options to enhance the performance was recognized as altitude training **(Alvarez-Herms, 2015).**

Nowadays, exercising at altitude has become a modern trend. The principal challenge that occurs by doing exercise at high altitude is a deficiency in the amount of oxygen reaching to the tissues. As the altitude increases, the barometric pressure decreases resulting in a drop in oxygen level pressure **(West, JB 1996)** which causes hypobaric hypoxia with the drop in barometric pressure, the body natural protective system starts automatically also known as acclimatization.

Acclimatization is a situation in which a body changes itself physiologically to compensate less oxygen generally occurring at high altitude. A person arriving at this altitude experiences sympathetic activity followed by increases heart rates. The maximum rate decreases with the increase in altitude. Increase vagal tone and the down-regulation of beta- 12 receptors is the mechanism behind this activity. The stroke volume decreases, **(Bartsch, P & Gibbs, JSR 2007)** leading to lower cardiac output. The systemic vascular pressure brings up the arterial pressure. The other reasons for arterial pressure are enhanced catecholamine secretion and blood vicinity. There are many major changes in blood during early weeks is an increase in red blood cell mass. Its importance is associated with the high hemoglobin concentration, finally improving the performance level of an athlete.

PROCEDURE

Participants: Total twenty-four district level long and middle distance male runners, age ranging between fourteen to seventeen years were selected from two sports hostel of Uttarakhand, India through purposive sampling. Twelve runners from sports hostel Pithoragarh which is situated at a Moderate altitude around 1550 meters above from sea level and twelve runners from Maharana Pratap sports hostel Dehradun which is situated at low altitude around 600 meters above from sea level were selected.

Selection of variable: After revealing the literature the research scholar has selected following hematological variables-

1. Hemoglobin
2. RBC

RESEARCH DESIGN:

Keeping in mind the purpose of the study pre and post-test random group design was used. In this design, by considering the effect of pre-test, which may have an effect on the post-test results, an effort is made to adjust the error variance accordingly. In the present study, the pre-test is considered as a covariate.

COLLECTION OF DATA:

All the selected subjects from both the altitude participated in 12 weeks of the training programme at their respective place and data has been collected before and after 12 weeks of the training programme. The testing of hematological variables was carried out in a pathology laboratory. The subjects were tested only during morning session.

The training program at low altitude was supervised by the investigator one month before the training program of moderate altitude. It was conducted with the help of assister after that the training program has been supervised by the assister as per the instructor gave by the investigator.

The training program at moderate altitude was supervised by the investigator after the first month of training of the low altitude. The assister often contributes to the training program along with the investigator. Prior to the beginning of training, programme assistants were made well acquainted with the purpose of the study, intensity and load magnitude assessment, pace and recovery according to time schedule made by the investigator.

ANALYSIS OF THE DATA

The influence of independent variables on each criterion variables are analyzed and presented below

Table -1

PRE AND POST DATA ANALYSIS ON HEMOGLOBIN AT MODERATE AND LOW ALTITUDE LEVEL

	Moderate Altitude group	Low Altitude group	Source of Variance	Sum of Squares	Df	Mean Squares	'F' Ratio
Pre-test Mean	14.41	14.33	B:	.048	1	.048	.151
S.D	.51	.60	W:	6.94	22	.31	
Post-test Mean	15.21	14.82	B:	.897	1	.897	3.75
S.D	.49	.48	W:	5.25	22	.239	
Adj.Post Test Mean	15.18	14.85	B:	.64	1	.64	5.83 *
			W:	2.31	21	.11	

In the table 1 analysis of co-variance (ANCOVA) for the means of Moderate and low altitude groups in hemoglobin were calculated and found significant at '0.05' level of significance. The pre-test, post-test and adjusted post-test mean values of both the training groups on Hemoglobin levels are graphically presented in the figure I.

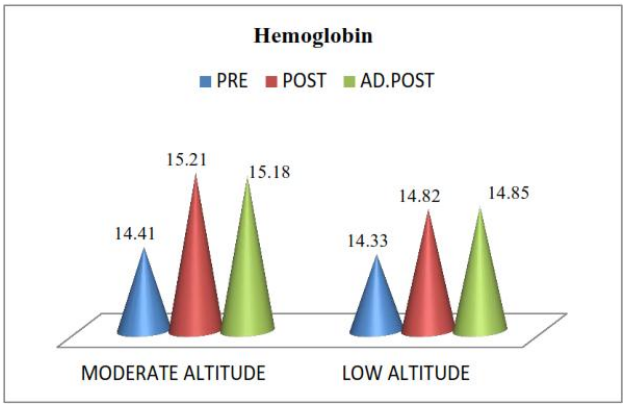

Figure –I

Table- 2

PRE AND POST DATA ANALYSIS ON RBC AT MODERATE AND LOW ALTITUDE LEVEL

	Moderate Altitude group	Low Altitude group	Source of Variance	Sum of Squares	df	Mean Squares	'F' Ratio
Pre-test Mean	4.65	4.54	B:	.067	1	.067	.38
S.D	.30	.50	W:	3.84	22	.17	
Post-test Mean	5.08	4.74	B:	.68	1	.68	5.68*
S.D	.30	.38	W:	2.65	22	.12	
Adj.Post Test Mean	5.05	4.78	B:	.41	1	.41	11.19*
			W:	.77	21	.03	

In the table 2, analysis of co-variance (ANCOVA) for the means of Moderate and low altitude groups in RBC were calculated and found significant at 0.05 level of significance. The pre-test, post-test and

adjusted post-test mean values of both the training groups on RBC levels are graphically presented in the figure II.

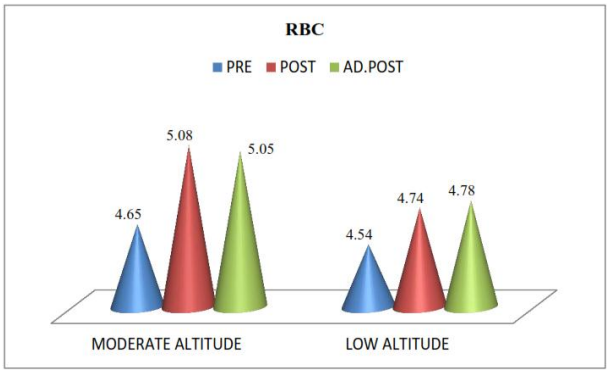

Figure –II

DISCUSSION OF FINDINGS & CONCLUSION

The result of the study showed that significant improvement in hemoglobin level in the moderate altitude training group as compared to the low altitude training group in terms of the mean values. The increase levels of hemoglobin as a result of training may be attributed to the reason that due to acclimatization the plasma level in blood increases. It access to the elevated levels of dehydration which takes place due to increase respiratory rate. As the respiratory rate increases the water through sweat gets out of the body.

One reason may be that due to excessive stress on respiratory system, which takes place due to a decrease in partial pressure of oxygen, the hemoglobin level increases to compensate the lack of oxygen in the body. Due to increasing hemoglobin the O2 binding in blood increases. This compensates the lack of oxygen in body **(Faulkner A. 1967)**.

Another result also showed that there is significant improvement in the red blood cells of moderate altitude training group when compared to low altitude training group, in terms of the values. These findings may be attributed to the reason that the partial pressure of the oxygen decreases and as a result of several effects the metabolism in bone marrow increases. As a consequence, the enzymatic activity in bone marrow increase and the RBC production also increases**. (Ramirez 1991)** has also shown similar effects of moderate altitude training in his study.

The RBC increase is also associated with an increase in the hemoglobin levels and RBC plays an important role in enhancing the endurance capacity.

The endurance training also causes an increase in erythropoietin (EPO) levels which is secreted by the kidney. The increase in EPO causes the bone marrow to elevate the levels of RBC production. **(Hoppler Hans, 2001)**

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