Original Article

"RELATIONSHIP BETWEEN HAEMATOLOGICAL VARIABLE HAEMOGLOBIN AND SELECTED PHYSICAL-PHYSIOLOGICAL PARAMETERS OF HIGH-ALTITUDE FEMALE BOXERS OF HIMACHAL PRADESH"

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Abstract

The aim of the study was to find out the relationship between haematological variable haemoglobin (Hb) level and selected physical-physiological parameters of high-altitude female boxers of Himachal Pradesh. The researcher formulated assertive hypotheses to be tested to investigate the relationship between haematological variable haemoglobin (Hb) level and selected physical-physiological parameters. Purposive sampling device was used to select the subjects. 30 female subjects were selected for the present study, from high-altitude regions (Kinnaur and Shimla districts) of Himachal Pradesh. Haemoglobin (Hb) level was measured using haematology analyzer from collected blood sample and physical-physiological variables were measured by anthropometric rod, body analyzer and spirometer. For the purpose of analysis coefficient of correlation was taken between haematological variable haemoglobin (Hb) level and selected physical-physiological parameters. Level of significance was established at 0.05 level of confidence and results showed that haemoglobin (Hb) is insignificantly related with most of the selected physical-physiological parameters.

Keyword: Haemoglobin (Hb), Boxing, Physical-Physiological and High-Altitude.

INTRODUCTION

Altitude exposure is a well-known environmental factor that causes big changes in athletes' bodies and blood. Training and residing at high altitudes subject the body to hypobaric hypoxia, which diminishes oxygen availability and initiates a series of compensatory processes designed to enhance oxygen delivery and usage. Hemoglobin (Hb) is one of the most important adaptations since it directly affects how much oxygen blood can carry and helps the body make energy through aerobic processes during exercise. An increase in hemoglobin concentration is regarded as a significant adaptation to prolonged altitude exposure and is closely linked to endurance performance and aerobic capacity (Levine & Stray-Gundersen, 1997; Sawka et al., 2000).

Boxing is a high-intensity sport that requires a unique mix of aerobic endurance, anaerobic power, speed, agility, and muscle strength. Female boxers who train at high altitudes are always under hypoxic stress, which may boost erythropoiesis and raise hemoglobin levels. These modifications are believed to enhance oxygen transport to active muscles and postpone exhaustion over successive high-intensity sessions (Wilber, 2007; Gore et al., 2013).

Although the significance of hemoglobin in altitude adaptation is well recognized, the correlation between hemoglobin levels and physical-physiological attributes, including body composition and pulmonary function, is not yet fully understood. Certain research indicate that haemoglobin adaptations transpire mostly irrespective of body size and composition, since hypoxia serves as the principal trigger for erythropoiesis (Wehrlin & Marti, 2006). Likewise, respiratory measures such as forced vital capacity and peak expiratory flow are primarily affected by thoracic dimensions and respiratory mechanics rather than hematological factors (Bassett & Howley, 2000). So, it is important to look at the link between hemoglobin and physical and physiological factors in athletes who train at high altitudes to learn more about how the body changes when it is at high altitudes.

Himachal Pradesh is a great place for these kinds of studies since athletes in this area live and train at high altitudes, which puts them under constant hypoxic stress. There is not enough scientific information about the link between hemoglobin levels and physical-physiological traits in high-altitude female boxers, even though more women are now boxing. Comprehending these linkages is crucial for refining training methodologies, overseeing athlete health, and improving performance. The current study was conducted to investigate the

correlation between hemoglobin levels and specific physical-physiological markers in high-altitude female boxers from Himachal Pradesh.

PURPOSE

The purpose of the study was to find out the relationship between haematological variable haemoglobin (Hb) level and selected physical-physiological parameters of high-altitude female boxers of Himachal Pradesh.

MATERIALS AND METHODS

Researcher formulated assertive hypothesis to investigate relationship between haemoglobin (Hb) level and selected physical-physiological parameters of high-altitude female boxers of Himachal Pradesh. Purposive sampling device was used to select the subjects. 30 female subjects were selected for the present study, from high-altitude regions (Kinnaur and Shimla districts) of Himachal Pradesh. Haemoglobin (Hb) level was measured using haematology analyzer from collected blood sample and physical-physiological variables were measured by anthropometric rod, body analyzer and spirometer. Variables for the present study were haemglobin (Hb), height, weight, body fat percentage, muscle mass, visceral fat, basal metabolic rate (BMR), forced vital capacity (FVC), and peak expiratory flow (PEF). For the purpose of analysis Pearson's product moment correlation method was used to find out the relationship between the collected data.

Table 1 Correlation of Haematological Variable Haemoglobin (Hb) with Selected Physical-Physiological Parameters of Female Boxers at Moderate and High Altitude (N=30 each)

Sr. No.	Haematological Parameter	Physical-Physiological Parameters	High Altitude (r)
1.	Haemoglobin (Hb)	Height	-.147
2.		Weight	-.010
3.		Body Fat Percentage	.208
4.		Muscle Mass	.074
5.		Visceral Fat	.113
6.		Basal Metabolic Rate	.062
7.		Forced Vital Capacity (FVC)	.109
8.		Peak Expiratory Flow (PEF)	-.030

RESULTS

It is evident from the table-1 that among high-altitude female boxers, haemoglobin (Hb) shows negative and statistically non-significant correlations with height (r = −0.147), weight (r = −0.010), and peak expiratory flow (PEF) (r = −0.030). Furthermore, positive but statistically non-significant correlations are observed between haemoglobin (Hb) and body fat percentage (r = 0.208), muscle mass (r = 0.074), visceral fat (r = 0.113) basal metabolic rate (r = 0.062), and forced vital capacity (FVC) (r = 0.109). None of these correlations exceed the critical r value (±0. 0.250); hence, demonstrating the absence of statistically significant relationships at high altitude.

DISCUSSION OF FINDINGS

On the basis of obtained results in high-altitude female boxers, the relationships between haemoglobin (Hb) and height, weight, body fat percentage, muscle mass, visceral fat, basal metabolic rate, forced vital capacity, and peak expiratory flow were determined to be statistically non-significant. This suggests that, the majority of physical-physiological traits do not exhibit a significant correlation with erythrocyte levels at high-altitude. This indicate that haematological adaptations occur largely independent of physical–physiological traits.

At high altitude, chronic hypoxic exposure strongly stimulates erythropoiesis via hypoxia-inducible mechanisms, resulting in elevated haemoglobin levels that primarily reflect environmental stress rather than

individual differences in body composition or performance capacity. Under severe hypoxia, haemoglobin concentration may reach a physiological plateau, beyond which further increases do not enhance lung function. This may explain the absence of significant associations with forced vital capacity and peak expiratory flow, as ventilatory adaptations are regulated more by respiratory mechanics than oxygen-carrying capacity. Similar observations have been reported by Wehrlin and Marti (2006), Gore et al. (2013), and Lundby and Robach (2016), who noted weak or inconsistent relationships between haemoglobin indices and functional performance at high altitude

CONCLUSION

It is evident from the results that haemoglobin (Hb) is insignificantly related with most of the selected physical-physiological parameters.

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