

# Haemoglobin Level of Apparently Healthy Children

MA WAHED<sup>a</sup>, MH RAHMAN<sup>b</sup>

## Summary :

*A prospective and cross-sectional study was conducted in the department of Paediatrics of Rangpur Medical College Hospital to estimate the level of Haemoglobin (Hb) in the healthy and well nourished children. The total number of samples was 1500 with male : female ratio 1:1. Samples were collected from newborn babies to children upto 14 years of age from Children Out-Patient Department (COPD) and from a Baby Friendly Clinic of Rangpur Town. Haemoglobin level was estimated from all*

*the children by Methhaemoglobin method. Possible causes of anaemia were excluded from all the samples. Mean Hb level of both sexes was 10.03±1.16 gm/dl, with 10.41±1.09gm/dl in the male children and 10.17 ± 1.23 gm/dl in the females. Mean values were compared with the 50th centile of percentile (NCHS) charts of both sexes. The mean value of Bangladeshi children was lower than that of the developed countries.*

*(J Bangladesh Coll Phys Surg 2004; 22 : 12-15)*

## Introduction :

Haemoglobin is a complex protein consisting of iron containing haem and the protein moiety globin. In children the haemoglobin level is 23gm/dl at birth, falling to 10.5gm/dl at the end of the third month. The concentration then gradually rises to reach 12gm/dl at one year. In adult male, the mean blood haemoglobin level is 15.5gm/dl; the range is 14-18 gm/dl. In adult female, the mean haemoglobin concentration is 14.0 gm/dl with a range of 12-15.5gm/dl<sup>1,2,3</sup>. These are the findings from the studies carried out in developed countries. These values may differ in a country like Bangladesh due to racial, genetic and dietary variations. Amino acids, iron, copper, manganese, cobalt, nitrogen, vit-B12 and folic acid, which are necessary for haemoglobin synthesis, may have different bio-availability. Thyroxin, pituitary and adrenal hormones, and erythropoietin which are also necessary for haemoglobin synthesis, may vary in bio-activity<sup>4,5</sup>.

Iron deficiency anaemia is a common problem of children of Bangladesh. Seventy three percent of children and women suffer from iron deficiency anaemia<sup>6,7</sup>. It causes difficulty in maintaining attention and poor school performance, lowering IQ by about 9 points<sup>8,9</sup>. Few studies have been done on this subject, which are mainly related to iron metabolism and iron deficiency anaemia. Only one nation wide survey was carried out about 20 years

back<sup>6,7,8</sup>. The present situation is not known. So this study was designed to know the present status of Hb level and rate of anaemia among the children of this country.

## Materials and method :

A cross-sectional study was done to estimate the level of haemoglobin in healthy children. The objective of the study was to know the normal haemoglobin level of healthy children of Bangladesh and to compare this level with that of developed countries. The study was conducted in the department of Paediatrics of Rangpur Medical College Hospital (RMCH) for a period of two years from first July 1998 to 30th June 2000. Samples were collected from two places - a Baby Friendly Private Clinic in Rangpur town and the Children Out-Patient Department (COPD) of RMCH. Children from birth to 14 years of age were the study population. Children from birth to seven days of age were selected from the clinic. These babies were born in the clinic and had a birth weight of >2.5 kg. The mothers of these babies were healthy and had no intra-partum complication and Hb level was more than 60% during pregnancy. Children from the second week of age up to 14 years were selected from the COPD. These children first attended at COPD for treatment of different diseases. They were then asked to attend the COPD during their disease-free period for study purpose.

In the clinic, cord blood was collected from the babies delivered by LUCS and from heel prick from the babies delivered vaginally. In COPD, the samples

a. Dr. MA Wahed, FCPS, Assistant Professor (Paed.), Rangpur Medical College

b. Dr. Md. Hamidur Rahman, FCPS, Professor of Paediatrics, Rangpur Medical College

**Address of correspondence :** Dr M. A. Wahed, Assitt. Professor (Pead.), Rangpur Medical College

were weighed along with physical examination. Children having body weight of >80% of the expected weight in NCHS weight chart were considered. In these samples blood was collected from finger prick. In all cases haemoglobin was estimated by Cynmethhaemoglobin method from two selected private laboratories. Haemoglobin level of 16.0 gm/dl of blood was regarded as 100.0% and <11 gm/dl as anaemia. In children having mild splenomegally, blood film and reticulocyte count was done to exclude haemolytic anaemia. Routine examination of stool was done in children having history of taking anti-helminthic drugs more than four months back. Children having haemolytic anaemia, helminthiasis, giardiasis, any chronic systemic disease, chromosomal disease, rickets or gross bony abnormality and convalescent period of a disease were excluded from the study. Children having no biological mother and taking iron supplements were also excluded from the study. At first the children were divided into 15 groups. Newborn infants in one group and from one year to 14 years another 14 groups. In each group, there were 100 children, 50 male and 50 female. In this way, 1500 samples (750 male, 750 female) were selected for analysis. Finally the children were grouped into five groups for ease of analysis. In each case, consent from parents was taken to avoid any ethical obligation.

Before data collection, an "Interview schedule" was prepared to use as research instrument. Variables used were age, sex, religion, address, weight, splenomegally and Hb%. After data collection, each interview schedule was checked for consistency. Then the data were entered into a computer for analysis. Hb level was arranged according to age groups from birth to 14 years of age. Results were presented as tables. A frequency distribution curve was also constructed.

### Results :

The total number of children was 1500 among which 750 (50%) male and 750 (50%) female. In newborn babies, the average level of Hb was highest and in infancy it was lowest (Table I). In both the sexes, about 80% of children were anaemic (Table II). In all age groups, the level of Hb was lower in females (Fig. 1). The level of Hb was lower in

Bangladeshi children compared to NCHS standard (Fig. 2 and 3).

**Table I**

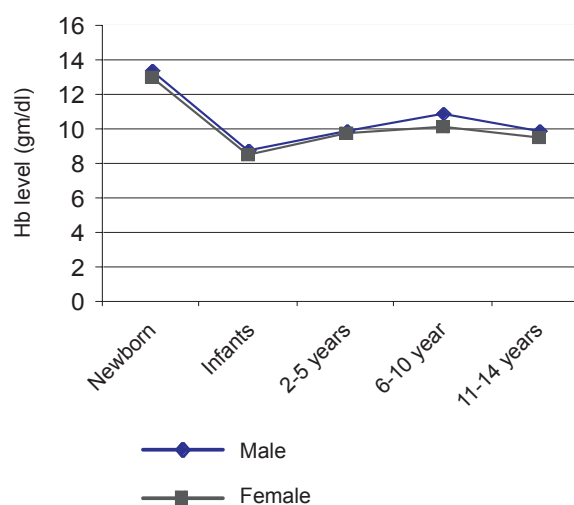
*Haemoglobin level in different age groups of studied children*

Age	Number		Mean Hb level (gm/dl)	
	Male	Female	Male	Female
Newborn	50	50	13.35	13.03
Infants	50	50	08.77	08.55
2-5 years	200	200	09.84	09.69
6-10 years	250	250	10.90	10.14
11-14 years	200	200	09.93	09.44
Total	750	750	10.41	10.17

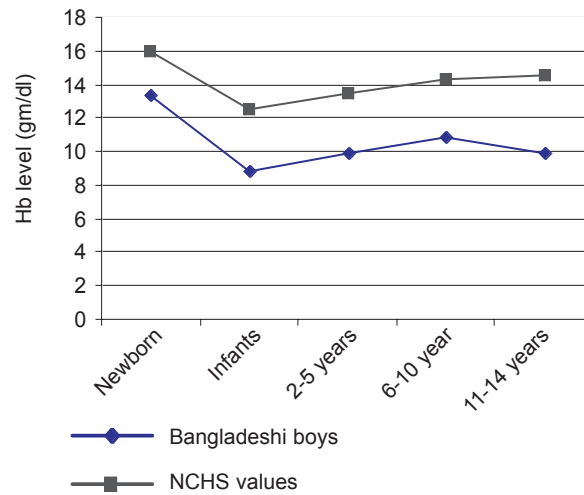
**Table II**

*Rate of anaemia (Hb < 11 gm/dl) among studied children*

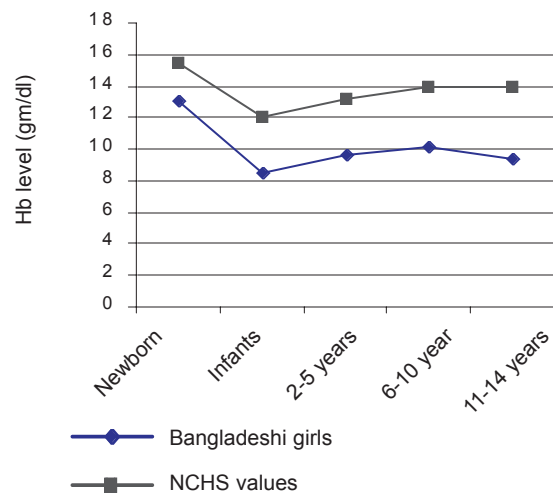
Sex	No of children	No of anaemic children (%)
Male	750	600 (80.00)
Female	750	604 (80.50)
Total	1500	1204 (80.25)



**Fig.-1 : Haemoglobin level according to sex**



**Fig.-2 :** Haemoglobin level of boys compared with NCHS median



**Fig.-3 :** Haemoglobin level of girls compared with NCHS median

### Discussion :

The study was carried out to estimate the level of Hb in healthy children of Bangladesh. Children up to 14 years of age were included in the study for ease of collection of samples as the Hospital Authority of RMCH regards 15 years as paediatric age instead of 12 years in other hospitals. In each age group, 50 children were included from both sexes to increase the number of samples and to decrease the variation or error. The average Hb level was  $10.03 \pm 1.16$  gm/dl in both sexes,  $10.41 \pm 1.09$  gm/dl in boys and  $10.17 \pm 1.23$

gm/dl in girls. The average level of Hb in both sexes is lower in this study than the figures shown in percentile charts. This may be the average level of Hb of Bangladeshi children. A study conducted in Dhaka city<sup>10</sup> showed Hb level of better nourished children as 9.6 gm/dl (60%) which is consistent with the present study. It may also be due to iron deficiency as low Hb level and iron deficiency has been a perennial problem in children age group and it is the most common single nutrient deficiency in the world<sup>8,10,11</sup>. There are some studies and surveys on healthy and hospitalized infants and toddlers in France<sup>12</sup>, Spain<sup>13</sup>, and United Kingdom<sup>14,15</sup> which have shown low Hb level in this age group. But as the children were healthy and non-hospitalized, this is not applicable on these children. The slightly higher level of Hb in boys, but this is not significant in statistical analysis. This may be due to improved nutritional status in girls as there is little difference in nutritional status between boys and girls due to gradual decline in intra-familial food discrimination between sexes<sup>16</sup>.

The result shows that the average level of Hb is lower in both sexes than that of percentile chart from birth throughout childhood. The lower level in newborn babies may be due to maternal malnutrition as 74% of non-pregnant and 47% of pregnant mothers have low Hb level in Bangladesh<sup>6</sup> and though the pregnant mothers in this study had Hb level above 60% during pregnancy, they were still mildly anaemic. Low Hb level in infancy and childhood may be due either to rapid growth or low content of iron in the foods of Bangladesh. Because infants have a high iron requirement for growth but frequently consume iron intakes below dietary recommended levels<sup>17</sup>. The combination of larger body size and rapid growth creates an increased demand upon dietary iron to fulfill the needs for haemoglobin synthesis and tissue growth<sup>18</sup>. During infancy, mother's milk or formula milk is usually the major part of the diet and frequently there is delayed or improper weaning. Both human milk and cow's milk provide relatively small quantities of iron (0.2-0.4 mg/l). Though the bioavailability of iron from human milk is considerably higher than cow's milk, it cannot maintain adequate iron level beyond six months of age<sup>19</sup>.

Dietary intake of iron during childhood is often low or marginal in most developing countries. Cereals and legumes, which are the most common staple foods, only provide modest amount of iron. In addition, iron bioavailability from cereals and legumes is low due to

the presence of phytates which inhibits iron absorption<sup>20</sup>. Meat which is a good source of iron with high bioavailability is rarely consumed or a minor part of the diet. Ascorbic acid provided by the fruits or vegetables can also has a pronounced positive effect on iron absorption, but it is taken in very small quantities by the children in developing countries<sup>21</sup>. Similar dietary patterns responsible for inadequate iron intake in developing countries has been described among toddlers aged 18-30 month living in villages in Egypt, Kenya and Mexico, the proportion judged to consume less than basal iron requirement was 35%, 13% and 43% respectively<sup>22</sup>. The cut-off point for anaemia by the World Health Organization (WHO) is 11 gm (69%) for the children from 6 months to 14 years<sup>23</sup>. According to this value, around 80% of the children in this study are anaemic. The survey conducted in this country<sup>6</sup> has shown that 73% of children are anaemic. The higher level in this study may be due to the fact that micronutrient deficiency has been worse in this country over the years though nutritional status as a whole has improved over the past few years<sup>24,25</sup>.

### Conclusion :

There are several limitations of the study. Serum iron level, serum ferritin level and malarial parasite could not be investigated due to lack of facilities. In spite of these limitations, this study shows the trend of Hb level in Bangladeshi children. Further study is needed to establish this finding.

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