DISCUSSION

Although several studies have indicated that repeated blood donation induces iron depletion and iron deficiency, all blood centers still test only hemoglobin as an indicator for selecting the donors.\(^8\) The present study shows the importance of measuring the iron stores and then proposed a strategy to prevent severe iron depletion during frequent donations.

It is known that frequent blood donations can cause depletion in iron stores. Published studies\(^{43,111}\) have used different parameters to detect iron deficiency and iron depletion in blood donors. The present study done by testing various parameters such as hemoglobin, RBC indices, serum iron, TIBC, transferrin saturation, serum ferritin, and zinc protoporphyrin levels. TIBC can be measured on only 325 samples and transferrin saturation is calculated by formula from the value of serum iron and TIBC. TIBC levels are increased in iron deficiency but decreased in inflammations and infections.\(^{165}\) In country like India where chronic infections are common, these parameters probably have limited value.

Iron is a vitally important element in human metabolism. It plays a central role in erythropoiesis and is also involved in many other intracellular processes in all the tissues of the body.\(^{166,167}\) The potential for an individual donor to give blood without developing iron-deficiency anaemia is dependent on many factors such as differences in nutritional iron intake, the prevalence of iron deficiency in the particular population, menstrual iron loss in females, the frequency of blood donation, the use of supplemental iron, as well as the capacity to absorb iron.\(^{11,14,25}\)
There is evidence that male subjects or non menstruating females can absorb 3-4 mg of dietary iron per day, equivalent to a yearly blood loss of 2000 ml, this figure can be greatly influenced by the amount of meat and ascorbic acid in the diet.\textsuperscript{168, 169}

Iron deficiency is the state in which the content of iron in the body is less than normal. Iron depletion is the earliest stage of iron deficiency, and signifies that iron stores are decreased or absent, but the serum iron concentration and blood hemoglobin levels are normal. Iron deficiency without anemia is a somewhat more advanced stage of iron deficiency, characterized by decreased or absent iron storage, usually a low serum iron concentration and low blood hemoglobin concentration, but without anaemia.\textsuperscript{170}

Blood banks should have the responsibility to protect blood donors, which includes preventing anaemia among them. In this population-based study the concentrations of serum ferritin (and thus stored iron) among voluntary blood donors were measured and the prevalence of those with a serum ferritin concentration below 15μg/L, i.e. erythropoiesis with iron deficiency, was determined.

The cut-off value for hemoglobin levels for blood donation in men was 12.5 g/dl. However, the normal hemoglobin level does not exclude iron deficiency among the blood donors. Several studies indicate that hemoglobin is not a sensitive indicator to detect iron deficiency but is useful in detecting the majority of donors with established iron deficiency.\textsuperscript{10,11} It has been reported that in men, the amount of iron lost from a 400 ml donation is made up by enhanced absorption of dietary iron over 3 months.\textsuperscript{171}

The sole use of the copper sulphate test at a cutoff level of 12.5g/dL would result in the recruitment of already iron deficient donors who are above the cutoff level. In addition, the poor sensitivity of the copper sulphate test and its low negative predictive value
would result in recruitment of already iron deficient and anaemic donors. Although the copper sulphate test is a time honoured pre-donation screening test, its sensitivity and specificity has always been in question. Measurements are very much dependant on the technical skill of the person performing the procedure and previous studies have shown that the haematocrit value of a predonation fingerstick capillary sample was considerably higher than the immediate postdonation venous haematocrit levels.

Accurate portable haemoglobin measurement devices are currently available in the market but their cost precludes routine use for blood donor screening in most developing countries. In conclusion, the sole use of the copper sulphate test, as a criterion for deferral of iron deficient and anaemic individuals may not be adequate in the prevention of iron deficiency developing among blood donors. Serum ferritin would need to be included in assessment of blood donors, particularly among regular male donors and all female donors so that a better picture of iron status may be obtained and donors managed and counseled appropriately. Better and more cost effective methods for assessing hemoglobin levels as compared to the current copper sulphate method should be explored for donor screening.

Bianco et al found that 13 % of donors were rejected and that 41 % of all deferrals were explained by low Hb-values. The reduction of iron in donors is not sufficiently compensated by a normal diet and it is discussed whether iron supplementation after donations will restore the iron status more quickly. Furthermore, iron supplementation is a controversial issue as a donor may suffer from unknown, hereditary hemochromatosis in the preclinical stage, and it may be considered unethical to offer iron
supplementation to these donors.\cite{55} Genetic screening for hemochromatosis is not a routine.

- Taken this into consideration there is a certain possibility to give iron supplementation on wrong indications to persons who have contraindications for using iron.\cite{6, 58} At the opposite, young female blood donors who are vulnerable to iron deficiency, should be offered iron supplementation. In general, to avoid a possible harm, it is preferential that the iron status of a donor has been normalized prior to a subsequent donation of blood.\cite{59} Increased frequency of donation may cause stress in the donor. Better knowledge of adjusting the frequency of donations both for donors with low iron status and for donors having iron overload will take better care of the donor on an individual basis.

- Recruiting a sufficient number of new blood donors is a huge challenge in many countries.\cite{63, 64, 65} One of the main reasons for rejection was failing to meet the Hb criteria, predominantly amongst young women.\cite{66} To keep the blood supply sufficient, an increased pressure is laid upon established donors. The donors with a high frequency of donations are at risk for iron deficiency.

- Significant additional iron requirements are imposed by blood donation. It was assumed that basal losses are 0.9 mg/day in the adult male and 1.3 mg/day in the adult female.\cite{173, 174} The average phlebotomy of 472 ml represented the removal of about 236 mg of iron from the male and 213 from the female. In individuals donating 1 unit of blood yearly, this increased the daily iron requirement by 0.65 mg/day in the male and 0.58 mg/day in the female. In men, when the basal requirement of 0.9 mg/day was increased to 1.5 mg/day by one blood donation per year, serum ferritin levels were halved. They were further reduced to about one-fourth basal when the daily requirements were increased to
2.9 mg/day by about three blood donations per year. In female donors with a basal iron requirement of 1.3 mg/day, iron stores were approximately 30% lower than in men giving 1 unit of blood yearly. Iron requirements of the two groups were similar, and the difference probably reflected the higher iron intake in male subjects due to their higher caloric intake.

Free iron has the potential to cause oxidative tissue damage and our body has developed a very elaborate mechanism for iron absorption. Iron homeostasis is achieved more by control of iron absorption than by altering its excretion. Mittal R. has shown the extent of iron deficiency in our so called healthy blood donor population. Though others have also shown the extent of iron deficiency in regular blood donors, 50 per cent of healthy females were iron deficient even before donation. Even the male voluntary donors become progressively iron deficient (serum ferritin <15 μg/l) so that 49 per cent are iron deficient if they donate over three times per year.

These observations illustrate the varied potential of people to give blood. A significant portion of the female population cannot give blood without developing a significant degree of iron deficiency, whereas other individuals, largely males, can replace losses up to 2000 ml of blood per year without developing iron-deficiency anemia. The chief variables are available iron in the diet and blood loss, and perhaps ingestion of medicinal iron. Some 10% of menstruating women have iron requirements of 2 or more mg/day due to large menstrual losses.

No general rules of blood donation are likely to fit each individual, especially when important variables such as available iron in the diet and the amount of menstrual blood loss in the female are not known. The mean serum ferritin values in first time female
donors were lower compared to male donors. These results are similar to the observations made by other authors.\[^{10, 11, 12}\] These workers explained that in female donors with a basal iron requirement of 1.3 mg/day, iron stores were approximately 30 percent lower than in men giving one unit of blood yearly. Iron requirements of the two groups were similar, and the difference probably reflected the higher iron intake in male subjects due to their higher caloric intake.\[^{10, 12}\] The aim of this study was to evaluate the iron status in first time and regular blood donors by measuring various tests for measuring iron status. The study indicates the mean serum ferritin level of the repeat blood donors was lower compared to first time donor group. This finding was consistent with the results of other studies in which serum ferritin levels were significantly lower in regular blood donors.\[^{12, 124, 175}\]

The results of this study show that 28.5% of blood donors had depleted iron stores (serum ferritin <20 μg/L) and 19.6% of donors are anemic [Hb <12.5 g/dl]. Our study indicates that there was a significant correlation between the frequency of donations, last donation interval and the serum ferritin level.

It seems likely that blood donation-induced iron deficiency among women may be an important reason for the predominance of male donors among those individuals donating blood frequently. In the present study out of 393 donors total only 9 donors were female donors and again out of this 9, only 3 females were as repeat donors which are nearly 0.8% of the total donor population. The literature dealing with the effects of blood donation on iron balance includes observations on changes in hemoglobin concentration, plasma iron concentration, total iron-binding capacity, and iron stores. Initially, hemoglobin concentration was the chief concern. Most reports agree that anemia occurs
much more frequently among female donors,\textsuperscript{[178,179,180]} and that this sex difference diminishes after the menopause.\textsuperscript{[181]}

\textbullet A high prevalence of iron deficiency however, was also noted among first time donors in our study population, especially among female donors. The prevalence of iron deficiency among first time and regular female blood donors however was not significantly different. The higher prevalence of iron deficiency in females with borderline or absent anaemia may also mean that a larger number of preexisting iron deficient female donors who are not anemic are recruited for donation, resulting in high numbers of iron deficient first time and regular female donors.

\textbullet The study shows that statistically significant difference in mean hemoglobin, RBC count and ferritin level of female donors compared to male donors. Other parameters like serum iron, MCV level, MCH level and transferrin saturation levels are also low in female donors compared to male donors but the data are not statistically significant.

\textbullet The data in table 9 shows that there is marked statistically significant difference in first time female and first time male donors which suggest that in the study area large number of females must be anemic even before blood transfusion. As shown in table no 11 the first time and repeat female blood samples analysis data does not show any significant changes. The reason may be that the females were already anemic even in first time donation group and the data is too small to reach to any reliable conclusion from the study. As shown in table 12 the data shows statistically significant difference in iron status parameters between first time and repeat male donors. Findings suggest that repeat donation has significant impact on iron status of the population.
Differences in the prevalence and development of iron deficiency among male and female blood donors would mean that different strategies may need to be employed for prevention of iron deficiency among blood donors. Among males, it is important that regular supervision of ferritin levels be made for regular donors with adequate iron supplementation, in order that iron deficiency does not develop among this vulnerable population while among females, it is important that pre-existing iron deficient individuals are recognized and treated before they donate blood and further aggravate their iron status.

Alvarez-Ossorio et al (2000) recommend measurements of serum ferritin levels after five donations. This will help identify iron deficient individuals. One of the most frequent observations in long-term blood donors is chronic iron deficiency. Several studies have used serum ferritin concentration as an indicator of iron stores. The results of this study show that the ferritin concentrations decreased significantly with an increase in the number of donations. These results are similar to those reported by other authors. In this study, negative iron balance was considered when serum ferritin values were <20 μg/L, iron deficient erythropoiesis when the values were between 15-20 μg/L and normal when values were ≥ 20 μg/L.

Some studies have shown that the frequency of iron deficiency is high in blood donors and more dependent on the frequency of donation than on the accumulated number of donations as we also found that frequency of donation and the last donation interval both significantly affect the iron status of repeat donors in the present study. Other studies demonstrated that iron deficiency was present in 14% of men who had four or more blood donations during 1 year. In addition Djalali et al revealed that the
frequency of blood donation per year was inversely correlated with hemoglobin, hematocrit, mean corpuscular hemoglobin concentration and serum ferritin. Mittal et al also showed that an increase in donation frequency was accompanied by a significant decrease in serum ferritin; serum ferritin below 15 μg/l was found in 49% of male and 100% of female donors who donated thrice per year. Cancado et. Al. found that the frequency of iron deficiency was higher among male donors with three or more donations per year and among the women with two or more donations per year. The results of all these studies were similar to our findings and showed the importance of measuring iron stores as an indicator for being selected for blood donation.

This study confirmed the finding of previous studies, in that the prevalence of iron deficiency increased with frequent blood donations. Of the entire study population including first time and repeat donors, 21.12% and 7.37% had iron deficiency [ferritin <20μg/L with normal Hb]and iron-deficiency anaemia, respectively.

Results showed that the prevalence of reduction in iron stores increased with an increase in the number of donations (P < 0.001). It is therefore recommended that blood donors should be educated about iron deficiency, and research studies should be performed to determine the best method of iron supplementation with minimal complications for all regular blood donors and women of childbearing age on their first donation.

The values of iron and haematological parameters were significantly lower in repeat donors than in the first time donors group. Simon et al showed that 8% of men and 38% of women have reduced iron stores, as assessed by serum ferritin status, after five donations. In present study 21.35% of men and 11.11% of women have reduced iron
stores without anemia and 7.29% of men and 11.11% of women have iron deficiency anemia.

In a large Danish study, the prevalence of depleted iron stores was found to be higher in donors than in people who did not donate blood. Furthermore, in the study by Milman, 26% of regular blood donors had low ferritin levels and 12% were found to be anemic. In Nigeria, in 1990, Usanga observed that the mean ferritin concentration of 64.75 ng/mL ± 4.6 in normal males was significantly higher than the mean value of 49.19 ng/mL among blood donors suggesting that some blood donors may have prelatent or latent iron deficiency at the time of donation and become iron deficient after blood donation.

In present study mean ferritin concentration of 85.81μg/L in first time donors was significantly higher than the mean value of 44.88 μg/L among repeat blood donors. In female donors the mean ferritin concentration was 32.16μg/L and that of male donors was 57.04μg/L.

Mackintosh and Jacob who reported decreased ferritin in 53% of a sample of 566 non-anaemic healthy male donors in present study it was seen in 28.5% of donor population.

Our results are nearly identical with a study conducted in Thailand by Linpisarn et al in which the serum ferritin level was lower significantly in those who donated three times per year compared to the first time donors. Similar results were observed by Morse et al in female blood donors. Another resembling study is the one by Guilleman et al who evaluated 217 regular donors and reported that an increase in the donation frequency was followed by a significant decrease in serum ferritin concentration. Halvorsen et al
reported that 10% of the male donors in their study had reduced iron stores while in 3% iron stores were empty.\textsuperscript{[194]}

\begin{itemize}
  \item A study from Germany has reported that ferritin decreases after 10 donations and with the increase of donation frequency. They found 26\% of regular donors to have ferritin levels of less than 15 µg/L and 12\% of them were anemic due to low hemoglobin.\textsuperscript{[12]} Another study conducted in Denmark reported that the prevalence of depleted iron depots is higher in donors than in non-donors.\textsuperscript{[111]}
  \item A study from Brazil has recently reported a higher frequency of iron deficiency in multi-time blood donors that is more serious in female blood donors. They found frequency of 7.6\% iron deficiency in multi-time donors with three or more donations per year.\textsuperscript{[43]}
  \item There was significant inverse correlation of frequency of blood donations with the serum ferritin.\textsuperscript{[10,43]} The reason for iron deficiency in donors with repeated donations is that the iron demands increase with number of annual blood donations. Even though the absorption of nutritional iron among donors is much more efficient than non-donors, a donation frequency of 4-5 units per year cannot be compensated by iron absorption and results in an iron deficiency.\textsuperscript{[11,195,196]}
  \item A donation frequency of more than four or five units per year could not be compensated by iron absorption and resulted in iron deficiency.\textsuperscript{[39,197]} Early detection of iron deficiency among blood donors would allow appropriate readjustment of donation intervals and would guide the use of iron supplementation. It has recently been recommended that short-term iron supplementation combined with adjustments of hemoglobin acceptance levels may reduce the rate of donor deferral for low hemoglobin.\textsuperscript{[198]}
\end{itemize}
Rosvik AS suggested the need for a better administration of iron supplementation to blood donors according to their serum ferritin values. Measurements of serum ferritin once a year is needed to supervise the iron supplementation. Donors with pre donation serum ferritin below 50 μg/L should be offered iron after donation, while donors with serum ferritin above 80 μg/L do not need additional iron. Donors with serum ferritin between these limits must be judged individually. Measurements of serum ferritin regularly can detect iron overload. If iron overload is present, it will be considered malpractice to provide iron supplementation.[130]

In this study it was found that substantial number of persons had low iron stores, indicating their vulnerability to the development of anaemia. Hence, such male donors also need evaluation of serum ferritin, otherwise, the regular voluntary donor pool may decrease due to development of iron deficiency anaemia.

In conclusion, hemoglobin estimation alone may not be enough to evaluate donor safety prior to phlebotomy. In our country, the iron stores in females are low especially in the reproductive age group. Hence, serum ferritin evaluation needs to be included in the testing of first time female donors for donor safety.

Plasma ferritin has been used to diagnose IDA because the ferritin level is considered to be the single, most powerful test for its diagnosis.[199,200,201] Ferritin is independent of external contamination of blood samples, diurnal variation, and concurrent iron therapy. Even though plasma ferritin is an acute phase reactant that can be elevated in various inflammatory conditions, as this study group comprised of healthy donor population, the probability of inflammation was negligible. For diagnosis of IDA, plasma ferritin threshold of 15 μg/ l was used in this study, as suggested by Susan F Clark.[202]
The study investigates microcytosis in blood donors. Microcytosis is the most common red cell change observed during a routine blood count and is an important indicator of anemia. Anemia, to date, remains the most important cause of deferral in blood donors, and therefore, investigating microcytosis in donors, not only helps in identifying the cause of anemia but also provides right treatment and counseling to the donor. This goes a long way in maintaining a dedicated pool of donors. In several studies, red blood cells are described as being microcytic when the mean corpuscular volume is less than 80 fl. MCV measurement by cell counter is direct, rapid, inexpensive, and automated. The prevalence of microcytosis in donors in this study was 14.75%. This was higher than that found in the high school students of Hong Kong (8.3%), in a study by Yu-Lung Lau et al. (1997), and Aseem K Tiwari and Iva Chandola who also followed the same criteria for MCV (< 80 fl). This difference could be because of the different sets of population and different mean age of subjects in this study.

Out of total 58 donors with low MCV that is < 80 fl, only the donors with high RBC count and Mentzer index favoring for thalassemia were selected and were also screened by the High Performance Liquid Chromatography for quantization of HbA2 because of the simplicity of sample preparation, superior resolution, accuracy and combined with complete automation of the method. Diagnosis of BTT was based on levels of HbA2 greater than 3.5 %. Reduction of HbA2 because of coincident iron deficiency did not preclude detection of BTT. In the present study total 12 samples were tested by HPLC to know the cause of low MCV, out of which 6 cases were turn out to be Beta thalassemia trait [1.53%] and 5 cases were normal and one case was in diagnostic dilemma situation with ? sickle cell trait/ ? Hb D trait which requires further family screening and repeat
testing for confirmation. In six diagnosed beta thalassemia trait cases 3 cases show normal ferritin value, 2 cases show low ferritin level that is associated with iron deficiency and one case of high ferritin level. Both low ferritin level cases were frequent donors with one case donated 20 times and the other donated 3 times. The case of other haemoglobinopathy that is Hb D/ sickle cell trait was also with low ferritin level. Out of five cases of normal HPLC report, 4 cases show markedly low level of ferritin and one case show ferritin normal level just near to lower limit of normal range suggestive of iron deficiency as a cause of low MCV.

Present study illustrates two important aspects; one, the prevalence of IDA and BTT was high among blood donors and second, the probability of both IDA and BTT in microcytic samples was significantly high. Several studies including two recent Indian studies emphasized the high prevalence of IDA in blood donors.\cite{8,212} The prevalence of BTT in blood donors in India is being reported for the first time by Aseem K Tiwari and based on their findings and the findings of current study have suggested an algorithm which recommends conducting a hemogram on all donor samples, routinely. Plasma ferritin could be done only in microcytic samples. Those with ferritin levels less than 15 ng/ml are diagnosed as IDA. HPLC is performed only for non-IDA samples, with ferritin levels higher than 15 ng/ml, as BTT is more likely in samples with higher ferritin levels.\cite{207} The same recommendation has been put forward by Loria and Hershko.\cite{213,214} But in the present study, out of six cases of beta thalassemia trait two cases\cite{33.33%} showed low ferritin value that is <12 ng/ml almost zero storage iron level. So this study suggests some practical correction in the algorithm suggested by Aseem Tiwari and that should be implemented after thorough study with large sample size data.
Under developed Asian countries are considered to be areas of highest prevalence of iron deficiency due mainly to poverty, dietary habits and worm infestation. The magnitude of the problem seems to be the greatest in our population and the reason for that is lower iron status of our population as compared to the Western norms. The reasons for that in turn are racial, environmental, parasitic and dietary factors. Among the dietary factors the most important ones are low ‘heam’ proteins in diet and high phytate content of the wheat flour.

Dietary habits have significant influence on iron levels. However, present study data analysis suggested that there was no significant difference in the iron profile of vegetarians and non-vegetarians. The reason is majority of non-vegetarians consumed meat/fish only once or twice a week and some even less frequently.

Almost all measures currently used to assess iron status show a high sensitivity and specificity in distinguishing between subjects with iron deficiency and those with iron stores and a normal haemoglobin concentration, but only in the absence of any other disease process. Zanella et al examined the sensitivity and predictive value of serum ferritin and zinc protoporphyrin (ZPP) concentrations to identify iron deficiency. The overall sensitivity and specificity of diagnosis were 82% and 95% for serum ferritin and 61% and 95% for ZPP. However while the sensitivity was over 90% for both ferritin and ZPP in cases of severe anaemia, in the absence of anaemia the sensitivity dropped to 70% for ferritin and less than 50% for ZPP. In a systematic review of the diagnostic value of various laboratory tests to diagnose iron deficiency it was concluded that serum ferritin was the most powerful test for simple iron deficiency in both populations and hospital patients. Fishbane et al concluded that the reticulocyte hemoglobin concentration
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(CHr) was a markedly more stable analyte than serum ferritin or transferrin saturation, and that it predicted functional iron deficiency more efficiently.[221]

Hematological parameters MCV and MCH have been reported to be useful in the identification of iron deficiency.[38] Present study shows that the MCV and MCH values show statistically significant difference in repeat donors in comparison to first time donors. The current guidelines in most countries require the determination of haemoglobin and haematocrit levels before blood donation. However, with regards to meeting safety requirements for donors, haemoglobin and haematocrit are unsuitable for use as a screening tool for the diagnosis of iron depletion. Blood donation is known to be associated with iron depletion or deficiency particularly in repeat blood donors.[14,222] Haemoglobin estimation is inadequate for detecting iron deficiency,[10,11] as is also supported by our study.

Iron-depleted and iron-deficient donors are often annoyed and might become reluctant to donate again, even if they had been regular blood donors. On the other hand, we need a safe and effective donation; therefore, blood centers should consider consultation and iron replacement also for men, and not only for women, in order to retain the volunteer donor base.[55] Several studies have found a rapid recovery of hemoglobin in autologous blood donors with iron deficiency anemia who had been supplemented with a daily dose of 200 mg iron.[12,55]

From other studies[29,223, 224] we know that iron replacement may be associated with some problems such as need of new section to deal with donors in the blood center setting, concern about missing underlying disease such as gastrointestinal disease, increase of iron overload resulting in hemochromatosis, and the belief that donors with lower iron

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stores might be healthier, particularly with regard to atherosclerosis and the risk of cardiovascular events. Thus a protocol is required for iron replacement. For example, donors who are iron-depleted and have a first-degree relative under the age of 60 years diagnosed with colorectal, small bowel, ureteral and/or in some instances pancreatic cancers, or donors who have multiple family members with cancer should not receive iron supplement before further evaluation and screening test. Consequently, based on these controversies, such a protocol should consider advantages and disadvantages of iron replacement. However, we should keep in mind that iron therapy is not dangerous. If iron deficiency was approved, it is necessary to start iron replacement. Since iron stores are reduced by about 200 mg iron per donation and with respect to an of iron absorption rate of usually 10-20% the recommended dosage of iron supplementation is roughly 100 mg/day for 10-20 days after the blood donation.

Because ferrous sulfate is associated with gastrointestinal side effects and poisoning in children who have access to the medication, some researchers suggest to use iron carbonil which is not associated with gastrointestinal side effects or poisoning.

Given the findings in this and other studies, what measures can blood collectors pursue to address iron depletion? There is no single answer, but several approaches should be considered: 1) modifying the donor Hb requirements and measurement of Hb, 2) changing the inter donation interval, 3) testing for serum ferritin, and 4) iron supplementation. One way is to take national initiative to reduce the magnitude of iron deficiency in our population by education, behavioral changes in the area of food habits and iron supplementation.
Educating the donor about iron rich food is easy but takes time. Hence, it is difficult for a busy blood bank to spare the time for such education. However, it is possible to create various educative materials to improve iron uptake through dietary modifications but the effect of this to change the nature of food intake may be marginal. Supplementation of iron through common food items is a simple measure. Supplementing iron tablets to regular donors should not be difficult. Oral iron is known to produce gastrointestinal side effects hence unlikely to be accepted by healthy donors even if it is given free from blood banks. However, in India a significant proportion of our population has haemoglobinopathy genes which on iron supplementation may cause iron overload. The ideal solution would be education and supplementation of iron coupled with haemoglobinopathy control programme. A majority of Indians are vegetarian that results in poor absorption of iron from the food. Reduction of frequency of donation from 3-4 times a year to twice a year may bring down the proportion of donors who become iron deficient after a few years of regular transfusion.

Finally, screening the donors by serum ferritin levels at the time of first donation and subsequently once every year becomes very rational for voluntary blood donation programme avoiding iron deficiency in donor population. In the study by Mittal R, 8% of male and 50% of female donors had low serum ferritin levels at the time of blood donation. In fact, ferritin assay costs extra financial burden but this gives us value for money by generating national data on prevalence of iron deficiency, treating the iron deficient donor, referring the donor for further medical investigation and treatment if donor remains persistently iron deficient in spite of compliant oral iron intake. Donors will also feel that they are given extra care for the service they are doing.
In India, donors are allowed to donate up to 4 times a year. Donors must weigh at least 45kg and all are screened for anaemia at the donation session, usually using a copper sulphate screening method on a finger prick blood sample. A cut off level of 125 g/L is used, below which potential donors are excluded from donating. Although hemoglobin has generally been used for donor screening, studies have shown that hemoglobin levels may not correlate with iron status.

In conclusion, hemoglobin estimation alone may not be enough to evaluate donor safety prior to phlebotomy. In our country, the iron stores in females are low especially in the reproductive age group. Hence, serum ferritin evaluation needs to be included in the testing of first time female donors for donor safety. The data from the study shows that there is a need to understand the problem and to educate the regular donors regarding iron supplementation. The study also suggests that the blood banks must check serum ferritin of all the regular donors at least once every year. This is our responsibility towards these very important persons who are donating life to others.