Iron deficiency in blood donors

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The aim of this study was to evaluate the frequency of iron deficiency in Santa Casa Hemocenter blood donors and to establish the frequency of iron deficiency in blood donors according to sex, whether they were first-time or multi-time donors, and the blood donation frequency per year.

METHODS

From September 20 to October 5, 1999, three hundred blood donors were studied using a combination of biochemical measures of iron status: serum iron, total iron-binding capacity, transferrin saturation index, serum ferritin and the erythrocyte indices.

Approximately 450 ml of blood was drawn at each phlebotomy and blood samples were taken at the end of the procedure.

According to the Brazilian Government requirement for blood donation, we included in this study only donors with standard values of hemoglobin (≥12 g/dl for women and ≥13 g/dl for men) and/ or hematocrit (38% for women and 40% for men).

Iron-depleted donors were defined by serum ferritin values below 12 ng/ml and TSI greater than or equal to 16%; iron-deficient erythropoiesis when serum ferritin values were less than 12 ng/ml and TSI less than 16%; and iron-deficiency anemia when serum ferritin values were less than 12 ng/ml and TSI less than 16%, and hemoglobin less than 13 g/dl (for men) or 12 g/dl (for women).

INTRODUCTION

The general impact of blood donation on iron status has been studied since the late 1970s. Blood donation results in a substantial (200 to 250 mg) loss of iron at each bleeding procedure (425 to 475 ml) and subsequent mobilization of iron from body stores. Recent reports have shown that body iron reserves generally are small and iron depletion is more frequent in blood donors than in non-donors.

CONCLUSION: We conclude that blood donation is a very important factor in blood donors, particularly in multi-time donors and especially in female donors. The high frequency of blood donors with iron deficiency found in this study suggests a need for a more accurate laboratory test, as hemoglobin or hematocrit measurement alone is not sufficient for detecting and excluding blood donors with iron deficiency without anemia.

KEY WORDS: Iron deficiency. Blood donor. Serum ferritin.
deficiency includes iron-depleted donors and iron-deficient erythropoiesis donors.

In statistical analysis, differences were evaluated by the Mann-Whitney rank sum test and the Student “t” test, and correlations using Spearman’s rank correlation coefficient. A “P” value less than 0.05 was considered as statistically significant. All the statistical analyses were performed on the software SPSS, version PC+.

RESULTS

The characteristics of the 300 blood donors that were studied were the age in years (mean 33.0; median 32.0; range 18 to 60); the sex, with 79% being male (237/300); and the color, with 35% being non-white (104/300). The number of first-time blood donors was 94 (31.3%), and there were 206 (68.7%) multi-time blood donors. Of the latter, 133 (64.5%) were considered repeat donors (who had donated one or more times per year) and 73 (35.5%) sporadic donors.

The frequency of iron deficiency in blood donors was 11.0%, of whom 5.5% (13/237) were male and 31.7% (20/63) female donors. The frequency of iron deficiency was higher in multi-time blood donors than in first-time blood donors, for male blood donors (7.6% versus 0%, P < 0.05) and female ones (41.5% versus 18.5%, P < 0.05) (Table 1).

Figures 1 and 2 show the mean ferritin serum level observed in the male and female blood donors, respectively, according to the blood donation frequency in the last 12 months.

The frequency of iron deficiency found was higher in the multi-time blood donors. This difference was statistically significant among the male blood donors with three or more donations per year (P < 0.05) and among the female blood donors with two or more donations per year (P < 0.05) (Table 2).

DISCUSSION

Iron is a vitally important element in human metabolism. It has a central role in erythropoiesis and is also involved in many other intracellular processes in all the tissues of the body.16, 17

The potential for an individual donor to give blood without developing iron deficiency anemia displayed wide variation, probably due to differences in nutritional iron intake, the prevalence of iron deficiency in the population, the menstrual iron loss in females, the frequency of blood donation and the use of supplemental iron, as well as the capacity to absorb iron.5, 6, 18

Recent reports have shown that the frequency of iron deficiency is high in blood donors (1.8%)

Table 1. Frequency of iron deficiency in blood donors according to sex and type of donor

| Sex             | Male                  | Female                 |
|-----------------|-----------------------|------------------------|
|                 | Male Blood            | Female Blood           |
|                 | First-time (n = 67)   | Multi-time (n = 170)   |
|                 | First-time (n = 27)   | Multi-time (n = 36)    |
| Iron Deficiency | 0 (0.0)               | 13 (7.6) *             |
| N (%)           | 67 (100.0)            | 157 (92.3)             |
| No Iron Deficiency | 127 (18.3)            | 22 (18.5)              |
| N (%)           | 677 (99.7)            | 213 (96.2)             |

* P < 0.05.

Table 2. Distribution of serum ferritin, transferrin saturation index (TSI) and the frequency of iron deficiency in male blood donors according to the blood donation frequency in the last 12 months

| Blood Donation Frequency in the last 12 months | Male Blood Donors: Iron Deficiency n (%) | Female Blood Donors: Iron Deficiency n (%) |
|-----------------------------------------------|-----------------------------------------|-------------------------------------------|
| Zero                                          | 127 (1.8)                               | 9 (22.5)                                  |
| 1                                             | 94 (2.1)                                | 7 (36.9)                                  |
| 2                                             | 15 (6.0)                                | 2 (100.0)                                 |
| 3                                             | 1 (1.00)                                | 2 (100.0)                                 |
| Total                                         | 237 (5.5)                               | 63 (31.7)                                 |

* P < 0.05.
to 8.4% in males and 4.5% to 34.8% in females), and more dependent on the frequency of donations than on the accumulated number of donations.5,10,11 As also found in the present study.

The only known significant disadvantage of blood donation is the potential risk for iron deficiency. Therefore it seems reasonable to secure adequate iron reserves in the donor population in order to maintain an appropriate donation potential and to avoid possible non-hematological side-effects of iron deficiency, i.e. changes in immune function, energy metabolism and work performance.6,19

CONCLUSIONS

We conclude that blood donation has a profound influence on iron stores and is an important factor for iron deficiency in blood donors, particularly in multi-time donors and, especially in female donors. The high frequency of blood donors with iron deficiency found in this study suggests a need for a more accurate laboratory trial, since hemoglobin or hematocrit measurement alone is not sufficient for detecting and excluding blood donors with iron deficiency without anemia.

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