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Studies on the Haemoglobin Concentration in Relation to Sex, Age and Season among the Population of Multan, Pakistan

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Abstract: The present study was carried out to assess the haemoglobin level of different age groups of human population in Multan, Pakistan for a period of 18 months from June 2001 to December 2002. The study revealed that both old and mature male/females had significantly higher percentage of haemoglobin level than youngs. The percentage haemoglobin of males was significantly higher than females. Hb percentage was significantly higher in summer than winter. Whereas overall percentage haemoglobin when compared for male and females with standard levels, the whole population was found to be below the normal range. Therefore it is concluded that the experimental population appears to be anaemic.

Key words: Haemoglobin concentration, sex, age, season, population

Introduction

Erythrocyte precursors synthesize haemoglobin which is a protein, globin united with the pigment haem and is essential for transport of oxygen from the lungs to tissues and for transport of CO_2 in opposite direction and for the regulation of blood pH. The synthesis of haemoglobin requires the provision of nutrients such as protein, vitamins and minerals (especially iron) and only takes place in the cells of erythroid series (monoblasts) (Keele *et al*., 1983). Different abnormalities of erythrocytes, many of which are hereditarily acquired or due to nutritional problems causes anemia. One of the nutritional problems affecting a large number of populations in many developing countries is nutritional anaemia. (WHO, 1968 and Edmundson and Edmundson, 1992). Nutritional anaemia is defined as a condition in which the haemoglobin (Hb) contents of the blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency, (WHO, 1968). It is reported that individuals suffering from nutritional anaemia are more susceptible to infections (Chandra, 1976 and Dallman, 1987).

Moreover, data on the Hb concentration are also very useful in making out human variation under different ecological and cultural conditions (Crane *et al*., 1972; Garn *et al*., 1977; Owen-Yenochik, 1977 and Gupta *et al*., 1984). It may however be mentioned that such studies are still very limited.

In the present study, an attempt has been made to give a very brief account of the haemoglobin level in relation to age, sex and season in Multan city which is in south of Punjab, Pakistan and is known for its extreme hot temperature.

Materials and Methods

The present study was carried out to assess the haemoglobin level in relation to age, sex and season from human population in Multan, Pakistan. The study period was selected from June 2001 to December, 2002. The present study was based on the data, collected randomly from the population of Multan, Pakistan. Ninety five males and two hundred thirty eight females of different age groups were analyzed. The male population was divided into three age groups i.e. old male (age above 50 years), mature male (age 13 to 50 years) and young male (age below 13 years) The female population was also divided into similar three groups. The estimation of haemoglobin was carried out in summer and winter to observe the seasonal effect. Efforts were made to include samples of all those persons who were willing to cooperate in carrying out the purpose of present study . The estimation was carried out immediately after the collection of blood samples by using Cyanmethaemolobin method (Wintrobe, 1956).

Haemoglobin + Cyanide + Ferricyanide → Cyanmethemoglobin

The samples were collected randomly from population of Multan Pakistan and were analyzed following the standard techniques (WHO, 1980) by using a photometer 4010. Twenty five ml potassium hexacyanoferrate and 25

ml potassium cyanide were mixed in 950 ml of distilled water by using graduated cylinder to make the working solution. This working solution had a stability of one year and was preserved in an amber glass bottle. In the photometer a glass cuvette of 1 cm light path was used and tests were performed by using a filter of wavelength 546 nm. 5 ml working solution was taken in glass test tube, added 0.02 ml fresh blood and calculated the absorbance (A) of sample. In this way obtained the concentration (c) of haemoglobin in blood by using the formula:

$$C = 36.77 \times \text{Absorbance (gd l}^{-1}\text{)}$$

As the solution contained potassium cyanide so only safety auto pippetts were used.

Results

The result from the present study revealed that there was a significant effect of age on Hb concentration. The Hb concentration was higher in mature and old group than young ones in both sexes. The Hb concentration was significantly higher in Males than females (Table 1).The effect of season was also significant. The individuals of both sexes had higher Hb concentration in summer than winter (Table 2). The Hb concentration of observed population when compared with the normal range, it was observed that all individuals of both sexes had significant lower Hb than normal range (Table 3).

Discussion

In normal circumstances erythropoiesis is regulated so as to maintain the number of erythrocytes and haemoglobin content within a narrow range. In anaemia there is a reduction in number of circulating erythrocytes or a decrease in their content of haemoglobin. Anaemia occurs when the erythropoietic tissues cannot supply enough normal erythrocytes to the circulation. The normal balance between production and destruction is maintained by a daily output of 2×10^{11} erythrocytes from the bone marrow, the cells surviving for about 120 days. The balance is upset if there is an excessive loss of blood e.g. haemorrhage or if there is some defect in the production of erythrocytes by the bone marrow. Maintaining adequate amount of iron, Hb and RBCs is essential to the normal functioning of the body. An anaemic person feels constantly tired and run down and is often susceptible to infections because the body cells do not get enough oxygen. Anaemia can result from a variety of factors, including excessive blood loss, vitamin or mineral deficiencies and bone marrow cancer. Iron deficiency is the most common cause. A person may not get enough iron in the diet or the digestive tract may not absorb enough of it. Women are likely to develop iron deficiency than men because of blood loss during menstruation. Pregnant women generally benefit from iron supplements to support the developing foetus and placenta (Campbell, *et al*., 1997). The association of Hb contents and nutritional status of population with socio-economic conditions, is perhaps no longer an uncommon phenomenon (Basu, 1987; Edmundson and Edmundson, 1992; Osmani, 1992). However the question of how the low income groups adopt themselves to such an environment of low Hb concentration or lower intake of nutrients is yet to be clearly understood. In males the mean blood haemoglobin concentration is 14.0 gd l^{-1}, with a range of 14-16 gd l^{-1}. In females, the mean Hb concentration is 12.0 gd $l^{-1}$with a range of 12-14 gd l^{-1}. At birth, the Hb concentration is 23 gd l^{-1}, falling to 10.5 gd l^{-1} at the end of the third month. The concentration then rises gradually to reach 12 gd l^{-1}at 1 year.

The present study revealed that both old and mature male/females had significantly higher percentage of haemoglobin level than youngs.The percentage Haemoglobin of males was significantly higher than females (Table 1). Hb percentage was significantly higher in summer than winter (Table 2). Whereas overall percentage haemoglobin when compared for male and females with standard levels, the whole population was found to be below the normal range (Table 3). Therefore,it is concluded that the experimental population appears to be anaemic. The present study, no doubt is short of data on disease prevalence, susceptibility to infection and the life with a view of understanding the well being or health status of Multan population according to different socio-economic conditions. In the view of the present findings,

Table 1: Haemoglobin content (gdl^{-1}) according to age and sex. Standard deviation is given in parenthesis

Type	Age (years)	Sex	N	Hb (gdl^{-1}) Mean
Old	>50	Male	21	11.243^{ab} (1.641)
Mature	13-50	Male	47	11.932^{a} (1.998)
Young	<13	Male	27	9.878^{c} (1.560)
Old	>50	Female	21	10.405^{bc} (1.396)
Mature	13-50	Female	186	10.984^{b} (1.209)
Young	<13	Female	31	9.471^{c} (1.280)

Note: Letters indicate results of multiple range tests (LSD) procedure. Mean with same letters are not significantly different from each other at 0.05 level

Table 2: Haemoglobin content (gdl^{-1}) according to season

Season	N	Mean	±SD
Summer	235	11.200	1.354
Winter	98	10.068	1.734

Table 3: ANOVA Table of comparison of haemoglobin (gdl^{-1}) in relation to age, sex, season and compared with normal range

Factor	Df	S.S.	M.S.	F	P
Normal	7,658	904.80	129.26	129.01	<0.001***
Age	5,327	150.15	30.03	14.90	<0.001***
Season	1,331	88.63	88.63	40.70	<0.001***

one may suggest that Hb contents seems likely to be associated with age, sex and season. The population under study is from southern part of Punjab which is considered as underdeveloped, poor and the literacy rate is low. This population is likely to be under nourished. The temperature is hot in summer, therefore, it might be playing some role on Hb contents. We do hope that further studies will throw more light on what the present study admits limitations. Similarly the differences between populations mentioned in the study may provoke many questions which could not be answered on the basis of present set of data. Are the differences in Hb contents due to population differences in socio-economic conditions, or are they due to population variation in both genetic, socio-economic and extreme weather? How do these population adopt themselves to their respective environmental conditions and so on. Last but not the least it is observed that little attention has so far been given to Hb in population of Multan region, though such a study is likely to reflect the nutritional and health status of population.

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