Effect of Conditioning Training on Hemoglobin and Red Blood Cell Count in All India Inter-University Male Sprinters

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***Abstract*—Background: Physiological changes brought about by conditioning exercise are critical for athletic performance, especially in sprint events where effective oxygen transport is critical. Red blood cell count and haemoglobin concentration are important haematological markers of the ability of blood to carry oxygen.**

Objective: The objective of the study is to investigate the effect of a structured conditioning program on haemoglobin (HGB) concentration and red blood cell (RBC) count of male sprinters from All India Inter-University.

Methodology: To attain the purpose of the study, twenty sample (N=20) were selected as subjects using a convenience sampling technique. The age of the subjects ranged between 18 to 25 years. A one-group pre-test and post-test experimental design was employed. The measurements of haemoglobin concentration and RBC count were obtained before the intervention. The selected haematological variables were measured by the assessment of the blood samples by a professional pathologist using Erba Chem – 5 V_2 Plus Analyzer. The pre- and post-intervention data were analyzed using a paired sample t-test to determine significant changes in the selected variables, with a level of significance set at 0.05.

Results: The analysis revealed a significant improvement in the RBC count and Hemoglobin of the group from the pre-test to the post-test.

***Index Terms*—Conditioning training; Hemoglobin; Red blood cell count; Male sprinters**

I. INTRODUCTION

Red blood cells (RBCs) are pivotal to athletic performance owing to their essential function in oxygen transport, carbon dioxide elimination, and acid–base equilibrium during physical exertion. Red blood cells, as the principal transporters of haemoglobin, dictate the efficacy of oxygen supply to active muscles, thereby affecting endurance, sprint performance, and recovery (Mairbaurl, 2013; Shaskey & Green, 2000). In elite athletes, haematological measures including red blood cell (RBC) count, haematocrit (HCT), and haemoglobin concentration (HGB) are routinely assessed as indications of training adaptation and physiological preparedness (Diaz Martinez et al., 2022).

Haemoglobin (Hb), the oxygen-transporting protein in red blood cells, is a crucial factor in exercise performance due to its function in delivering oxygen from the lungs to active muscles and aiding in the expulsion of carbon dioxide (Shaskey & Green, 2000; Mairbaurl, 2013). In sprinting, when repeated high-intensity muscular efforts are necessary, the availability of haemoglobin is crucial for maintaining oxidative metabolism, mitigating lactate accumulation, and facilitating swift recovery between exertions (Brocherie et al., 2015).

The importance of red blood cell counts and haemoglobin concentration in oxygen transport and sprint performance is critical; the evidence on their adaptation to conditioning training in competitive sprinters remains limited. Therefore, the objective of this study was to examine the effect of a structured conditioning training programme on red blood cell count and haemoglobin concentration in All India Inter-University male sprinters.

II. METHODOLOGY

Selection of the subjects to attain the purpose of the study, forty samples (N=20) were selected as subjects using a convenience sampling technique. The age of

the subjects ranged between 18 to 25 years. A one-group pre-test and post-test experimental design was employed. The subjects were informed about the study's objective and protocol, and all their queries were addressed. Erba Chem – 5 V_2 plus Analyzer was used to collect the data of the participants.

Selection of variables:

RBC count and Hemoglobin.

Criterion Measures:

The selected hematological variables were measured by the assessment of the blood samples by a professional pathologist using Erba Chem – 5 V_2 Plus Analyzer (Erba Diagnostics Mannheim, 2015).

III. COLLECTION OF DATA

The experimental group N=20 participated in 6 weeks of the training programme at their respective place and the data was collected before and after 6 weeks of the training programme. All hematological testing was performed by an expert lab technician in a pathology laboratory. A blood sample (5ml) was taken before the commencement of the training schedule and after its completion using Erba-Chem-5V2 Plus analyzer (Sudhakar et al., 2013; Das et al., 2023; Kaniganti et al., 2021; Marques-Jimenez et al., 2022; Khodaiji et al., 2022).

IV. ANALYSIS AND INTERPRETATION

Table 4.1 shows pre vs. post-test results comparison using paired sample t-test with mean and SD of RBC for male sprinters from the All-India Inter-University.

Variable.	Test Stages	N	Mean Scores	Standard Deviation	t-value	p-value
RBC	Pre-Test	20	5.02	0.23	10.34	0.000
	Post-Test	20	5.46	0.19		

Table 4.1 shows mean and SD for RBC of the participants with pre-test 5.02±0.23 and post-test 5.46±0.19, and t-value of 10.34 with p-value=0.000, p<.001. The analysis revealed a significant improvement in the RBC count of the participants from the pre-test to the post-test.

Figure 4.1: Showing Mean and SD of RBC of the Subjects

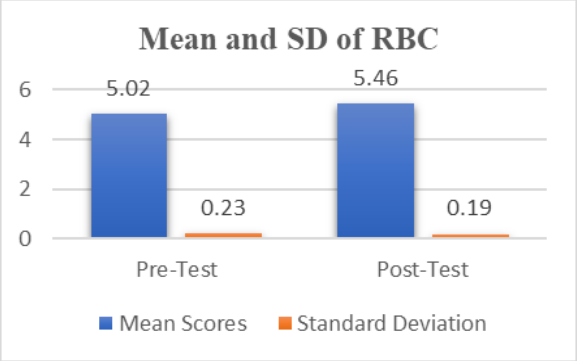
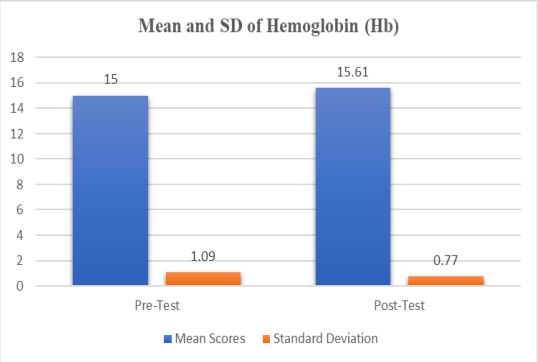


Table 4.2 shows pre- vs. post-test results comparison using a paired sample t-test with Mean and SD of Hemoglobin (Hb) for the participants

Variable	Test Stages	N	Mean Scores	Standard Deviation	t-value	p-value
Hb	Pre-Test	20	15.00	1.09	7.43	0.000
	Post-Test	20	15.61	0.77		

Table 4.20 shows mean and SD for Hemoglobin (Hb) of the participants with pre-test 15.00±1.09 and post-test 15.61±0.77, and t-value of 7.43 with p-value=0.000, p<.001. The analysis revealed a significant improvement in participants' Hemoglobin (Hb) from pre-test to post-test.

Figure 4.2: Showing Mean and SD of Hemoglobin (Hb) for the participants



V. DISCUSSION OF THE FINDINGS

The current study demonstrated notable enhancements in red blood cell (RBC) count and haemoglobin (HGB) in male sprinters after a systematic conditioning regimen. The data suggest that persistent physical

conditioning induces beneficial haematological changes, potentially improving oxygen transport capacity and athletic performance.

The rise in RBC count noted in the experimental group indicates the established erythropoietic response to consistent training. Exercise-induced enhancement of erythropoietin (EPO) synthesis, coupled with mechanical and hypoxic stresses, facilitates erythropoiesis (Sawka et al., 2000; Hu & Lin, 2012). Yunus (2023) reported analogous findings, observing a substantial increase in erythrocyte count following eight weeks of moderate-intensity aerobic training. Moreover, Wardyn et al. (2008) established that prolonged exercise enhances haematological parameters and mobilises progenitor cells that facilitate haematopoiesis and immunological modulation.

The elevation in haemoglobin (HGB) noted in this study corresponds with prior research emphasising haemoglobin as a crucial indicator of enhanced oxygen-carrying capacity due to endurance and sprint training (Mairbaurl, 2013; Hu & Lin, 2012). Diaz Martinez et al. (2022) indicated that elite athletes generally demonstrate increased haemoglobin levels, a physiological adaptation essential for optimal performance. The present findings align with those of Noushad et al. (2012), who exhibited markedly superior haematological values in trained males relative to untrained individuals.

The present study concludes that a structured conditioning training programme elicits significant improvements in red blood cell count and haemoglobin concentration in All India Inter-University male sprinters. These haematological adaptations reflect enhanced erythropoietic activity and improved oxygen-carrying capacity, which are fundamental physiological requirements for sprint performance. Future research incorporating control groups, larger samples, and performance-related variables is recommended to further substantiate and extend these findings.

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