IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

An Investigation On Insulin And Hemoglobin Of Tribal Athletes – Relevance For Improving The Performance

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ABSTRACT

The available related literatures have reached at a long last conclusion is that the exposure of optimal genetic factors to the optimum training environment produces champion athletes. Sporting ability is found that racial athletic ability reify race as inherited permanent biological characteristics. In order to adapt the training load, the athletes have to develop physiologically to meet the physical demand required at elite levels. The present investigation was an attempt to evaluate the influence of insulin and hemoglobin on performance of tribal athletes.

Seventeen (N=17) middle distance tribal male athletes (800mt. and 1500mt.) were selected as subject from different training clubs of Jalpaiguri district assuring their minimum district level participation for two times. The age of the respondents were ranged from 18 to 22 years.

Venous blood samples were collected through Venipuncture Sampling technique and were tested in pathological laboratory for the assessment of fasting insulin and hemoglobin of subjects. Performance level was measured through time in 1500mt. run.

In order to analysis the collected data, Pearson's product moment correlation of coefficient was adopted to find out the existence of relationship between the selected variables and performance of tribal athletes.

The major findings of this investigation was that fasting insulin was significantly associated with performance level of middle distance tribal athletes and also noted a profound insight on the influence of lower range of fasting insulin on higher performance in middle distance running event. On other hand, an insignificant relationship was found between hemoglobin and performance.

Key words : Insulin, Hemoglobin, Performance, Tribal athletes

1. Introduction

How genetics could soon become the new frontier for advantage in sport – a conclusive headline given by Catherine Taylor (ABC News Australia). Professor Nir Eynon, an expert in genetics, epigenetic and sport, from Victoria University, says the genes help to explain why an average person could never outrun an Olympic sprinter like Usain Bolt, even if they trained alongside him for a decade. The way certain genes are expressed in the body can influence an athlete's strength or endurance, making them better suited to sprinting or to marathons, for example. Professor Eynon agrees 'Athleticism is influenced by environment and genetics'.

The genome is formed in the process of phenotype selection, whereas the phenotype is a physiological system, however, its confined that physiology is determined by genes. Exercise physiology is a branch of physiology which examines that how our bodily functions are altered when we are exposed to acute and chronic bouts of exercise and how the body adapts physiologically to the acute activity or chronic physical training. Sports Physiology further applies such concepts from exercise physiology specifically to training the athletes and development of athletes' performance within a specific game or sports. Exercise and sports physiology are about improving performance, by understanding how the body functions during exercise, and using scientific principles to allow the body to train better, perform better and recover quicker. These are the important issues in exercise physiology because the physiological systems or organs like morphological structure of muscle, cardiovascular system, pulmonary system, energy system, hematological components and so many affect the decisions regarding the type, intensity, and duration of exercise to be prescribed to an athlete.

During athletics training, the influential parameters may be evaluated at regular intervals to assess the training load imposed on the athlete. In order to adapt the training load, the athletes have to develop physiologically to meet the physical demand required at elite levels. Physiological variables may exhibit in response to various categories of exercise through the reflection of training adaptations. The previous literatures suggested that all the physiological variables that are highly responsive to exercise training also respond due to inherent characteristics. This would enable to identify the benefits and drawbacks as key importance to further modifying the training process and can lead to better competitive success. In the present investigation, there are two dimensions to evaluate the performance of middle distance tribal athletes - one is insulin and another one is hemoglobin.

Insulin is a peptide hormone that is produced and stored in the beta cells of the pancreas which is considered as the main anabolic hormone of the body. It secretes from beta cells in response to elevated blood glucose. Insulin is mainly responsible to transport glucose from the blood to within cells, thus helping regulate blood glucose levels and play a role in lipid metabolism. Whatever may be the form of activity, insulin does play the major role to supply energy to working muscle and also in the response during recovery. Insulin is vital to regulate and keep in balance blood glucose levels.

Blood contains erythrocytes or red blood cells and red blood cells consist of a special protein – hemoglobin which is an iron containing oxygen transport element. The enormous literatures focus on the effects that acute changes in blood hemoglobin may have on maximal aerobic power and endurance capacity. Hemoglobin concentration in blood indicates the capacity of oxygen transport and utilization by the body. Oxygen carrying capacity of the blood to the working muscles depends on the amount of hemoglobin presence in blood. There is a close relation between total hemoglobin mass and VO2max thus it is associated with the cardiovascular and respiratory response to exercise. Many authors reported that reduction in hemoglobin concentration directly affected VO2max and performance, especially aerobic oriented activity. During aerobic exercise the demand of oxygen increases at the working muscle, so an optimum level of oxygen carrying capacity of blood is required to perform at the highest level with high intensity and oxygen carrying capacity of blood proportionately depends on hemoglobin concentration in red blood cell.

Genetic science in order to describe and explain common-sense impressions of racial physiology and sporting ability is found that racial athletic ability reify race as inherited permanent biological characteristics. An enduring and fascinating question in sports science is the dominance of specific population at the extreme ends of the competitive running spectrum.

If genetic factor plays an essential role to possess a higher efficiency in sports, then the athletes from a specific community or race definitely can exhibit their talent or potential based on the specific physiological requirements for a particular sport. Such logistic reason stands behind the selection of this type of research problem which may identify the key factors of excellence of tribal in sports. The tribes are an intrinsic part of our nation with their rich cultural heritage. In order to identify talent train and to provide better opportunities for performance, we chose tribal runners because they have been widely studied, and physiological characteristics and candidate genes for endurance in this population have been described extensively in previous kinds of literature.

In West Bengal the district of our concern, Jalpaiguri that is most identical region of Dooars, ranks first in the state in ST population (18.87% of total) (Sensus 2001). Part of a race or tribe that over many tens of thousands of years has to, out of necessity or need for survival, engage in certain regular behaviours then over time genetics are altered through the process of evolution are likely responsible for excellence in sports performance as the district was considered for the present experiment.

The ultimate focus of this study is to offer some insight into the factors contributing to success in sports performance of tribal athletes. This study will help to identify the specific physiological phenomenon influencing the aerobic with anaerobic capacity of the tribal athletes. The findings of the study will contribute to the quantum of knowledge regarding talent identification and in the field of sports science, in addition, to discover new facts or to include a new dimension to enrich the standard of performance.

2. Methodology

The primary objective of the investigation was to identify the association of fasting insulin and hemoglobin with performance of tribal athletes. In the present study, to ascertain the tribal athletes, the Jalpaiguri district of West Bengal was taken into consideration. The investigator identified 24 tribal athletes from the largest population of tribal community living in Dooars of Jalpaiguri district out of which seventeen (N=17) middle distance male runners (800mt. and 1500mt.) were selected as subjects as they only fulfilled all the criteria had been framed at the initial phase of this investigation. The subjects were selected from different training clubs of Jalpaiguri district. To provide the true representation to the sampling, the investigator adopted Purposive sampling technique for selection of subjects and single group design was followed. Only the respondents were selected as subjects for this present study assuring their minimum District level participation for two times. The age of the respondents were ranged from 18 to 22 years.

The initial approach was to apply to the Internal Ethical Committee (IEC) of West Bengal State University for their approval regarding collection of blood sample from the subjects. The university ethical committee approved the testing protocols and offered a certificate (approval no. WBSU/IEC/16/01, 3.12.2018) as allowing the researcher for conducting the experiment. Second approach was to identify the athletes who were interested to involve themselves voluntarily, were signed in a consent form.

2.1. Criterion Measures : The following variables were selected for the ultimatum of the purpose of the present experiment and the tests were conducted to measure the parameters were:

Variables	Measuring Tools	Unit of Measurement
Insulin in Blood (Fasting)	Pathological Lab Test (Electronic method and automated analysis)	µIU/mL
Hemoglobin (Hb)	(The selected variables were measured by the assessment of the blood samples were taken by phlebotomist)	gm/dl
Performance Level Over 1500mt. Run	Stop-Watch (Casio- 1/100)	min.

Venous blood samples were collected through Venipuncture Sampling technique. A sterilized syringe with needle was used to draw 5 ml. blood samples from superficial vein located in elbow, generally the median cubital vein by phlebotomist of Health Plus Diagnostic Pvt.Ltd., Jalpaiguri in the morning between 8:30a.m. to 9:00a.m. Collected blood samples were preserved into separate tubes for testing hemoglobin and fasting insulin in their laboratory. Performance level of the subjects was measured by 1500mt. run which was their major event. Fraction of minute (second) was converted in percentage due to avoid the error at the time of statistical calculation.

2.2. Statistical Procedure : In order to analyse the collected data and to investigate the existence of association between the parameters, Pearson's Product Moment Correlation of Coefficient was employed. Prior evaluating, all the collected data were converted into standard scores as measuring units were not in uniform in nature.

For testing the hypothesis, the level of significance was set at 0.05 level. Further to evaluate the descriptive statistics, mean, standard deviation and standard error were calculated to characterise the selected variables of the respondents.

3. Analysis of Data and Findings of the Study

Analytical findings regarding the mean of age of subjects was 20.7 $\pm$1.32 with standard error 0.32 and range was 18 to 22 years.

Table - 1

Subjects Characteristics Regarding Fasting Insulin and Performance Level Over 1500mt. Run and Ratio of Association Between Them

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
Fasting Insulin (µIU/mL)	5.43	$\pm$2.75	0.67	10.1	2.1	0.512**
Performance (Minute)	5.1	$\pm$0.28	0.067	5.65	4.62	

Significant at $r_{0.05}(15) = 0.482$

** - Significant

The above table indicates that a positive significant relationship was found between fasting insulin and performance of middle distance tribal athletes as the calculated value of coefficient of correlation (r = 0.512) was higher than the tabulated value [r(15)=0.482] at 0.05 level. Here we need to clarify a crucial fact of this study for the appropriate interpretation of the result. Actually an inverse relation always exists between performance and time in running event. So, we can conclude that as 1500mt. run has an inverse relation with performance, the revealing correlation which indicated positively significant was actually existed as an inverse significant relationship between fasting insulin and Performance. The strength of relationship was moderate between them.

The structure of strength of relationship is shown in the following table :

Table – 2

Strength of Correlation of Co-efficient

Range	Strength of association
0 (zero value)	Zero relation or absolutely no relationship
From 0.01 to ± 0.20	Slight or almost negligible relationship
From ± 0.21 to ± 0.40	Low correlation or small relationship
From ± 0.41 to ± 0.70	Moderate correlation
From ± 0.71 to ± 0.90	High correlation or marked relationship
From ± 0.91 to ± 0.99	Very high correlation or quite dependable relationship
± 1	Perfect correlation

Mangal (2016)

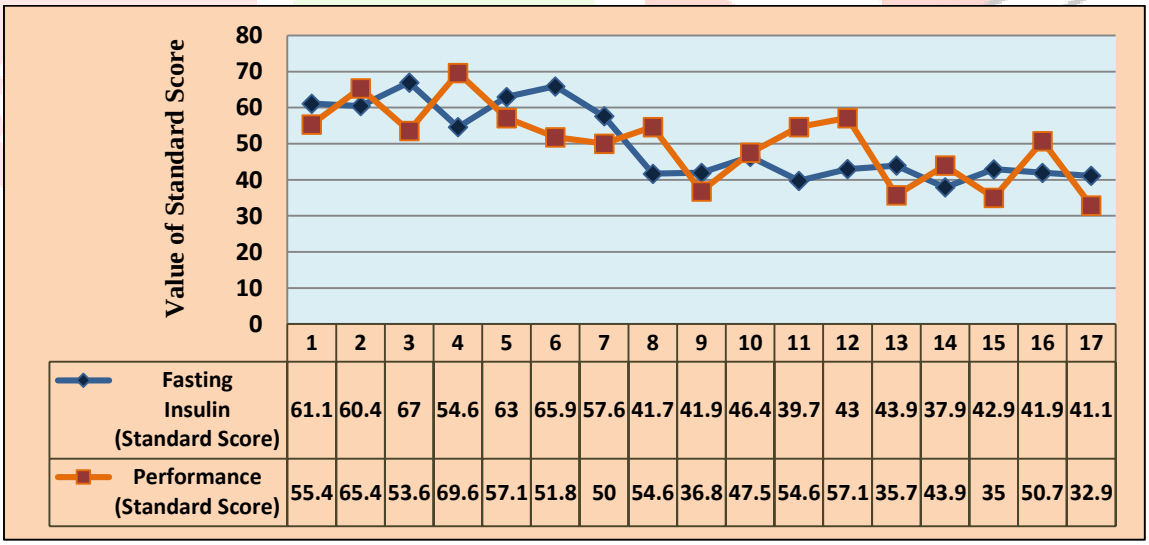

Fig-1 : Graphical Representation of Association Between Fasting Insulin and Performance Level in Time Over 1500mt. Run in Respect to Standard Score

Table - 3

Subject Characteristics Regarding Hemoglobin and Performance Level Over 1500mt. Run and Ratio of Association Between Them

Name of the Variables	Mean	Standard Deviation	Standard Error	Highest Score	Lowest Score	'r' Ratio
Hemoglobin (gm./dl)	12.99	±0.98	0.24	15.4	11.4	-0.131^{NS}
Performance (Minute)	5.1	±0.28	0.067	5.65	4.62	

Significant at $r_{0.05}(15) = 0.482$

NS – Not Significant

Table-3 depicts a negative insignificant relationship between hemoglobin and performance of tribal athletes as the calculated value of coefficient of correlation (r = 0.131) was lesser than the tabulated value [r(15)=0.482] at 0.05 level. Just like the previous interpretation, here we can also conclude that as 1500mt. run has an inverse relation with performance, the revealing correlation which indicated negatively insignificant was actually existed as a positive insignificant relationship between hemoglobin and Performance. The strength of relationship was slight between them.

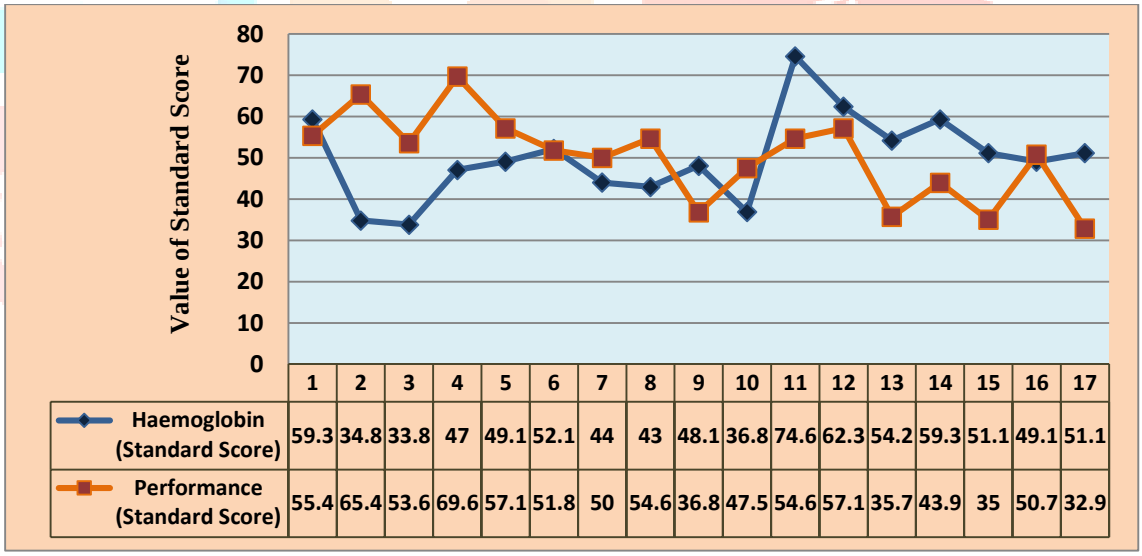

Fig-2 : Graphical Presentation of Association Between Hemoglobin and Performance Level in Time Over 1500mt. Run in Respect to Standard Score.

3.1. Discussion of Findings

The findings pertaining to the study revealed a significant relationship of fasting insulin with performance level over 1500mt. run, and also pointed that performance was not significantly associated with hemoglobin. These findings may be attributed to the following.

3.1.1. Fasting Insulin

Insulin is a hormone which is vital to transport glucose from blood to within cell, thus helps to control the amount of glucose in blood. Whatever may be the form of activity, insulin does play the major role to supply energy to working muscle and also in the response during recovery. The present study examined the association of objectively measured fasting insulin and performance of middle distance tribal athletes and found an inverse significant relationship between them. Pancreas secretes insulin into blood in response to elevated blood glucose. As glucose moves into cells, the level of glucose in blood decreases and simultaneously secretion of insulin by the pancreas also decreases. A numerous number of study in marked to the reduction of fasting insulin due to intense activity. Trapp et al. (2008) found a significant reduction in fasting insulin in relation to high-intensity intermittent exercise. On the other hand Schmitz et al. (2002) examined and concluded that physical activity is correlated with lower fasting insulin and greater insulin sensitivity. This result is consistent with the effect of aerobic fitness founded by Bertoli et al. (2003) and Allen et al. (2007). A person who is insulin-sensitive needs only a relatively small amount of insulin to keep blood glucose levels in the normal range and to keep the body's cells supplied with the glucose they need (Prasad-Reddy and Isaacs, 2015). This is in marked to the contrast relationship of fasting insulin with aerobic and anaerobic both exercises. This result probably could be that exercise exerts a long-term effect on reduction of fasting insulin and improvement in insulin sensitivity through enhanced glucose transport into muscle cells and increased production of muscle glycogen to replace the glycogen used during exercise (Schmitz et al., 2002). Another reason of such moderate relationship may be the influence of genetic variability of Dooars tribal athletes.

3.1.2. Hemoglobin

Hemoglobin is important and is one of the major limiting factors of endurance performance. Efficient oxygen transport to tissues is determined by the hemoglobin concentration in the blood circulation system, blood volume and muscle perfusion. The respondents of this study exhibited that no significant relation existed between hemoglobin and performance even though a positive correlation is reflected in table no.-3. The predominant mechanism is thought to be accelerated erythropoiesis increasing hemoglobin mass resulting in a greater maximal oxygen uptake (VO_2 max). The correlation was weak which indicates that other factors are still important in increasing $\dot{V}O_2$ max, apart from increased hemoglobin. A recent study found no correlation between performance of endurance athletes and hemoglobin (Zelenkova et al.,2018) that goes in accordance with present study. In contrast, Lippi et al. (2014) found in his experiment that hemoglobin significantly associated with middle distance running performance and also some studies reported that experimental groups were significantly improved in hemoglobin concentration due to exercise training programme (Shenbagavalli and Sam, 2009). Whereas Schumacher et al. (2002) and Manna et al. (2016) noted that reduction of hemoglobin observed in the experimental group after the training. They suggested that such findings can be attributed to exercise induced plasma volume expansion.

Hemoglobin concentration of the respondents of the present study was 12.99 $\pm$ 0.98 gm/dl, whereas National Health portal of India recommended the normal range of hemoglobin for Indian men is 13.8 to 17.2 gm/dl . This could be probably due to sports anemia which is a condition that an individual has a less amount of hemoglobin than ideal for endurance performance. Iron deficiency is the foremost cause of anemia in athletes which is known as sports anemia. Athletes, endurance athletes, tend to have slightly low hemoglobin levels as judged by general population norms (Eichner, 2001).

Hemoglobin is the iron - containing oxygen-transport metalloprotein in the red blood cells of all vertebrates as well as the tissues of some invertebrates (Umarani & Shelvam, 2013). The researcher of present study suggested that iron may be mainly responsible for such results regarding hemoglobin and performance. Several of the well-known consequences of iron deficiency that occur after the depletion of iron stores are a decline in hemoglobin concentration and volume of new red cells. Many other descriptive studies also demonstrated a significant decrease in red blood cell number and a decrease in hemoglobin and ferritin concentrations in athletes (Tobin and Beard, 1996). The authors speculated that a recurring

hemoglobinuria might produce diminished iron reserves in middle and long distance runners. The tribal community of North Bengal are suffering from a very high percentage of malnutrition mostly attributed to iron deficiency. Study showed that the intake of protective food such as milk, green leafy vegetables and fruit was very deficient among tribal (Murugasen & Ananthalakshmi, 1991). Deficit of fruits and vegetables were lead to deficiency of several nutrients such as calcium, iron, vitamin A and C etc (Mittal & Srivastava, 2006). In addition, it is documented that iron status is negatively altered in many populations of chronically exercising individuals (Beard and Tobin, 2000).

4. Limitations

The impact of environment during the period of testing as performance influenced by climatic conditions, was considered as one of the limiting factors. Along with that the certain factors associated with the study like socio-economical condition, diet, lifestyle, daily routine, habits and state of health of subjects during testing period which were beyond the control of the researcher. Less number of samples (N=17) might be a major issue which would not be taken into consideration for deriving the result.

5. Acknowledgement

First and foremost, the researcher wishes to express his deepest sense of appreciation to those who served as subjects for this study. The researcher expresses his deep indebtedness to the Secretary and other members of Internal Ethical Committee of West Bengal State University to approve this study from an ethical point of view and for extending his sincere co-operation. The investigator acknowledges his sincere gratitude to those from whom and from whose works help have been taken, directly or indirectly to accomplish the present study.

6. Conclusions

Within the limitations of the study the following conclusions appeared justified as per the results obtained.

1. Fasting insulin was moderately correlated with performance of middle distance tribal athletes. Higher performance in running event was significantly associated with lower range of fasting insulin.
2. Hemoglobin was not a dominant factor in relation to higher performance of middle distance tribal athletes. Hemoglobin concentration was positively but slightly associated with performance of middle distance running event.

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