

Anemia and the Blood Donor

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The World Health Organization recommends a collection rate of 10-20 whole blood units per 1000 inhabitants to address transfusion needs⁽¹⁾. However, demand for blood is ever-increasing as medicine continues to develop⁽²⁾.

Donor selection is critical to blood transfusion safety and blood donor eligibility policies are designed to protect both the donor and the recipient^(1,3). Donors with relatively low hemoglobin (Hb) levels are not allowed to donate to prevent them from developing iron deficiency anemia (IDA). In addition, deferral of these donors guarantees that blood units for transfusion meet the required standards for Hb content⁽⁴⁾.

Deferral for low Hb accounts for 35% to 75% of total deferrals, with the vast majority occurring in women⁽⁵⁻⁷⁾. At the New York Blood Center, 92.7% of these deferrals were women^(6,7).

Iron deficiency is the world's most widespread nutritional disorder, affecting both industrialized and developing countries⁽⁸⁾. In Brazil, there are no consistent studies to show the real problem, although some studies showed 25% of anemia in women of childbearing age^(9,10).

On the other hand, because IDA is the last stage of iron-deficiency, Hb measurement alone is inadequate to detect blood donors with iron deficiency but without anemia. Recent publications have suggested that serum ferritin levels could be a reliable indicator for body iron stores since they provide a determination of iron deficiency at an early stage^(11,12).

As ferritin testing is comparatively costly, various red blood cell (RBC) parameters have been proposed as markers for low ferritin/iron depletion⁽¹³⁾. Significant correlations between ferritin and RBC parameters were shown in these analyses, but no study has determined which marker is the most useful to identify donors at risk of developing anemia⁽¹³⁾.

Beta-thalassemia trait (BTT) is the second most common cause of microcytic anemia and, for this reason, the possibility of this disease must be discarded when anemia or microcytosis is present^(12,14). An interesting paper by Tiwari et al.⁽¹⁴⁾ suggested that it could be useful to routinely perform a complete blood count (CBC) for all blood donors and further analyze the microcytic samples for ferritin and Hemoglobin A₂ to differentiate between IDA and BTT. This approach, however, is relevant only in areas where there is an elevated prevalence of BTT. These authors, also, reviewed nine indices to differentiate IDA and BTT. (Table 1)

Table 1 - Formulae and cut-off point of nine indices to differentiate iron deficiency anemia (IDA) and beta-thalassemia trait (BTT)⁽¹⁴⁾

Index	Formula	In favor of	
		IDA	BTT
RBC	$\times 10^9/\mu\text{L}$	< 5	> 5
RDW	%	> 14	< 14
Mentzer	MCV/RBC	> 13	< 13
Shine and Lal	$\text{MCV}^2 \times \text{MCH} \times 0.01$	> 1530	< 1530
England and Fraser	$\text{MCV} - \text{RBC} - (5 \text{ Hb}) - 3.4$	Positive	Negative
Srivastava	MCH/RBC	> 3.8	< 3.8
Green and King	$\text{MCV}^2 \times \text{RDW}/100 \times \text{Hb}$	> 65	< 65
RDW index	$\text{MCV} \times \text{RDW}/\text{RBC}$	> 220	< 220
Ricerca	RDW/RBC	> 4.4	< 4.4

RBC: Red blood cells; RDW: Red blood cell distribution width; MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin

In order to fulfill their necessities, blood centers have long recognized that it is more effective and less expensive to collect blood from existing donors than to recruit new donors and in the United States, 71% of donors are repeat donors. But, this strategy has come at a price: iron depletion of these donors⁽⁵⁾. After donation of 450 mL of blood, a male donor loses 242 ± 17 mg and a female 217 ± 11 mg of iron^(5,15). Since the 1970s, various investigators documented the decrease in serum ferritin levels in association with blood donation^(5,11,13,16-18).

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The lost iron is not readily repleted. It has been common practice for blood centers to recommend iron-rich diets to donors who have been rejected for low Hb. However, even with excellent compliance, it requires 6 months or longer to positively impact ferritin levels⁽⁵⁾. Because of this, many researches have prescribed iron supplementation with good results^(15,19,20). However, the majority of regular blood donors with low or absent iron stores will never develop IDA⁽¹³⁾.

It is important to remember that avoiding unnecessary deferrals, keeps donors engaged with the blood center⁽⁶⁾. In fact, Boulton demonstrated that only 25% of first-time donors return to the blood donation facility after rejection, while 47% of first-time donors come back within 6 months when accepted at their first visit⁽²¹⁾.

Anemia is an important topic for blood donor candidates and effort has to be made to identify these individuals, prevent iron depletion in regular blood donors, and engage these individuals with blood donation.

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