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Research Article

**STUDY TO KNOW RELATIONSHIP BETWEEN RATES OF BLOOD  
DONATIONS AND IRON DEFICIENCY ANEMIA**<sup>1</sup>Dr.Naveed Shafqat Zia, <sup>2</sup>Dr. Javeria Shoukat, <sup>3</sup>Dr.Khawaja Mashood Arif<sup>1</sup>Latin American School of Medicine (ELAM)<sup>2</sup>Allama Iqbal Medical College, Lahore<sup>3</sup>Demonstrator, AJK Medical College, Muzaffarabad.**Abstract:**

**Objective:** To see the relationship between rates of blood donations with iron insufficiency anemia. **Study Design:** Cross sectional Study **Place and Period of Study:** This study was directed from November 2016 to March 2017, in Jinnah Hospital lahore **Materials and Procedures:** Total 120 male between the ages of 25 – 40 years of were enrolled for this study from the Blood Bank and pathological laboratory in Jinnah Hospital. **Results:** We found that concentration of haemoglobin was significantly greater ( $df=118$ ,  $t=6.834$ ,  $p<0.01$ ) in group A ( $10.68 \pm 2.7$ ) as compared to group B ( $7.81 \pm 1.79$ ) demonstrating that persons that donate blood regularly have lower hemoglobin levels and are in anemic state. **Conclusion:** The present study determined that frequent blood donations has severe effect on iron status of body.

**Key Words:** Iron deficiency anemia, Ferritin, Hemoglobin, Blood donation**Corresponding author:****Dr.Naveed Shafqat Zia,**

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**INTRODUCTION:**

Blood donation is the common practice all over the world because this tissue is easily donated in different life saving conditions. Generally, blood donors are considered to have a good health, and have been reported to live a healthier life and have a lower mortality compared to the general population<sup>1</sup>. But the only known significant disadvantage of blood donation is the potential risk of iron deficiency (ID). Iron is an important element in the human metabolism that has a central role in erythropoiesis and many other intracellular processes occurring in the body [2]. Iron deficiency is a global health issue estimated to concern as many as 2.7 billion people effected worldwide with a high prevalence in blood donors<sup>1</sup>. It is the most common nutritional deficiency worldwide which leads to reduced work capacity<sup>3</sup>, impaired scholastic achievements and increase fatigue [1].

The impact of blood donation on iron status has been studied since the late 1970s<sup>4</sup>. The iron stores in healthy men is normally almost 1000 mg, while in healthy females only about 300 mg. approximately 225–250 mg of iron is depleted from donor after a whole blood during which up to 425-475 ml of whole blood are withdrawn [5].

There is 3.2mg of iron present in 1 gram of hemoglobin and in normal persons 50mgs of iron present in 100ml of blood, so when a person donates a single pint it means 225mgs of iron has been lost from body [2] leading to subsequent mobilization of iron from body stores [5]. Dietary absorption of iron can be up to 3.5–4 mg/day when iron stores are low, less when iron stores are higher<sup>5</sup>. So, The RBC's and hemoglobin count will return to normal values within 4 weeks if person not sufferer from iron deficiency anemia, and longer to recover iron stores. In order to donate frequently, many donors may require iron supplements [5] because synthesis of hemoglobin, myoglobin, and cleavage of hemoglobin also influence by the action of iron. 30 mgs of iron per day required for synthesis of new molecules of hemoglobin. In Human body, Iron stores in liver, spleen and bone marrow in the form of ferritin and hemosiderin. When the blood loses or donated these storage forms of iron has been activated and give quick supply of iron in blood loss conditions [6]. Hence adequate iron stores are very important in maintenance of the donor's health [7].

It is suggested internationally that a healthy individual can donate blood up to four times a year

i.e. as iron stores at 3- monthly intervals, can be depleted if blood is donated more recurrently. An increase in the rate of blood donation is liable to result in unnecessary iron loss and development of iron insufficiency anemia [5] which may be consequence of donating blood at a rate that is beyond the ability of their body to compensate [7]. Studies have reported that continuous repeating donations effect on the serum ferritin level and it will take part in genesis of iron deficiency anemia [8]. The frequency of ID is high in blood donors and more dependent on the frequency of donations than on the cumulated number of donations<sup>2</sup>. It is evident that in donors with repeated donations iron demands increases, even though the absorption of nutritional iron among donors is much more efficient than non-donors, however, a donation frequency of more than 4 units per year cannot be compensated by iron absorption and results in an iron deficiency [6]. Number of studies up till now has addressed this issue but unfortunately very few studies concerning this issue are conducted in Pakistan. So, the object of present study is to see the relationship between frequencies of blood donations with iron deficiency anemia by assessing hemoglobin which is simplest technique to identify anemic donors and serum ferritin which reflect body iron stores.

**MATERIALS AND METHODS:**

**Subjects:** Total 120 male subjects between the ages of 25 – 40 years of were enrolled for this study from the Blood Bank and pathological laboratory Jinnah Hospital. These 120 subjects divided into two different groups; (Group A & B) There were 60 subjects in each group. Group A subject donated 4-6 times per year, Group B 7-9 times per year.

**Study area:** This study was directed from November – March 2017 at Jinnah Hospital lahore, Pakistan.

**Inclusion/Exclusion criteria:** The subjects having history of alcoholism, hepatitis B & C, malaria, malnutrition etc. were omitted from this study.

**Sample Collection:** After given appropriate information and taken written agreement from all members in this study, 5ml of fresh venous blood was drawn from each subjects by a clean vein puncture from the median cubital vein, 3ml brought into an iron free dried plain tube and 2ml drawn in hemoglobin meter. The samples were allowed to clot at room temperature and centrifuged to separate the serum. All serum samples were stored at -70°C and kept under these conditions until chemical analysis was done.

**Biochemical Analysis:** The hemoglobin levels in

whole blood were determined instantly with portable hemoglobin meter. While the serum ferritin levels were assessed by Enzyme-Linked Immunoassay method (ELISA).

**Statistical Analysis:** SPSS software version 20.0 for windows was used to complete the arithmetical analysis of data for biochemical analysis. The Student's *t*-test was used to make comparisons between two groups. Values of  $p < 0.05$  were considered statistically important.

### RESULTS:

In the current study we have determined the hemoglobin and ferritin concentration in two different repeated/frequent blood donor groups varying in their rate of donating blood. Group A subject donated 4-6 times per year while Group B subjects given 7-9 times per year. Our objective is to see the connection between rates of blood donations with iron insufficiency anemia by evaluating hemoglobin and serum ferritin levels in Pakistani population. We have found that hemoglobin concentration was considerably higher ( $df=118$ ,  $t=6.834$ ,  $p < 0.01$ ) in group A ( $10.68 \pm 2.7$ ) as related to group B ( $7.81 \pm 1.79$ ) representing that by persons that donate blood repeatedly have lower hemoglobin levels and are in anemic state.

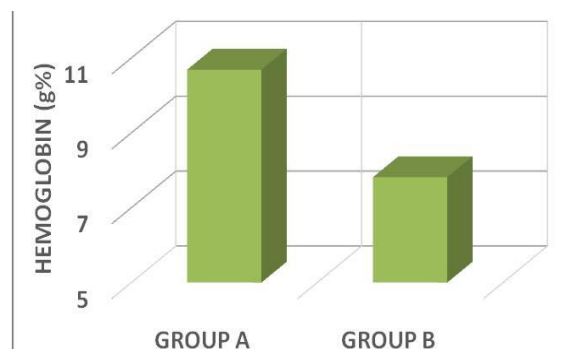


Figure No.1: Hemoglobin

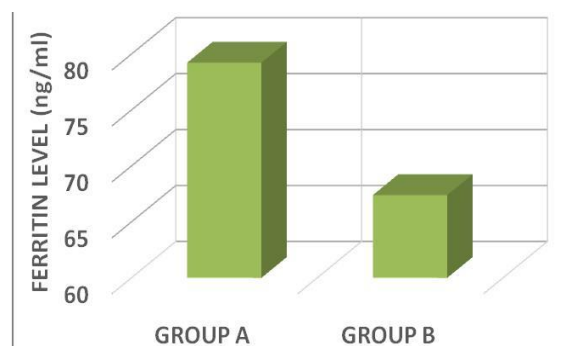


Figure No.2: Serum Ferritin

Statistical analysis of serum ferritin levels presented that concentration of serum ferritin is considerably lower ( $df=118$ ,  $t=5.594$ ,  $p < 0.01$ ) in Group B subjects ( $67.4 \pm 12.25$ ) that donated blood 7-9 times per year as compared to Group A subjects ( $79.2 \pm 10.87$ ) that donated 4-6 times per year demonstrating regular blood donations decreasing the iron stores so the ferritin level drops.

In order to understand the connection between serum ferritin levels and hemoglobin content in both blood donation groups a Pearson's correlation test was executed. The outcomes of correlation indicated that there is positive relation between hemoglobin content and ferritin levels in the complete data ( $r=0.386$ ,  $p < 0.01$ ) presenting that hemoglobin content is reliant on the ferritin level as ferritin level increases the hemoglobin content also increases and as it decreases the hemoglobin content also lessens leading to anemic state. While when correlation analysis was implemented on blood donation groups then we found that in group A there is no important relation between serum ferritin level and hemoglobin content however in group B there is a significant relation ( $r=0.482$ ,  $p < 0.01$ ) between serum ferritin level and hemoglobin content.

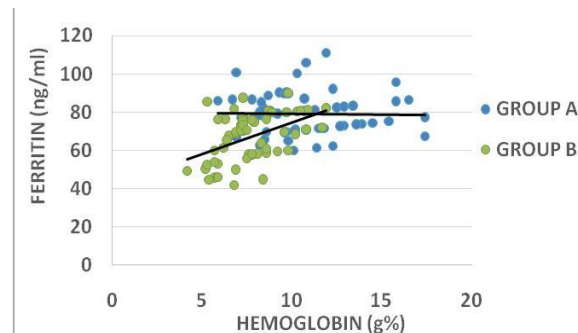


Figure No.3: Correlation between ferritin and HB

### DISCUSSION:

The purpose of current study is to find out the association between rates of blood donations with iron insufficiency anemia. For this purpose, hemoglobin content which is the simplest method to recognise anemic donors and serum ferritin which are the indicators of body iron stores<sup>7</sup> have been determined in two different frequent blood donor groups changing in their rate of donating blood in the way that group A subject given 4-6 times per year whereas Group B subjects contributed 7-9 times per year. Outcomes of the current study presented that rate of blood donations disturbing the health of donor

via affecting the iron stores of the body.

Reports have revealed that iron lessening is common between blood donors [5]. It has presented that the rate of donation per person depends upon the storage of iron and hemoglobin concentration [9]. It has been suggested internationally that 3 – 4 blood donations per year are reliably safe for a person's health as RBC's and hemoglobin count take at least 4 weeks in order to return to normal values if person not targeted from iron deficiency anemia<sup>10</sup>. It has been apparent that following blood donation iron content has been lost to about 0.5 mg per ml of blood donated and if it is not compensated or blood is donated repeatedly then it may lead to chronic iron deficiency and ultimately to iron deficiency anemia [11]. Individuals at risk of increasing iron deficiency can be noticed only by evaluating serum ferritin concentration which is the more sensitive indicator of body iron stores [4]. Although, hemoglobin content is measured routinely for evaluating the donor's eligibility and a cut-off value of hemoglobin of 12.5 g/dL is often indorsed before a blood donation is made<sup>12</sup> but studies have presented that it is a late indicator of iron deficiency and are insufficient to detect the donors having iron deficiency without anemia [4,13] that's why serum ferritin is considered as a convenient marker of body's iron status [5]. So, that's why in the present study along with measuring the hemoglobin concentration, the serum ferritin content was determined to study the effect of repeated blood donation on iron status of body.

Outcomes of present study indicated that hemoglobin and serum ferritin levels were lower in Group B subjects that donated blood 7-9 times per year as compared to Group A subjects that donated 4-6 times per year indicating that regular blood donations dropping the iron stores of body as the serum ferritin content decreases eventually leading to loss in hemoglobin content hence evolving iron deficiency anemia. These consequences are in accordance with previous findings that iron deficiency is more prevalent in repeated/frequent blood donors [1,6,14]. It is stated that among regular donor's 66% woman and 49% men were iron deficient [14,15].

#### CONCLUSION:

Hence, from the present study it has been decided that iron status of body gets harshly affected by recurrent blood donations so it has been suggested to donate blood 3-4 times a year not more than that. It is also suggested that along with hemoglobin content, the serum ferritin levels must in every blood donor must also be assessed before going through blood donation. In addition to this it is directed to indorse the use of iron supplements and proper diet to the

regular donors so that their iron stores will be restored and maintained more effectually.

**Conflict of Interest:** The study has no conflict of interest to state by any writer.

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