INTRODUCTION

The gift of blood is the gift of life. Nothing is comparable to the preciousness of human blood. In spite of rapid and remarkable conquests of medical science today, there is no factory that manufactures blood – it can only come from generous donors. It is only in human beings that human blood is made and circulated.

The voluntary unpaid blood donation is a humanitarian act towards the sick by the healthy. No transfusion service can survive without blood donors. The well being and health of the blood donors is of prime importance for the medical profession. A lot has been discovered and written about protection of the recipients from the potential hazards of blood transfusion. A lot of money is being spent for the screening of donors for protection of recipients but very little attention is given to the health status of donors. The main reason is the fear of losing the donor in a time when the demand of blood is soaring all over the world and the donors are becoming scarce.¹

Since the 1980s blood collectors worldwide have focused on two central themes: blood product safety and an adequate blood supply. From the standpoint of safety, specifically the reduction of transfusion-transmitted diseases, the achievements over the past quarter century are remarkable. Human immunodeficiency virus, hepatitis B virus, and hepatitis C virus have largely been eradicated as blood-borne threats.²

The need for blood is great. Every two seconds someone needs blood. More than 38,000 blood donations are needed every day.³ The amount of blood needed is very little when compared with the potential blood donor population in India. The total population of India is 1210 million, the second largest in the world.⁴ However the current supply in
India is only 74 Lakh units / year. The blood needs of the country are estimated to be 85 lakh to 1 crore units/year. WHO estimates that blood donation by at least 1% of the population is generally sufficient to meet a country’s basic requirements for safe blood.\[5\]

Accident victims, people undergoing surgery, and patients receiving treatment for leukemia, cancer, or other diseases, such as sickle cell disease and thalassemia, all utilize blood. More than 23 million units of blood components are transfused every year. In most countries, strict regulations have been established for the selection of blood donors that incorporate criteria that serve to protect both the donor and recipient.\[1\]

With respect to the adequacy of the blood supply, the past decade has witnessed major gains in some countries of Europe, Canada and the US and less than had been expected in others, including India, where the challenge of having a more stable blood supply, in which supply and demand are in better balance remains an important issue. Prolonged post holiday shortages, summer shortages, and storm-related interruptions that plagued many metropolitan areas, forcing cancellation of surgery or rationing, have been greatly diminished. This achievement has come about with implementation of better collection technology.\[2\] The result is a more stable blood supply in which supply and demand are in better balance. This success has come at a price: iron depletion of the repeat blood donor.

To increase the quantity and safety of national blood supplies, there has been a steady push for recruitment of more regular blood donors and encouragement to first time donors to become repeat donors. An increase in the frequency of blood donations among our donor population is liable to result in excessive iron loss and development of iron deficiency anaemia. Blood centers have long recognized that it is more effective and less
expensive to collect blood from existing donors than to recruit new donors. While first-time donors, particularly the young and minorities, have been more successfully recruited. Today’s whole blood donor donates on average 1.5 times per year.\[^2\] However, this figure varies widely and in some communities the number is much higher, in excess of two times annually. The question that arises is whether this practice is in the best interest of donor health.

The process of blood donor selection is designed to ensure that the donation does not cause harm to the donors. A healthy individual can donate blood up to four times a year i.e. at 3-monthly intervals as iron stores can be depleted if blood is donated more frequently.\[^6\] Their age should be between 18 years to 60 years, the weight at least 45 kg and they should be generally healthy according to a history obtained from a health questionnaire and questions asked during pre-donation counseling as per Drugs and Cosmetics Act, Government of India,1940 and all are screened for anaemia prior to donation.\[^7\] A cutoff value of hemoglobin of 12.5 g/dL is often recommended before a blood donation is made.\[^8\]

Deferral for low hemoglobin (Hb) accounts for 35% to 75% of total deferrals, with the vast majority occurring in women.\[^9\] With all the precautions taken to ensure safety of blood donation, iron deficiency among regular blood donors is still a common problem. There are several studies confirming iron stores depletion in blood donors.\[^10, 11, 12\]

The general impact of blood donation on iron status has been studied since the late 1970s.\[^13, 14, 15, 16, 17\] Blood donation is recognized as the most common iatrogenic cause for iron deficiency among healthy adults. Various investigators documented the decrease in
Iron status in voluntary blood donors

serum ferritin levels in association with blood donation. Repeat whole blood donors have lower serum ferritin levels than the donor undergoing a first donation.\[10,11,18,19\]

Bleeding results in mobilization of iron from body stores.\[20\] As stores decrease iron absorption increases.\[21\] With continued bleeding an individual either reaches equilibrium at a lower level of iron stores or becomes anemic.\[22\] These considerations apply directly to people who serve as blood donors. The frequency of blood donation has been so adjusted as to prevent anemia in most donors, but quantitative information concerning the iron status of donors is limited. With the development of the ferritin assay, an evaluation of iron stores became possible.\[23,24\] Recent reports have shown that body iron reserves generally are small and iron depletion is more frequent in blood donors than in non-donors.\[17,25\]

One gram of haemoglobin contains 3.4 mg of iron. In a normal individual with 15 g of haemoglobin per dl, 100 ml of blood contains approximately 50 mg of iron. Thus removal of only 2 ml of blood results in the loss of 1 mg of iron.\[26\] If 450 ml of blood are taken in a donation approximately 225 mg of iron will be lost. Replenishment of this lost iron will take approximately 50 days based on daily iron absorption rates of 2.8 - 6.0 mg/ day.\[27\] If the donor has no iron deficiency, the erythrocytes and the hemoglobin level will generally return to normal within 3-4 weeks. Hence adequate iron stores are very important in maintenance of the donor.\[28\]

Chronic iron deficiency is a well-recognized complication of regular blood donation.\[18,29\] After a single donation, a person needs approximately 3 months to replenish iron stores.\[30\] An inverse correlation exists between body iron stores and absorbed iron. As body iron stores decrease, iron absorption increases. With continued iron loss, an individual
either reaches equilibrium at a lower concentration of iron stores or becomes iron-depleted, eventually developing iron-deficient Erythropoiesis and anemia.\cite{25}

Therefore iron deficiency in regular blood donors is an important donor safety issue. In the majority of blood banks, hemoglobin (Hb) and/or hematocrit measurements are used as a screening test for the ability to donate blood.\cite{31} Since hemoglobin levels may be normal in the presence of reduced iron stores,\cite{12, 25, 32} The use of this parameter has been reported to have poor sensitivity in the detection of early stages of iron deficiency.\cite{1, 19, 33} It is well-known that iron-deficiency anaemia is the last stage of iron deficiency and it is evident that hemoglobin levels alone are inadequate for detecting blood donors with iron deficiency without anaemia.\cite{33, 34, 35}

Indeed, an accurate diagnosis of a state of iron deficiency requires several laboratory tests. Measurements of serum iron and serum ferritin concentrations and red cell indices such as mean cell volume (MCV) and mean corpuscular haemoglobin (MCH) can be used with a high degree of accuracy and precision.\cite{36, 37, 38} Previous studies have shown that the serum ferritin levels were reduced markedly in regular donors corresponding to annual donation frequency.\cite{12, 39, 40}

Though blood donation in developed countries reduce serum iron stores in the donors but few regular donors becomes frankly iron deficient.\cite{10} Voluntary blood donation is the bedrock on which the safety of blood as a product largely depends. In India there is only 20 per cent voluntary blood donation. That 50 per cent of male blood donors become iron deficient by giving three units of blood per year poses a serious public health issue. These otherwise healthy individuals will have normal hemoglobin but may suffer innumerable non-hematological consequences of iron deficiency.\cite{41} This will deter voluntary donors
to come ahead as repeat donors; moreover the iron deficiency may reduce their work performance compromising their ability to earn enough for their livelihood.

- The potential for an individual donor to give blood without developing iron-deficiency anemia 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 and the frequency of blood donation. Recent 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.\[11,14\]

- The clinical implications of ID and IDA are not insignificant, including fatigue, reduced work performance and intellectual capacity, reduced endurance, restless leg syndrome, pica, and cognitive and immune function changes. The degree of symptomatology is proportionate to the severity of the anemia.\[42,43\]

- In order to fulfill the global and national drive to recruit and retain regular repeat voluntary blood donors, the iron status of the donors needs to be identified and necessary steps for iron supplementation need to be taken. There is a need to increase the national voluntary blood donation for safe blood supply. However, there is paucity of data in India country, particularly in and around Surat city regarding impact of regular voluntary blood donation on iron status of donors. The present study is, therefore, designed to assess [using a combination of hematological and iron status parameters] the development of anaemia and prevalence of iron deficiency anaemia in the voluntary blood donors at blood bank, New Civil Hospital, Surat. And most importantly to prove “I.R.O.N” {Iron Replacement Or Not} protocol for regular voluntary blood donors.