

A STUDY TO ANALYZE THE HAEMOGLOBIN CONTENT OF CONTINUE BLOOD DONATING VOLUNTEERS

Dr. K. SURESH KANNA¹, MRS. J. JAYABHARATHI², DR. J. JAIPRABU³

¹ Assoc. Professor, Bharathiyar College and Technology, Karaikal, Puducherry state, India

² Asst. Lecturer in Nursing MTPG&RIHS Puducherry State, India

³ Assistant professor, Vinayaka Mission's Medical College & Hospital, Karaikal, Puducherry state, India

ABSTRACT

Blood can save millions of human life. The necessity of blood in our country depends on the population and health problems. The only source of blood is blood donation. However requirement of voluntary blood donors possess main challenges to transfusion services throughout the world [1]. In this study we have analysed the iron status of continue blood donors. 160 blood donating volunteers were included in this study and were divided into two groups depending on number of donation. Group 1 consisted of (90) initial blood donating volunteers and group 2 consisted of (70) blood donating volunteers, who had donated more than three times in past 2 years,. Serum ferritin, Haemoglobin (Hb), total iron binding capacity (TIBC), transferrin saturation and complete blood count (CBC) was done in all blood donating volunteers. The mean serum ferritin level in group 2 (52.7±32.9) ng/ml was significantly lower compared to group 1 blood donors (69.3±44.6). (5.1)% of blood donating volunteers in group 2 and 3.1% of the volunteers in group 1 had reduced Haemoglobin. Serum ferritin and Haemoglobin should be done in all blood donating volunteers to ensure the volunteers healthy.

Keywords: Blood donation, haemoglobin deficiency anaemia, Serum ferritin, Serum iron.

Introduction:

Blood donation is one of the noblest and greatest donations a man can make. Blood is our life sap. There is no other substitute. Several lives are lost for want of blood. Nowadays blood donating become more and more common and takes a more important part in medical treatment [2]. Fresh and healthy blood is needed everywhere. Many people joined the group of donating blood, to consider that to be an obligation for the member of the society. The only source of blood is blood donation. However requirement of voluntary blood donors possess main challenges to transfusion services throughout the world. [3] As per the world health organisation (WHO) norms 1% of population is generally the minimum needed to meet the countries basic needs of blood [4]. A regular supply of blood is needed to treat severe anaemia in children under seven years old, management of pregnancy related complications also used for supportive care in cardiovascular, transplant surgery, massive trauma and cancer treatment[3]. Before blood donation, donors' haemoglobin is measured as a routine screening test for allowing him to donate blood[5]. To determine the level of Hb is a simple method to find anaemia in donors. However, such routine methods cannot reflect the total body iron content of a person. Recent reports have shown that body iron reserves are small and iron depletion is more common in blood donors than in non-donors [6, 7]. According to WHO and estimated 38% of reported voluntary blood donors are contributed by people under age of 25 years. WHO also insist countries to focus on young people to achieve 100 % regular voluntary non numerated blood donations? Accepted baseline haemoglobin (Hb) is 12 g/dl and 13 g/dl for female and male donors' respectively and, a donation interval of 12 weeks minimum have been stipulated in some countries to ensure donor safety [8]. Recent reports have been shown in body haemoglobin reserves small and haemoglobin depletion is more common in blood donating volunteers than non donators. Due to regular donation there will be a continue haemoglobin & iron loss causes anaemia

Previous studies have shown that serum ferritin levels are markedly reduced in regular blood donors corresponding to annual donation frequency⁶. Therefore, serum ferritin measurement was considered to reflect iron stores accurately.

Material and methods

The qualitative study was conducted at blood bank, Govt. hospital, Puducherry. 160 blood donating volunteers were selected and the age group between 18 to 50, they were divided into 2 groups depending on number of donations. Group 1 included 90 first time blood donors (taken as control) Group 2 included 70 blood donors, who donated blood more than 3 times in past 1 year. And the haemoglobin ranges between 12–16 mg /dl were included in this study. To evaluate the effect of haemoglobin level of frequent blood donors using biochemical parameters. Approval of the institutional ethical committee was obtained. Informed written consent was taken from the blood donating volunteers and the demographical data was collected by self administered questionnaire regarding blood donation history, age, sex, marital status socio economic background, dietary pattern, smoking habit, alcoholism & supplementation of vitamin or mineral etc. Pre-donation haemoglobin estimated by photometric azide-methemoglobin method. Randomizing serum sample was done for the estimation of ferritin, Hb, total iron binding capacity (TIBC), & plasma for estimation of complete blood count (CBC) was collected. Complete blood count was done in Sysmex XE2100-fully automated analyzer. Serum ferritin was estimated by automated chem. Illuinescence immuno assay method. Serum iron & TIBC were estimated by RxL dimension, by photometric method. Transferrin saturation (Tf) was calculated from serum iron & TIBC values using the formula:

$$Tf = \text{Serum Iron } (\mu\text{L/dl}) / \text{TIBC } (\mu\text{L/dl}) \times 100$$

Statistical analysis was done using SPSS software 19.0. Mean and standard deviation was calculated for quantitative continuous variable. Chi-square test was used to test the significance of difference in the qualitative data. T-test was applied to test the significance in the difference between two continuous variables. Correlation between ferritin levels and different variables were tested by Pearson correlation coefficient. $p < 0.05$ was considered as statistically significant. In the present study, Hb is classified as (a) depleted, when serum ferritin (SF) value is < 15 ng/ml; (b) reduced, when value ranges between 15-20 ng/ml; (c) normal value between 20-360 ng/ml. Hb deficiency anemia is considered present when SF is < 15 ng/ml.

Table 1 Demographic Characteristics of Donors

S.No	variable	Donors (n=160)	
1	Age in years	<20	35(21.8%)
		20- 30	67(41.8%)
		30-40	38(23.75%)
		40-50	20(12.5%)
2.	sex	male	114(71.25%)
		female	46(28.75%)
3	marital status	married	50(31.25%)
		unmarried	110 (68.75%)
4	Number of donations	3- 5 times	48 (68.5%)
		more than 5 times	22(31.4%)

Comparison of hematological and parameters are given in Table 2. No statistical significant difference was noted between two groups of donors in Hb, MCV, MCH, MCHC and PCV. The level of serum iron in group 2 when compared with group 1 show statistically significant difference ($p=0.001$). No statistical difference was seen in TIBC and transferrin saturation among the two groups.

Table 2: Comparison of haematological and biochemical parameters between the groups

Parameters	Group 1(n=90)	Group 2(n=70)	p value
Hb(g/dL)	12.9±1.5	12.7±1.1	0.625
MCV(fl)	88.2±4.9	82.6±5.2	0.069
MCHC (%)	31.9±1.2	29.6±2.1	0.198
MCH (pg)	30.6±2.5	28.9±2.1	0.597
PCV (%)	41.2±4.5	39.3±2.7	0.889
Ferritin(ng/ml)	76.1±49.1	58.6±37.5	0.001
Iron(μg/dl)	103.2±58.2	91.5±41.0	0.003

TIBC($\mu\text{g}/\text{dl}$)	371.8 \pm 89.9	369.8 \pm 73.6	0.129
Transferrin saturation (%)	28.2 \pm 10.8	23.9 \pm 11.2	0.006

Iron status of donors in group 1 and group 2 as shown in Table 3. Total 19 subjects, 7 from group 1 and 12 from group 2 had shown SF level below the normal range of 20–397 ng/ml. None of these donors with low SF had shown Hb level below 12.0 mg%. A total of 7 subjects, 4 in group 1 and 3 in group 2 had SF level <15 ng/ml and showed iron deficient Anemia. 7.1% donor in group 2 serum iron <35 $\mu\text{g}/\text{dl}$ compared to 3.3% of donor in group 1

Table 3 Iron status among group 1 and group 2 blood donors

Parameter	Group 1	Group 2
Ferritin \geq 20 ng/ml	68 (75.5%)	47 (70%)
Ferritin 15–20 ng/ml	2 (2.2%)	7 (10%)
Ferritin < 15 ng/ml	4 (4.4%)	3 (4.2%)
Iron < 35 $\mu\text{g}/\text{dl}$	3 (3.3%)	5 (7.1%)
TIBC > 450 $\mu\text{g}/\text{dl}$	10 (11.1%)	4 (5.7%)
Transferrin saturation < 16 %	3 (3.3%)	6 (8.5%)

Table 4 shows correlation between various parameters. Significant correlation was found between ferritin and number of donations with $p=0.012$

Table 4: Correlation between parameters

Parameter	Pearson Correlation	p-value
Ferritin–Hb	0.109	0.078
Ferritin–age	0.077	0.156
Ferritin–donation number	0.151	0.009
Hb- Donation number	0.001	0.879

(p value < 0.05 is significant)

Discussion

All the blood banks have minimum Hb requirement for donation. In the present study, done in govt. Hospital Puducherry Blood Bank, donors with Hb >12–17 g% were included in the study. However, many studies showing that Hb measurement alone is inadequate to detect donors with Hb deficiency cause anemia. This results in accepting many Hb depleted donors with normal values. Since 30 years blood banks have focused on safe blood collection and an adequate blood collection [9,10]. There is decrease in transfusion-transmitted diseases, and, also we have evidence gain in blood supply. However, this achievement in adequacy of blood supply has affected the regular donors. Since it is not easy to collect blood from a known or existing neither than recruiting a new donor, regular donors are at risk of developing Hb deficiency. In a prospective study on blood donors found that the sensitivity of Hb concentration as an indicator of iron deficiency in repeat donors was only 40%.

In the present study also, no significant difference was noted between the two groups of donors for Hb, PCV, MCH, MCHC and MCV. Recent studies have proved that SF is a better indicator of Hb & iron stores. SF level starts decreasing in the first stage of iron deficiency [11]. The present study showed statistically significant decrease in SF levels of regular donors (group 2) when compared with first time donors (group 1). 17.5% of donors in group 2 had Hb deficiency (SF < 20 ng/ml) 7.2% donors had iron-deficiency anemia (SF < 15 ng/ml), respectively. Our results compare well with other studies, blood donors, found Hb cut-off levels did not appear to be predictive of iron deficiency as significant proportion of individuals showed low ferritin levels [13]. The study observed low ferritin level in donors donating their blood twice a year. [14,15] Iron deficiency anemia is seen in third stage of iron deficiency. It is characterized by significantly reduced hemoglobin, decreased MCV, elevated TIBC, low transferrin saturation and low serum iron level. In the present study, 4.5% of regular donors had reduced serum iron which was statistically significant. Also a significant correlation was seen between SF and number of donations

with p value 0.012 (Table 4). This shows the importance of measuring Hemoglobin and serum ferritin in continue donors selected for blood donation.

Conclusion

Our study found that regular blood donors had low Hb stores (decreased serum ferritin seen in 19.2% donors). Using the current accepting normal value (Hb > 12.5g/dL) for donating volunteers true Hb range is not reflected. Serum ferritin and serum iron ensures the true Hb status more accurately. Therefore, measuring serum ferritin and in addition to Hb will protect the donors and ensure safer blood donation. Further studies are needed to confirm these preliminary findings.

References

1. National Guidebook on Blood Donor Motivation. 2nd ed. India: Government of India; 2003. National AIDS Control Organization. Ministry of Health and Family Welfare; pp. 32–5.
2. National Guidebook on Blood donor motivation. Ministry of Health and Family Welfare, National AIDS Control Organisation, Government of India. Second edition 2003.
3. im JC, Tien SL, Ong YW: Main causes of pre-donation deferral of prospective blood donors in the Singapore Blood Transfusion Service. *Ann Acad Med Singapore*. 1993; **22**(3): 326–31.
4. Laboratory Bio-Safety Manual. 2nd edition. W.H.O. Geneva: 1993
5. Makroo RN, Blood Transfusion Therapy volume II. India: 1995
6. Harthoorn-Lasthuizen, E.J., Lindemans, J. and Langenhuijsen, M.M., 1998. Zinc protoporphyrin as screening test in female blood donors. *Clinical chemistry*, 44(4), pp.800-804.
7. World Health Organization (WHO) Blood donation factsheet 2009.
8. Gillespie TW, Hillyer CD (2002) Blood donors and factors impacting the blood donation decision. *Transfus Med Rev* 16: 115-130.
9. Hosain GM, Anisuzzaman M, Begum A (1997) Knowledge and attitude towards voluntary blood donation among Dhaka University students in Bangladesh. *East Afr Med J* 74: 549-553.
10. Hosain GM, Anisuzzaman M, Begum A (1997) Knowledge and attitude towards voluntary blood donation among Dhaka University students in Bangladesh. *East Afr Med J* 74: 549-553.
11. Zmijewski CM, Haesler WE (1982) Blood banking science. New York: Appleton Century Croft. p. 2.
12. Siromani, U., Molly, R., Daniel, D., Mammen, J.J., & Nair, S.C. (2012). Ahead to 100% of Voluntary non-remunerated Blood Donation at a tertiary referral hospital blood bank in South India. *Asian Journal of Transfusion Science*, 6(2), 190.
13. Djalali, M., Neyestani, T.R., Bateni, J. and Siassi, F., 2006. The effect of repeated blood donations on the iron status of Iranian blood donors attending the Iranian blood transfusion organization. *International journal for vitamin and nutrition research*, 76(3), pp.132-137.
14. Lasthuizen, E.J., Lindemans, J. and Langenhuijsen, M.M., 1998. Zinc protoporphyrin as screening test in female blood donors. *Clinical chemistry*, 44(4), pp.800-804.
15. Gillespie, T., Newman, J.L., Bellamy, M., Hillyer KL, Strong M, Hillyer CD. (2002). National study of blood donation-decision making: current and lapsed donors. *Transfusion*, 42, 122s-123s.