HAEMOGLOBIN LEVEL AMONG THE REGULAR VOLUNTARY BLOOD DONORS
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Abstract:
Context: The need for blood is great and health of the blood donors is also the prime importance for the medical profession. The present study conducted to find out the pattern of haemoglobin level among the regular voluntary blood donor.

Methods: The present cross sectional study included 200 consecutive regular voluntary blood donors. The study conducted in the Department of Transfusion Medicine, Dhaka Medical College Hospital, Dhaka, between July 2010 and June 2011. The level of haemoglobin in donated blood was estimated by cyanmethaemoglobin method.

Results: Age of the respondents was 29.5±12.2, with a range of 18 to 56 years. Most common age group of respondents was 21 to 30 years and male and female ratio was 7.3:1. Among the male 90.3% had required haemoglobin level for blood donation and 9.7% had haemoglobin level less than required. Among the female only 37.5% had required haemoglobin level for blood donation and 62.5% had haemoglobin level less than required. Out of 118 respondents aged less than 30 years, 89.8% had required haemoglobin level for blood donation and 10.2% had haemoglobin level less than required. Out of 82 respondents aged more than 30 years, 75.6% had required haemoglobin level for blood donation and 24.4% had haemoglobin level less than required.

Conclusion: The high frequency of decreased haemoglobin level among the regular voluntary blood donors found in this study suggests a need for a more accurate laboratory trial, since hemoglobin alone is not sufficient for detecting and excluding blood donors with iron deficiency without anemia.

Key words: Haemoglobin, Cross Sectional Study, Voluntary Blood Donors.


Introduction:
Blood transfusion is an essential component of health care which saves millions of lives each year. Donation of blood, the humanitarian act has been steadily declined while the demand for transfusion continues to rise¹,². Recruitment and retention of donors to sustain and increase the donor base are critical for blood banks³. Blood transfusion service is an integral and indispensable part of the healthcare system. The priority objective is to ensure safety, adequacy, accessibility and efficiency of blood supply at all levels⁴.

Anaemia is a condition characterized by a reduction in red cell mass and a decrease in the concentration of haemoglobin in the blood⁵. A large majority of the donor population in a developing country is deferred due to temporary
but easily correctable cause, anaemia\textsuperscript{5}. Hemoglobin assessment is an important
criterion for blood donor selection\textsuperscript{7}. In Canada and
the United States, the minimum values
for donors haemoglobin concentration is set at
12.5 g/dl for all blood donors\textsuperscript{8}, while in European
countries the cut-off level is 12.5 g/dl for
women and 13.5 g/dl for men\textsuperscript{9}. In 1999, FDA
finalized the current rule establishing a
minimum hemoglobin requirement of 12.5g/
dL or hematocrit of 38\% for both male and
female allogeneic donors. This rule also
established an inter donation interval of eight
weeks which is done to ensure both donor
safety and appropriate hemoglobin content in
the donated unit\textsuperscript{7-11}. A recent report by Karp
and King\textsuperscript{12} showed the variation in eligibility
criteria for volunteer whole blood donors.
Bangladesh Government has passed “Safe Blood
Transfusion Law 2002” in the Parliament and
in June’08 “Safe Blood Transfusion Rules
2008”, was published\textsuperscript{4}. In Bangladesh the
minimum values of haemoglobin
concentration for donors is set at 12.5 g/dl for
men and 11.5 g/dl for women\textsuperscript{13}.
Iron deficiency is the commonest cause of
anemia worldwide\textsuperscript{6,14}. Iron has a central role
in erythropoiesis and is also involved in many
other intracellular processes in all the tissues
of the body\textsuperscript{15}. A study from the United States
suggested that up to 8.0\% and 23.0\% of male
and female donors respectively may be iron
deficient\textsuperscript{14}. A healthy blood donor loses about
200-250 mg of iron per unit of blood donated\textsuperscript{7-}
14. The body compensates for this loss by
mobilizing iron stores in the form of ferritin\textsuperscript{14-}
16. If the lost iron stores in these donors are
not replenished and they continue to donate
blood, it results in iron deficiency anaemia and
deferral of these donors in the future and a
considerable number of regular donors who at
present are the best source of safe blood will be
lost\textsuperscript{16-18}. In fact, iron deficiency anaemia is the
main limiting factor in regular donors\textsuperscript{18-19}. To
the best of our knowledge no systematic study
has been conducted in Bangladesh to assess
the pattern of haemoglobin level in regular
voluntary blood donors. The present study was
conducted to find out the pattern of
haemoglobin level among the regular voluntary
blood donors in our population.

Methods:
The study was conducted in the Department of
Transfusion Medicine, Dhaka Medical College
Hospital, Dhaka, between July 2010 and June
2011. Total 200 consecutive regular voluntary
blood donors were included in the study.
Relevant history, clinical examination and
sociodemographic data were collected from
every respondent. The level of haemoglobin in
donated blood was estimated by
cyanmethaemoglobin method. Cut-off value of
haemoglobin of 12.5 g/dl for male and 11.5 g/
dl for female is used as described by Bangladesh
Gazette, (2008)\textsuperscript{13}. All data were analyzed by
standard statistical software version 16.0
(SPSS, Chicago, IL, USA). The chi-square test
was used for analysis of categorical data. A p
value <0.05 was considered significant.

Results:
The mean age of the respondents was
29.5\pm12.2 years, with a range of 18 to 56 years.
Most common age group of respondents was
21 to 30 years followed by 31 to 40 years.
Among the respondents 176 (88\%) were male
and 24 (12\%) were female. Male to female
ration was 7.3:1. In education highest number
were in the level of higher secondary followed
by graduate and above. In occupation 98 (49\%)
were student, 46 (23\%) were service holder,
23 (11.5\%) were businessman and rest 33
(16.5\%) were unemployed. ABO blood grouping
of 96 (48.0\%) was ‘O’, 48 (24\%) was ‘B’, 40 (20\%)
was ‘A’ and rest 16 (8\%) was ‘AB’ blood group.
Rh positive and Rh negative were 184 (92\%)
and 16 (8\%) respectively. Among the male, 159
(90.3\%) had haemoglobin level e12.5 gm/dl
and 17 (9.7\%) had haemoglobin level <12.5 gm/
dl and among the female 9 (37.5\%) had
haemoglobin level >11.5 gm/dl and 15 (62.5\%)
had haemoglobin level <11.5 gm/dl. Out of
118 respondents aged less than 30 years, 106
(89.8\%) had required haemoglobin level for
blood donation and 12(10.2\%) had haemoglobin
level less than required. Out of 82 respondents
aged more than 30 years, 62 (75.6\%) had
required haemoglobin level for blood donation
and 20 (24.4\%) had haemoglobin level less than
required.
**Table-I**

*Distribution of characteristics of the respondents*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>23</td>
<td>11.5</td>
</tr>
<tr>
<td>21-30</td>
<td>95</td>
<td>47.5</td>
</tr>
<tr>
<td>31-40</td>
<td>65</td>
<td>32.5</td>
</tr>
<tr>
<td>41-50</td>
<td>12</td>
<td>06.0</td>
</tr>
<tr>
<td>&gt;50</td>
<td>05</td>
<td>02.5</td>
</tr>
<tr>
<td>Mean ±SD (Range)</td>
<td>29.5±12.2 (18-56)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>176</td>
<td>88.0</td>
</tr>
<tr>
<td>Female</td>
<td>24</td>
<td>12.0</td>
</tr>
<tr>
<td>Male Female ratio</td>
<td>7.3:1</td>
<td></td>
</tr>
<tr>
<td>Educational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>08</td>
<td>04.0</td>
</tr>
<tr>
<td>Primary</td>
<td>12</td>
<td>06.0</td>
</tr>
<tr>
<td>Secondary</td>
<td>36</td>
<td>18.0</td>
</tr>
<tr>
<td>Higher secondary</td>
<td>92</td>
<td>46.0</td>
</tr>
<tr>
<td>Graduate and above</td>
<td>52</td>
<td>26.0</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>98</td>
<td>49.0</td>
</tr>
<tr>
<td>Service</td>
<td>46</td>
<td>23.0</td>
</tr>
<tr>
<td>Business</td>
<td>23</td>
<td>11.5</td>
</tr>
<tr>
<td>Unemployed</td>
<td>33</td>
<td>16.5</td>
</tr>
</tbody>
</table>

**Table-II**

*Distribution of ABO blood grouping and Rh typing*

<table>
<thead>
<tr>
<th>ABO grouping</th>
<th>Rh typing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rh positive</td>
<td></td>
</tr>
<tr>
<td>Rh negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>92</td>
<td>96(48.0)</td>
</tr>
<tr>
<td>B</td>
<td>41</td>
<td>48(24.0)</td>
</tr>
<tr>
<td>A</td>
<td>36</td>
<td>40(20.0)</td>
</tr>
<tr>
<td>AB</td>
<td>15</td>
<td>16(08.0)</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>200(100.0)</td>
</tr>
</tbody>
</table>

**Table-III**

*Distribution of haemoglobin level according to cutoff value required for blood donation of the respondents*

<table>
<thead>
<tr>
<th>Haemoglobin level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;12.5 gm/dl for male &amp;</td>
<td>168</td>
<td>84.0</td>
</tr>
<tr>
<td>&gt;11.5 gm/dl for female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12.5 gm/dl for male &amp;</td>
<td>032</td>
<td>16.0</td>
</tr>
<tr>
<td>&lt;11.5 gm/dl for female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Table-IV**

*Relationship of haemoglobin level with sex*

<table>
<thead>
<tr>
<th>Haemoglobin level</th>
<th>Sex</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>&gt;12.5 gm/dl for male &amp;</td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>&gt;11.5 gm/dl for female</td>
<td>159(90.3)</td>
<td>09(37.5)</td>
</tr>
<tr>
<td>&lt;12.5 gm/dl for male &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;11.5 gm/dl for female</td>
<td>017(09.7)</td>
<td>15(62.5)</td>
</tr>
<tr>
<td>Total</td>
<td>176(100.0)</td>
<td>24(100.0)</td>
</tr>
</tbody>
</table>

*Chi-square test was done to measure the level of significance.
*Figure within parentheses indicates in column percentage.

**Table-V**

*Relationship of haemoglobin level with age*

<table>
<thead>
<tr>
<th>Haemoglobin level</th>
<th>Age group</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;30</td>
<td>&gt;30</td>
</tr>
<tr>
<td>ed 12.5 gm/dl for male &amp;</td>
<td>106(89.8)</td>
<td>62(75.6)</td>
</tr>
<tr>
<td>ed 11.5 gm/dl for female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12.5 gm/dl for male &amp;</td>
<td>012(10.2)</td>
<td>20(24.4)</td>
</tr>
<tr>
<td>&lt;11.5 gm/dl for female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118(100.0)</td>
<td>82(100.0)</td>
</tr>
</tbody>
</table>

*Chi-square test was done to measure the level of significance.
*Figure within parentheses indicates in column percentage.

**Discussion:**

The present cross sectional study was conducted to find out the pattern of haemoglobin among the regular voluntary blood donors. In the present study the most common age group of respondents was 21 to 30 years followed by 31 to 40 years and the mean age of the respondents was 29.5±12.2 years. Agnihotri et al.\(^20\) in a study showed that the majority (57.7%) of the donors presenting for the donation were between 25 and 39 years of age. Olokoba et al.\(^21\) in a study found the age range of blood donors was 18 to 61 years with a mean of 31.3 years. This is similar to that in the study of Khan et al.\(^22\) and Muktar et al.\(^23\). However the study conducted by Egah et al.\(^24\) showed the age range 21 to 50 years. Kimani et al.\(^25\)
in a study showed that the majority of voluntary donors were less than 25 years old. Ray et al.\textsuperscript{1} in their study showed that 48% donors belonged to the age group 16-25 years with a range of 19 to 53 years. Studies by Sullivan et al.\textsuperscript{26} and Kandle et al.\textsuperscript{27} showed that the most of the voluntary blood donors belong to the younger age group.

In the study 176 (88.0%) were male and 24 (12.0%) were female. Male to female ration was 7.3:1. Studies by Oloko\textsuperscript{21} and Egh\textsuperscript{24} showed that male blood donors were 96.0% and 95.0% respectively. Muktar et al.\textsuperscript{23} found 98.0% of their donors were male while Nwokediuko et al.\textsuperscript{28} found that 91.8% donors were male. However, all the donors were male in the studies of Elfaki et al.\textsuperscript{29} and Khan et al.\textsuperscript{22}. In a study Agnihotri\textsuperscript{20} showed that of the total donors who presented for blood donation 10% were female, however majority of them were deferred so that they contributed only 5.2% of selected donors. Ray et al.\textsuperscript{1} in a study of 300 voluntary donors showed that 89.3% were males and 10.7% females.

In education highest number was in the level of higher secondary followed by graduate and above. In occupation 98 (49.0%) were student, 46 (23/-%) were service holder, 23 (11.5%) were businessman and rest 33 (16.5%) were unemployed (Table 1). Gao et al.\textsuperscript{30} in a study reported that the occupation of blood donors was widely distributed.

Among the male donors 90.3% had haemoglobin level e" 12.5 gm/dl and among the female only 37.5 had haemoglobin level e" 11.5 gm/dl that required for blood donation according to Save Blood Transfusion Rules\textsuperscript{13}. There is statistically significant difference observed in haemoglobin level between male and female donor (p<0.05). Rushton et al.\textsuperscript{31} found that of all the primates, only in humans do females have lower blood haemoglobin concentrations than males. Mahida et al.\textsuperscript{32} in a study showed that, 9.5% male and 26.7% female regular voluntary blood donors developed anaemia, defined as Hb below 12.5 g/dl. Sunder and Vivekanand\textsuperscript{33} conducted a study in Bangalore, South India and reported the incidence of anaemia as 2.4% in male and 19.7% in female donors. All the female participants of the present study were in pre-menopausal age group; hence, they may have developed anaemia. Significant correlation between the number of donations and hemoglobin level (r\textsuperscript{2} = 0.061) was noted in a study by Norashikin et al.\textsuperscript{14}. Alvarez-Ossorio et al.\textsuperscript{19} reported that 30% and 26% of women regular blood donors had respectively iron deficiency and iron deficiency anaemia. Among the respondents aged less than 30 years, 89.8% had haemoglobin level required for blood donation and 10.2% had less haemoglobin level than required. In the present it was found that haemoglobin level less than required for blood donation more prevalent among the donor aged more than 30 years. Among the respondents aged more than 30 years, 75.6% had haemoglobin level required for blood donation and 24.4% had haemoglobin level less than required for blood donation. There is statistically significant difference observed in haemoglobin level between age group more and less than 30 years (p<0.05).

Blood centers should establish expanded donor health screening programs in improving donor health, donor recruitment, and donor retention\textsuperscript{34}. Taken together, a declining donation rate and an increase in the consumption of blood components require novel approaches on both sides of the blood supply chain\textsuperscript{35}.

**Conclusion:**

The high frequency of decreased haemoglobin level among the regular voluntary blood donors suggests a need for a more accurate laboratory trial. Predicted haemoglobin levels for blood donation may be normal in the presence of reduced iron stores, individuals potentially at risk for developing iron deficiency anaemia can be detected only by serum ferritin estimation. Therefore iron status of the donors needs to be identified and necessary steps for iron supplementation need to be taken, which is especially relevant with the global and national drive to recruit and retain regular repeat voluntary blood donors.
References:


17. Simon TL. Iron, iron everywhere but not enough to date. Transfusion 2002; 42: 664-5.


