LEVELS OF SERUM IRON, TOTAL IRON BINDING CAPACITY AND FERRITIN IN REGULAR HEALTHY VOLUNTEER BLOOD DONORS; AN ALARMING SITUATION

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ABSTRACT

Objectives: Aim of this study was to evaluate the iron status of regular volunteer healthy blood donors.

Material & Methods: All donors were divided into two groups i.e. donors who never donated blood earlier were considered as control group while other group included donors who had donated blood more than once. A total of 255 volunteers included in this study i.e. 105 as control group while 150 as test group. From all blood donors blood samples were collected for complete blood counts, serum iron, total iron binding capacity and serum ferritin.

Results: Hemoglobin showed no statistical change in donors who donated blood once a year as compared to control group. However those donors who donated blood more than once showed statistically significant difference in their hemoglobin as compared with normal control group. Serum iron, TIBC and serum ferritin showed decreased levels in blood donors donating blood once a year or more than once a year as compared with control group.

Conclusion: It is concluded that depletion of iron leads to iron deficiency in regular blood donors. Hemoglobin level should not be the only criteria for normal healthy individuals who regularly donate blood.

Key Words: blood, blood donation, hemoglobin level, ferritin, iron binding capacity.

INTRODUCTION

Blood is donated by volunteers humanitarianly for saving lives of patients in a number of clinical situations. All blood banks and transfusion services require regular blood donation from volunteer donors. A blood donor generally donates 450 ml of blood at the time of donation. A donor usually loses about 200-250 mg of iron per blood donation.[1] An individual who donates blood at least twice a year loses up to 500 mg of iron. Body's compensatory mechanisms of iron include increased absorption and mobilization from its storage sites.[2] Blood donors shall have sufficient levels of hemoglobin, this is to ensure that blood donors have adequate number of red blood cells for donation as well as adequate iron stores for erythropoiesis following donation.[3] Iron is an essential micronutrient required for growth and differentiation of red blood cells.[4] Serum ferritin concentration is an indicator of mobilizable body iron stores. Lack of iron affects the body systems and produces variable symptoms. Iron content of the body is kept constant by maintaining the balance; the amount absorbed and the amount lost.[4] An individuals with decreased concentration of hemoglobin is not permitted to donate blood in order to prevent the donor from deleterious effects.[5] Regular male donors may have low iron stores, which can lead to iron depletion and eventually causing iron deficient anemia.[6] Aim of this study was to evaluate the iron status of regular volunteer healthy blood donors.

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MATERIAL & METHODS

This study was conducted at the Baqai Blood Bank, Baqai Medical University Hospital, Nazimabad, Karachi. Informed written consent was taken from all donors prior to blood donation. Personal information and history of blood donation of volunteer donors was noted. All donors were divided into two groups i.e. donors who never donated blood earlier were considered as control group while other group included donors who had donated blood more than once. A total of 255 volunteers included in this study i.e. 105 as control group while 150 as test group. From all blood donors 5 ml of blood sample was collected i.e. 2 ml in EDTA tube for CBC while 3 ml non anticoagulated for serum iron, TIBC and serum ferritin. CBC was performed on automatic hematology analyzer that included hemoglobin estimation, red cell count, total leukocyte count, platelet count, hematocrit, mean cell volume, mean cell hemoglobin, mean cell hemoglobin concentration and red cell distribution width (RDW). Serum ferritin was determined using chemilluminescent microparticle immunoassay. Serum iron and total iron binding capacity was determined using microlab 300.

Criteria followed for the selection of blood donors (as laid down by the American Association of Blood Banking): Hb 12.5 -16.00g/dl, age 18-60 years, weight minimum 50 kg, no history of transfusion transmitted diseases, donations interval (Minimum 8 weeks after

donation), pulse 50 - 100 per minute, temperature < 37.5 C (99.5 F) and blood Pressure (Systolic < 180 m Hg/ Diastolic < 100m Hg).

Inclusion criteria:

Inclusion criteria for control group were; random healthy male donors of 18 years and older who had not donated blood previously and fulfilling the above mentioned criteria. Inclusion criteria followed for test group were donors with blood donation history at least once or twice a year regularly for the last five years, unmarried and married both.

RESULTS

A total of 255 volunteers were included in this study. Initially two groups were considered i.e. donors donating blood for the first time were considered as control (n=105) while those who had donated blood during the last five years were considered as test group. Test group was further subdivided into two i.e. donors who were regular donors and donated blood only once a year (n=75) while the other group contained those donors who had donated blood more than once in a year (n=75). Consolidated results of hemoglobin, serum iron, total iron binding capacity and serum ferritin of all groups are shown in Table 1.

DISCUSSION

Normal healthy individuals are recruited for blood donation based upon physical health, clinical history, and estimation of hemoglobin. In many blood banks hemoglobin is estimated using copper sulphate method. It is crude method and at times does not evaluate the lower normal levels of hemoglobin in male donors. This study was conducted for the evaluation of iron status in regular blood donors. Findings of this study showed that donors who donate blood once a year have no statistical difference as compared with control as shown in Table 1. However significant statistical difference was observed when control group was compared with regular blood who had donated blood more than once in a year (p=0.001). Decreased levels of hemoglobin have also been observed in regular blood donors by other workers. Djalali et al[7] as well as that of Zaccheus and Baribefe[8] who reported a significantly lower hemoglobin and packed cell volume in regular blood donors when compared with healthy controls.

However findings of this study are at variance with those of Szymczy-Nuzka and Woloweic[9] and Denicourt and Goudemand[10]. These workers reported normal levels of hemoglobin in regular blood donors. Variance at these results are due to the racial differences, study population, environmental factors dietary habits, poverty and parasitic infestations.

Serum iron of control group showed no statistical difference as compared with donors who had donated blood once a year (p=0.586). Statistically significant difference was observed when the serum levels of regular donors who had donated blood more than once a year was compared with the control group (p=0.001). Other parameters of serum profile i.e. TIBC and serum ferritin also showed statistically significant difference when these parameters of regular blood donors (both once a year and more than once a year) were compared with control group as shown in Table 1.

Results of this study are in agreement with the findings of Badar et al,[1] Szymczyk-Nuzka and Woloweic,[9] Norashikin J et al,[11] Okpokam et al[12] Adediran et al[13] Usanga.[14] Apart from all these findings, results of this study are at variance with that of Vilsu et al who reported normal levels of serum ferritin in regular blood donors.[15]

Findings of this study reveals that despite hemoglobin estimation, regular blood donors showed decreased concentration of hemoglobin when analyzed by automated hematology analyzer. Serum iron, TIBC and ferritin were also decreased in these donors. It is therefore suggested that serum iron and ferritin shall be evaluated in regular blood donors. There is need to educate regular voluntary donors about iron deficiency, iron deficiency state and iron deficiency anemia. Serum Ferritin level should be checked for all regular donors. Serum Ferritin level will help to detect pre-clinical iron deficiency anemia. All regular blood donors should consider taking iron supplement for at least 3 months

Table 1: Consolidated results of control, regular donors donating blood once a year and donors donating blood more than once in a year

	Control	Regular once a year		Regular more than once a year	
N	105	75	Sig	75	Sig
Age	27.8 ± 4.7	32.04±0.04	0.014	25.30 ± 3.49	0.081
Hb	14.4 ± 0.86	13.88 ± 0.62	0.281	12.78 ± 0.24	0.001
Serum iron	78.66 ± 16.45	75.31 ± 19.67	0.586	41.40 ± 13.58	0.001
TIBC	195.06 ± 48.12	292.53 ± 53.36	0.001	441.40 ± 24.64	0.001
Serum ferritin	115.85 ± 34.42	58.59 ± 16.18	0.001	26.40 ± 7.63	0.001

Data are shown as mean ±SD. n= number of donors, Hb= hemoglobin, TIBC= total iron binding capacity

before next donation and their serum ferritin level should be checked at least once every year.

CONCLUSION

It is concluded that depletion of iron leads to iron deficiency in regular blood donors. Hemoglobin level should not be the only criteria for normal healthy individuals who regularly donate blood.

REFERENCES

1. Badar A, Ahmed A, Ayub M, Ansari AK. Effect of frequent blood donations on iron stores of non anaemic male blood donors. J Ayub Med Coll Abbottabad. 2002; 14(2): 24-7.
2. Akpotuzor JO, Isong C. Okpokam DC, Etukudo MH. Levels of serum iron, total iron binding capacity, transferrin saturation fraction and packed cell volume of blood donors in Calabar. Pak J Nutri 2008; 7 (3) 500-502.
3. Ranney HM, Rapaport SI. The red blood cell. In: Best and Taylor's Physiological basis of Medical practice. 12th ed., Baltimore: Williams & Wilkins; 1991. 369-384.
4. Arvedson TL, Sasu BJ. Role and regulation of iron metabolism in erythropoiesis and disease. Milestones in Drug Threapy. 2009: 279-298.
5. www.giveblood.ie/Become_a_Donor/Information_Leaflets/Changes_in_minimum_haemoglobin_levels_for_donors.pdf
6. http://www.aabb.org/Pages/PageNotFoundError.aspx?requestUrl=http://www.aabb.org/Content/Donate_Blood/Blood_Donation_FAQs/donatefaqs.htm
7. Djalali M, Neyestani TR, Bateni J, Siassi F. The effect of repeated blood donations on the iron status of Iranian blood donors attending the Iranian blood transfusion organization. Int J Vitam Nutr Res. 2006; 76: 132-137.
8. Zaccheus AJ, Baribefe BK. Anaemia, iron deficiency and iron deficiency anaemia among blood donors in Port Harcourt Nigeria. Blood Trans. 2010; 8: 113-117.
9. Szymczyk-Nuzka M, Wolowiec D. Iron stores in regular blood donors. Pol Arch Med Wewn. 2003; 110: 1415-1421.
10. Denicourt L, Goudemand M. Hypochromic anaemia and female blood donors. Transfusion. 1964; 7: 151-160.
11. Norashikin J, Roshan TM, Rosline H, et al. A study of serum ferritin levels among male blood donors in hospital University Sains Malaysia. Southeast Asian J Trop Med Public Health. 2006; 37: 370-373.
12. Okpokam DC, Emeribe AO, Akpotuzor JO. Frequency of Blood Donation and Iron Stores of Blood Donors in Calabar, Cross River, Nigeria. IJBLS. 2012; 1(2): 40-43.
13. Adediran A, Ebele I Uche, Adeyemo TA, Damulak DO, Akinbami AA, Akanmu AS. Iron stores in regular blood donors in Lagos, Nigeria. Journal of Blood Medicine 2013; 4: 75-80.
14. Usanga EA. Iron stores of Nigerian blood donors as assessed by serum ferritin concentration. Cent Afr J Med. 1990; 36: 170-173.
15. Vilsu I, Apksha B, Snehalata C. Iron status of regular voluntary blood donors. Asian J Transfus Sci. 2008; 2: 9-12.