Haemoglobin ranges of blood donors rejected for low haemoglobin at a blood centre of a tertiary care hospital in South India.
KINGSLEY S SIMON
Department of Immuno Haematology and Blood Transfusion, CHRISTIAN MEDICAL COLLEGE

Abstract: Background According to Indian blood banking regulations the haemoglobin cutoff of blood donation for both males and females is more than or equal to 12.5 g/dl percentage. This study analyses the haemoglobin profile of donors deferred due to low haemoglobin, and estimates the proportion of donors with haemoglobin between 12.0 and 12.4 gm percentage to assess the impact of the acceptance threshold of 12.5 gm percentage as against 12gm percentage on our donor base. Materials and Methods All donors screened between May 2011 and July 2011 were included in the study. The minimal haemoglobin cutoff for donor selection was set at 12.5 gm percentage of both male and female donors. Screening for haemoglobin cut off was performed on venous blood using the copper sulphate specific gravity method. All donors deferred using this method had their haemoglobin rechecked on either the cyanmethaemoglobin method or Coulter counter DXH800. Results A total of 9793 donors was screened. Total 3760 (38 percentage) donors were deferred, of which 1113 (30 percentage) were females. Of those deferred, 1082 of 3760 (29 percentage) were deferred due to haemoglobin levels of less than 12.5 gm percentage. Of the 1082 donors deferred due to haemoglobin less than 12.5 gm percentage, 674 (62.29 percentage) were females and 408 (37.70 percentage) were males. Among these 1082 donors, 155 (1.6 percentage of the total donors) donors had haemoglobin between 12 and 12.4gm percentage of which 96 (9.0 percentage of total female donor deferred) were females and 59 (2.0 percentage of total male donors deferred) were males. Interpretation and conclusion Our study shows that inclusion of donors with Hb levels greater than 12 gm percentage would result in a 1.6 percentage increase in the donor pool. If more female donors contribute to the pool, then the increase in numbers recruited are likely to be greater by 9 percentage. Change in policy regarding haemoglobin cutoff to 12gm percentage will result in a proportionately larger number of donors entering the pool.

Keywords: blood donors, deferral, low haemoglobin, venous blood, copper sulphate, Hb 12.0 gm per dl, donor pool.

INTRODUCTION: The proper selection of blood donors is one of the pre-requisites of all blood transfusion services. The acceptance of the voluntary or replacement donors depends on their satisfying certain definite criteria or standards which have been designed to protect both the donors and the recipients. Donor deferral due to low haemoglobin is one of the major reasons of temporary rejection of blood donation. Each year a relevant proportion of whole blood donors are deferred due to low haemoglobin levels. Such temporary deferrals are demoralizing, and donors may never return for a donation. Pre-donation haemoglobin screening is among the first and foremost tests done for blood donor selection with the main intention of preventing blood collection from anemic donor. It is therefore essential, that there should be an accurate and reliable method for haemoglobin determination. According to the Indian Drugs and Cosmetics Act, 1940 for blood donation, the minimum acceptable hemoglobin (Hb) is 12.5 g/dl or hematocrit (Hct) of 38% for both males and females. Haemoglobin level of 13.5 g/dl for men and 12.5 g/dl for women is widely accepted as the cut-off level for donation.

The National Health and Nutrition Examination Survey III (NHANES III) found that 95% of Caucasian men over 18 years of age had Hb concentrations greater than 13.5 g/dl while 95% of Caucasian women over 18 years of age had Hb concentrations greater than 12.0 g/dl (http://www.CDC.gov). Beutler and Waalen, based on analysis of multiple databases and excluding subjects with iron deficiency suggested that the lower limit of the reference range for Hb for adults 20 to 59 years old in the United States, is 13.7 g/dl in Caucasian males, 12.9 g/dl in African American males, 12.2 g/dl in Caucasian females, and 11.5 g/dl in African American females. Thus, the current Hb threshold allows some "anemic" males to donate blood while some "normal" females are not allowed to donate. The main objective of this study was to analyze the haemoglobin profile of donors deferred due to low haemoglobin, and estimates the proportion of donors with haemoglobin between 12.0 and 12.4gm% to assess the impact of the acceptance threshold of 12.5gm% as against 12gm% on our donor base.

AIM: To assess the proportion of blood donors rejected due to haemoglobin values below 12.5gm%, and analyses what proportion of them have haemoglobin values between 12 and 12.4gm%.

MATERIALS AND METHODS: This is a retrospective, single center-based study assessing the donor deferral due to low haemoglobin. During the study period of 3 months (May to July 2011), 9793 prospective replacement blood donors were screened according to the criteria laid down by the Drug and Cosmetic Act of India. All the donors were from different states of India. Haemoglobin estimation was performed by Copper sulphate specific gravity method.
Copper sulphate specific gravity method. The copper sulphate (CuSO₄) specific gravity method is the traditional method being used for donor screening at many blood centers. Though a cheap and easy method, it does not provide an acceptable degree of accuracy. Copper sulfate method is a qualitative method for screening the blood donors based on specific gravity. The copper ion denatures the outer proteins of haemoglobin and the coating of copper proteinate and keeps the drop from dispersing in the solution. The specific gravity of the blood is estimated by allowing a drop of blood to fall into a series of copper sulphate solutions of varying specific gravity and noting the behavior of the drop measure the specific gravity. If the drop of blood is sunk in the solution, its specific gravity is greater than that of the copper sulphate.

Prepare the Copper sulphate working solution with a specific gravity of 1.053. The donor’s blood dropped into a copper sulphate solution from a height of 1 cm. The drop becomes encased in a sac of copper proteinate, which prevents any change in the specific gravity for about 15 seconds. If the haemoglobin is equal to or more than 12.5 gm/dL the drop will sink within 15 seconds. If the drop fails to sink, blood has a haemoglobin content of less than 12.5gm%. Cynmethaemoglobin method. Cynmethemoglobin method is the method recommended by the International Council for Standardization in Haematology but the main disadvantage is the requirement of venipuncture before the actual donation. The principle of this method is that when the blood is mixed with a Drabkin’s solution (Containing potassium ferricyanide 200mg, Dihydrogen potassium phosphate (anhydrous) 140mg, the potassium cyanide 50mg and distilled water 1000ml) the haemoglobin is first converted to methaemoglobin by potassium ferricyanide and then to cyanmethaeoglobin by sodium or potassium cyanide. This stable color pigment reads photometrically at a wavelength of 540nm. Haemoglobin analyser (Coulter counter – DXH800). Coulter counter – DXH800 is based on the Coulter Principle. The sample preparation and data collection occurs in the sample analysing module and CBC modules. Analysis is done by the System Manager. After the WBCs are counted, the lytic reagent used to lyse WBC and lysed blood is drains into the hemoglobin cuvette for Hgb measurement. Hgb is measured photometrically at 525 nm using the sample from the WBC analysis. A blank is introduced into the cuvette during each operating cycle. The Hgb blank the sample signal is compared.

RESULTS: A total of 9793 donors was screened, of which 8632 (88%) were males and 1161 (12%) were females. Of the 9793 donors who presented for blood donation, 3760 (38%) donors were deferred due to either temporary or permanent donation. Of which 1082 (29%) were deferred due to haemoglobin levels of <12.5gm%, 674 (62%) were and 408 (38%) were males. Among the 1082 donors deferred due to low haemoglobin, 155 (1.6%) donors had haemoglobin between 12 and 12.40gm% of which 96 (62%) were females and 59 (38%) were males. Total male donors deferred were 2647, of which deferred due to Hb of <12.5gm% was 408 (15%) and deferred due to Hb of 12.0-12.4gm% was 59 (2%).

Figure 1 shows male donors deferred due to Hb of 12.0-12.4gm%.

Total female donors deferred were 1113, of which deferred due to Hb of <12.5gm% was 674(43%) and deferred due to Hb of 12.0-12.4gm% was 96 (9%).

Figure 2 shows the Female donors deferred due to Hb of 12.0-12.4gm%.

DISCUSSION

Whole blood donors are deferred due to several reasons, either temporarily or permanently. Deferrals can be characterized as temporary short term (1–56 days), long term (57–365 days), and multiple years/permanent (more than 365 days)(2). A healthy blood donor loses about 200-250 mg of iron per unit of blood donation. Average total body iron in men is 4.0 g and a woman is 2.5 g, roughly 6% and 9% iron loss in men and women following each blood donation. The body compensates for this loss by mobilizing iron stores in the form of ferritin. For this reason, the mean ferritin levels are significantly lower in blood donors than in non-donors and studies have shown that iron stores decline with repeated blood donation(3).

A large majority of the donor population in a developing country, like India, is deferred due to temporary but easily rectifiable cause - Anemia. Acceptable Haemoglobin assessment is an important criteria for blood donor selection. The minimal hemoglobin cutoff of blood donors set as 12.5 gm% lay down by the Drug and Cosmetic Act of India, which is done to ensure both donor safety and appropriate hemoglobin content in the donated unit. In our study, among the 9793 donors, males were 8632 (88%) and females were 1161 (12%). Donors deferred due to Hb of <12.5gm% was 1082, which constitute 11.04% among the total donors, of which 408(38%) male donors and 674 (62%) female donors. This is in accordance with blood donor deferral rates found in the literature, which range from 3% to 15%(4). Meenu Pujani et al in New Delhi, documented that among the 6817 donors, 15.5% (122/787) deferred due to anemia and also they reported, the prevalence of anemia in female donors was significantly higher than in male donors (34.2% vs 1.2%). In our study, donors deferred due to Hb between 12.0-12.4 gm% was 155 (1.6%) of the total donors, of which males were 59 (2%) and females were 96 (9%). According to gazette of India (1999) hemoglobin cutoff for blood donation should not be less than 12.5gm/dl both males and females.

However NACO STATEMENT 2007 states that the haemoglobin should be not less than 12.0 gm/dl. In the REDS-II Donor Iron Status Evaluation (RISE) study have demonstrated that frequent blood donations can be associated with depletion of body iron stores, which is more pronounced in premenopausal female donors compared to male donors and in repeat donors compared to first time donors(5). Simon and colleagues found that the number of lifetime donations was not as predictive of decreased iron stores as the frequency of donations per year(6). It has been shown that a longer interdonation interval prevented a decrease in Hb in women and was also associated with less iron depletion(7). Our study shows that inclusion of donors with Hb levels greater than 12 gm% would result in a 1.6% increase in the total donor pool. If more female donors contribute to the pool, then the increase in numbers recruited are likely to be greater by approx 9%.
CONCLUSION:
However 9% of female and 2% of male donors and 1.6% of total donors deferred due to haemoglobin values between 12 and 12.4gm%. Change in policy regarding haemoglobin cutoff to 12gm% will result in a proportionately larger number of donors entering the pool. This shall be a major contribution toward improving public health and also enable and motivate prospective donors to return for blood donation.

REFERENCES