DOI: 10.4176/090418

Investigating the Importance of Haemoglobin Measurement for Selection of Blood Donors in Libya

Abud AI[1], Bashein AM[2] and Msalati AA[2]

1 Blood Bank, Al-Jala Women Hospital
2 Department of Biochemistry, Faculty of Medicine, Alfateh University, Tripoli, Libya

Abstract; In Libya, haemoglobin estimation is not used routinely to assess the fitness of blood donors. We examined the importance of including this parameter in donor selection. Venous blood samples were collected from the bleed line at the end of the donation process from 1339 healthy adult male blood donors, aged 18–60 years, in Al-Jala Women Hospital in Tripoli, Libya. Haemoglobin concentration was measured using an automated haematology analyzer. The main donor age categories were 21-30 and 31-40 years (49.5% and 37%, respectively). Blood donation was mainly a replacement donation. The mean ±2SD range for haemoglobin was 10.8–17.0 g/dl. 27.2% of the donors had haemoglobin concentration of less than 13 g/dl, 16.9% of them had less than 12.5 g/dl and 1.9% had less than 10.8.5 g/dl. Our results suggest that it is important to include haemoglobin estimation as a routine procedure in selection of blood donors.

Key words: *Haemoglobin, Blood donors, Anaemia, Libya.*

Introduction

Blood donors are screened to exclude those whose health might be compromised by the donation and to protect blood recipients from transmission of infectious agents or medications taken by the donor [1]. In Libya, blood donations are usually made by replacement donors, i.e. by relatives and friends of the patient needing blood. A minimum of four months between donations is required. Donors should be 18–60 years, and they should be generally healthy according to a clinical examination that includes blood pressure measurement.

Most countries impose the pre-donation haemoglobin (Hb) measurement to protect donors from being severely anaemised and to ensure that the Hb content of the donated blood meets the required criteria [2]. In Canada and the United States, the minimum values for donors haemoglobin concentration is set at 12.5 g/dl for all blood donors [3], while in European countries the cut-off level is 12.5 g/dl for women and 13.5 g/dl for men [4].

Several studies showed that a large proportion of blood donors are excluded because their Hb level does not meet the minimum accepted standards [5-8]. However, though anaemia is still a widespread public health problem in the developing world, haemoglobin estimation is not an obligatory procedure for the selection of blood donors in Libya. This study is carried out to examine the importance of including haemoglobin measurement for blood donor selection. We used the reference values set by the WHO [9] to evaluate the haemoglobin values in our volunteers.

Materials and methods

Study population: The study was carried out at Al-Jala Women Hospital in Tripoli, Libya, between May 2006 and June 2007. It included 1339 male blood donors aged from 18 to 60 years. The participants were supposedly healthy, as they claimed to be feeling well and intended to donate blood. Every participant filled and signed an informed consent form, as well as a questionnaire aiming to exclude previous operations, receiving blood, any chronic disease, any haematological disease, any previous drug abuse, or premarital or extramarital sex. Before donation, every blood donor underwent a clinical check up, including measurement of the blood pressure with a sphygmomanometer and stethoscope.

Blood collection and haematological analysis: After donation of about 450 ml of blood, an additional sample of 5 ml was taken via the bleed line into an EDTA blood collection tube for haemoglobin analysis. The haemoglobin analysis was carried out immediately using an automated haematology analyzer (Sysmex k21, Kobe, Japan).

Statistical analysis: Data were analyzed with the Statistical Package for the Social Sciences (SPSS). The mean, median, standard deviation, and reference intervals were calculated for haemoglobin.

Normal reference range was defined as mean ± 2 standard deviations (SD). Since the haemoglobin data was normally distributed, we used the normal theory to establish the haemoglobin reference range.

The studied sample was divided according to age into the following categories: 18-20 years, 21-30 years, 31-40 years, 41-50 years, and 51-60 years. One-way analysis of variance (ANOVA) was used to compare the means of the haemoglobin between different age categories.

Results

The haemoglobin data exhibited a normal distribution (Figure 1). Both median and mean haemoglobin concentration in the 1339 male blood donors were 13.9 g/dl, standard deviation was 1.6 g/dl, and the reference range was 10.8-17.0 g/dl (Table 1).

Table 1 Haemoglobin median, mean, standard deviation, and reference intervals values in the 1339 male blood donors.

Median	Mean	SD	Mean±2SD
13.9	13.9	1.6	10.8-17.0

Using the haemoglobin cut-off value recommended by the World Health Organisation for detection of anemia in adult males (9) showed that 27.2% of the donors had haemoglobin concentration < 13 g/dl. Also, 16.9% had haemoglobin concentration <12.5 g/dl (the minimum values for donors' haemoglobin concentration in Canada

DOI: 10.4176/090418

and the United States), and 1.9% had haemoglobin concentration < 10.8 g/dl (the lower limit of the reference range estimated in this study).

Most blood donors were in age categories 21-30 and 31-40 years (49.5% and 37%, respectively) (Table 2). There was a tendency to lower haemoglobin values after the age of 40 years, and ANOVA analysis showed that there is a significant difference in haemoglobin concentration between different age categories (p = 0.002).

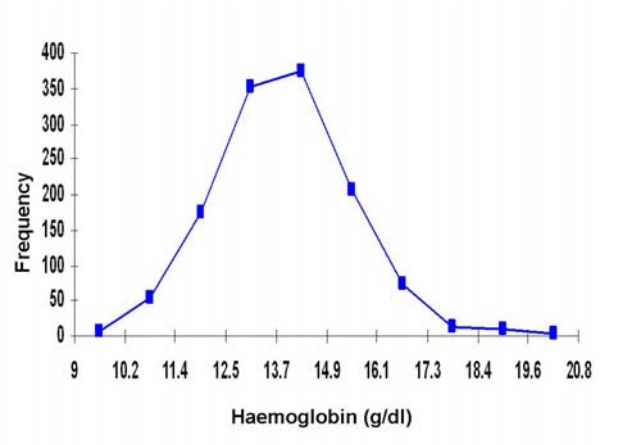

Figure 1 Frequencies of haemoglobin levels among donors

Table 2 Means of haemoglobin concentration of different age categories and the ANOVA analysis

Age group (years)	Percentage of donors	Mean Hb (g/dl)
18-20	4.0%	13.4
21-30	49.5%	14.0
31-40	38.2%	13.9
41-50	7.4%	13.6
51-60	0.9%	13.0
P-value		**0.002**

Discussion

In Libya, apart from the blood bank in Benghazi, there is no proper blood banking system and there are no national guidelines to regulate the process of blood donation. Blood donations are obtained mainly by recruiting relatives and friends of the patient requiring blood. The blood is tested for blood-borne infectious diseases, cross-matched, and given to the patient.

Our results showed that 27.2% of the donors had haemoglobin concentration of less than the WHO cut-off of 13 g/dl, 16.9% had haemoglobin concentration of less than the US cut-off value of 12.5 g/dl, and 1.9% had haemoglobin concentration of less than 10.8 g/dl (the lower limit of the reference range estimated in this study). These results emphasise the importance and the urgency of considering haemoglobin estimation as an integral part of the donor selection process.

We first showed that the haemoglobin values of the study sample had a Gaussian distribution, confirming the validity of defining the reference range as the mean ± 2 standard deviations.

Comparison of the estimated reference range and the mean values of haemoglobin in Libyan adult male blood donors with the published haemoglobin values in the Western countries and some African countries (Table 3) [10-17] showed that the lower limit of the Libyan blood donors' values is lower than those in Western and African countries, with the exception of Kenya [13]. These differences may be attributed to differences in genetic makeup, hematological diseases, or nutritional lifestyle, or to differences in the methods used. Given that haematological diseases such as sickle cell anaemia and thalassaemia are widely spread in the Mediterranean region, it is very important to study these diseases in Libyans.

Table 3 Comparison of haemoglobin reference values obtained from the present study with those published in Western and African countries.

Country (ref No.)	Hb(g/dl)	
	Mean	Range
Western countries (10)	15.0	13.5–17.5
Western countries (11)	15.0	13.0–17.0
Western countries (12)	15.0	13.0-17.0
Kenya (13)	9.9	8.3-11.3
Ethiopia (14)	16.1	13.9-18.3
Ghana (15)	14.2	11.7-16.5
South Africa (16)	14.0	10.3-16.7
Uganda (17)	14.1	11.1-16.8
Present study	13.9	10.8-17.0

These results suggest that larger studies are needed to establish the haematological reference values in different categories of Libyans, including children, pregnant women, and the elderly. These studies should exclude people with haematological diseases and any other abnormality that might affect haemoglobin concentration.

Comparison of haemoglobin concentration means in different age categories showed that there is significant difference in the haemoglobin concentration means between different age categories (p=0.002). The highest haemoglobin mean (14.0 g/dl) was in the age category of 21-30 years and the lowest (13.0 g/dl) was in the age category of 51-60 years. This suggests that the latter age category should be treated with extra care.

In Libya, family replacement donors usually feel under pressure to donate and may therefore hide aspects of their health even when not feeling well, which could mean that they are phlebotomised when they are anaemic themselves. This emphasises the urgent need for proper criteria for blood donor selection to avoid bleeding unfit donors. Libyan blood services should include among their selection criteria measurement of haemoglobin, and guidelines for a National Blood Transfusion Service should be established, including definition of acceptable haemoglobin level. Simple and inexpensive pre-donation estimation of haemoglobin should be used in blood banks for selection of blood donors [18-21].

Conclusion

This paper showed that there is an urgent need to revise the blood donation protocol in Libya. More attention should be given to selection of donors in order to guarantee their safety, and to ensure obtaining blood that is suitable for transfusion.

The procedure of blood donor selection should include testing donor's haemoglobin.

References

1. Joint UKBTS/NIBSC Professional Advisory Committee's (JPAC) Guidelines for the Blood Transfusion Services in the United Kingdom, 7th Edition 2005. www.transfusionguidelines.org.uk.
2. Lotfi, R. A noninvasive strategy for screening prospective blood donors for anaemia. Transfusion. 2005: 45:1585-92.
3. Goldman MR. Another stab at donor haemoglobin screening. Transfusion 2005; 45:1552-3.
4. Council of Europe. Guide to the preparation, use and quality assurance of blood components. 9th ed. Strasbourg: Council of Europe Publishing; 2003.
5. Rajab JA, Muchina WP, Orinda DA, Scott CS. Blood donor haematology parameters in two regions of Kenya. East Afr Med J. 2005; 82:123-7.

DOI: 10.4176/090418

6. Adediran IA, Fesogun RB, Oyekunle AA. Haematological parameters in prospective nigerian blood donors rejected on account of anaemia and/or microfilaria infestation. Niger J Med. 2005; 14:45-50.
7. Chueca PM, Galar GM, Ardanaz MF, Zabalegui A, Muruzábal L, Muñoz A. Haemoglobin in blood donor selection. Sangre (Barc) 1995; 40:41-4.
8. Sguaitamatti A. Low haemoglobin values in blood donors. Schweiz Med Wochenschr 1975; 105:1649-53.
9. WHO/UNU/UNICEF. Iron deficiency anaemia. Assessment, prevention and control. A guide for programme managers. Geneva, World Health Organization, 2001 (WHO/NHD/01.3).
10. Hoffbrand AV, Pettit JE. Essential haematology. 3rd ed. Blackwell Science. London. 1993:437.
11. Hughes-Jones NC, Wickramasinghe SN. Lecture notes on Haematology. 6th ed. Blackwell Sciences. London. 1996:277.
12. Lewis SM, Bain BJ, Bates I. Dacie and Lewis Practical Haematology. 9th Ed. Harcourt Publishers Limited. London. 2001:12.
13. Kibaya RS, Bautista CT, Sawe FK, Shaffer DN, Sateren WB, Scott PT, et al. Reference Ranges for the Clinical Laboratory Derived from a Rural Population in Kericho, Kenya. PLoS ONE 2008; 3(10): e3327. doi:10.1371/journal.pone.0003327
14. Tsegaye A, Messele T, Tilahun T, Hailu E, Sahlu T, Doorly R, Fontanet AL, Rinke De Wit TF. Immunohematological reference ranges for adult Ethiopians. Clin Diagn Lab Immunol 1999; 410–4.
15. Koram KA, Addae MM, Ocran JC, Adu-Amankwah S, Rogers WO, Nkrumah FK. Population Based Reference Intervals For Common Blood Haematological And Biochemical Parameters In The Akuapem North District. Ghana Med. J. 2007; 41:160-6.
16. Badenhorst CJ, Fourie J, Steyn K, Jooste PL, Lombard CJ, Bourne L, Slazus W. The haematological profile of urban black Africans aged 15–64 years in the Cape Peninsula. East Afr Med. J 1995; 72:19–24.
17. Lugada ES, Mermin J, Kaharuza F, Ulvestad E, Were W, Langeland N, Asjo B, Malamba S, Downing R. Population-Based Hematologic and Immunologic Reference Values for a Healthy Ugandan Population. Clin Diag Lab Immunol. 2004; 11:29-34.
18. Boulton FE, Nightingale MJ, Reynolds W. Improved strategy for screening prospective blood donors for anaemia. Transfus Med. 1994; 4:221-5.
19. Chambers LA, McGuff JM. Evaluation of methods and protocols for haemoglobin screening of prospective whole blood donors. Am J Clin Pathol. 1989; 91:309-12.
20. Lewis SM, Stott GJ, Wynn KJ. An inexpensive and reliable new haemoglobin colour scale for assessing anaemia. Clin Pathol. 1998; 51:21-4.
21. Ross DG, Gilfillan AC, Houston DE, Heaton WA. Evaluation of haemoglobin screening methods in prospective blood donors. Vox Sang. 1986; 50:78-80.