



## Original Article

# Estimation of Hemoglobin Level Among the Population of Rajshahi City in Bangladesh

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### Abstract

This study aimed at investigating the hemoglobin level among males and females in Rajshahi City in Bangladesh. The survey was conducted in a perceived healthy population in April 2007. Two hundreds and sixty five males and five hundreds and seventy non-pregnant females aged 10-65 years were purposively selected. Information was obtained on haemoglobin concentration and household socioeconomic status. About 69% of males and 70% of females were found to be anaemic according to WHO anaemia criteria. There was no difference in anaemia prevalence between males and females ( $p>0.05$ ). Literacy and perceived economic status were associated with anaemia prevalence among females, but not among males. The study suggests that anaemia is highly prevalent in Rajshahi City in Bangladesh which affects both males and females equally. Further studies should be undertaken to confirm the findings and also to examine the causes of anaemia both in males and females in the Rajshahi City of the country to undertake necessary preventive and control measures.

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### Introduction

Anemia is one of the major public health problems in many developing countries<sup>1-3</sup>. According to World Health Organization (WHO), about 700 million individuals around the world were suffering from anaemia of which a major proportion was from South Asia<sup>2</sup>. Many studies have reported higher prevalence of anaemia in females than in males<sup>3-5,8</sup>. The anaemia prevalence, particularly in pregnant women of developing countries, was estimated to be as high as 55-60%<sup>4</sup>. According to the Bangladesh National Nutrition Survey of 1981-82, about 74% of the adult women, 80% of the pregnant women, 73% of the under-five children, and 40% of the adult men were suffering from anaemia<sup>6</sup>.

The most important factors known to be associated with anaemia in a community include low socioeconomic status, poor diet, infections and infestations as a result of widespread poverty<sup>7-15</sup>. However, there are variations in these factors in relation to the prevalence and severity of anaemia in different parts of the world and even within countries<sup>16-20</sup>. In the United States, the highest anaemia prevalence was observed in infants aged 1-2 years, girls 15-17 years, young women and elderly men, and on the other hand, the lowest prevalence was in children aged 6-8 years and in males aged 12-44 years<sup>21</sup>.

Apart from the results of the 1981-82 National Nutrition Survey, a few reports were available on anaemia prevalence in the rural Bangladesh. Some

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reports based on hospital or clinical studies are available which do not necessarily show the true anaemia situation of the typical rural communities<sup>22-24</sup>. Community-based data on anaemia prevalence among both males and females are not available in the country.

## Material and Methods

### Subjects

The survey was conducted in April 2007 in Rajshahi city. The individuals who were available during the home visits, reported to be healthy and were willing to participate in the study were included in the sample. Thus, 265 males and 570 non-pregnant females aged 10-65 years were included in the sample. None of the selected individuals refused to participate in the study and all of them were found co-operative.

### Methods

A collaboration was made with the BPI Hospital (Government registered), Shipi para, Rajshahi; Badhon (Student Voluntary Organization) and Quantum foundation (Voluntary Organization) in Rajshahi City.

Two co-researcher supervised the sample collection at the clinic and as well as in the field level and researcher, himself to perform laboratory tests to ensure quality control.

A team of trained interviewers collected the data using a structured pre-tested questionnaire. Each individual was asked about his/her perception on the last one year's household economic status. A household was characterised as being 'deficit' if the last year's household earnings (cash and kind) were less than the total expenditure. On the other hand, a household was characterised as being 'non-deficit' if the earnings were equal to or more than the expenditure.

The individuals who could not sign were categorised as 'illiterate', who had non-formal or formal education from class 1 to 5 were categorised as 'non-formal and primary' and the individuals with formal education more than class 5 were categorized as 'above primary'.

Trained laboratory technicians collected the blood samples by finger pricking through home visits.

From each subject, 20 micro-litre of blood was collected through a haemoglobin pipette and was preserved in a vial containing 5 ml of haemoglobin reagent which had been prepared and bottled in the previous night. At the end of each day, all samples were brought to the laboratory of the BPI Hospital, Shipi para, Rajshahi.

Hemoglobin was measured by the cyanmethemoglobin method using a Chemistry Analyzer (25). The haemoglobin concentration of 189 subjects, in addition to Chemistry Analyzer, was estimated using a HemoCue Photometer<sup>26,27</sup> to cross-check the validity of the results using blood from the same finger pricks.

Hemoglobin levels used in this report to define anaemia were those suggested by WHO: <120 g/L for adult non-pregnant women aged 18-60 years and adolescent boys and girls aged 11-14 years and <130 g/L for adult men aged 18-60 years (3). Bi-variate tables were generated from the compiled data to examine the anaemia prevalence between males and females and also to explore the relation of different variables to the anaemia prevalence. Statistical significance was tested by Chi-square test and p values less than 0.05 was considered significant. The pooled analysis of males and females Mantel-Haenszel Chi-square and two-tailed p values were calculated, adjusting for sex. Differences between means were assessed by F-test.

## Results

The general characteristics of the study population by sex are given in Table 1.

**Table 1.** Number of study subjects by sex and other characteristics.

Characteristics	Males (n=265)	Females (n=570)	All (N=835)
<b>Age (year)</b>			
10-17	122	173	295
18-60	63	270	333
61-65	80	127	207
<b>Education level</b>			
Illiterate	65	243	308
Primary & non-formal	67	195	262
Above primary	133	132	265
<b>Perceived household economic status</b>			
Deficit	127	280	407
Non-deficit	138	290	428

Figure 1 shows the mean haemoglobin concentration differences measured on the same subjects by two different techniques, i.e., Chemistry Analyser and HemoCue Photometer in relation to the different interval of haemoglobin values. The differences were calculated by subtracting the each Hemo Cue value from the corresponding Chemistry Analyser value.

**Figure 1.** Cumulative percents of haemoglobin concentration estimated by HemoCue and Chemistry Analyzer.

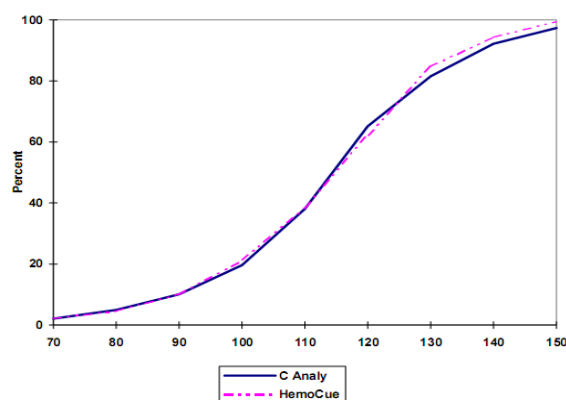


Figure 1 shows that HemoCue Photometer overestimated the haemoglobin concentration for the subjects with lower haemoglobin levels and underestimated for the subjects with higher haemoglobin levels compared to Chemistry Analyser. However, haemoglobin concentration values estimated by the two methods showed a very high correlation.

**Table 2.** Distribution of haemoglobin values according to different cut-off points by sex.

Sex	Sample size	Blood haemoglobin (g/L)		
		<90 (%)	<120 (%)	<130 (%)
All	835	8	64	81
Males	265	6	51	74
Females	570	10	70	84

Distribution of haemoglobin concentration values according to different cut-off levels are shown in Table 2. About 8%, 64% and 81% of the total subjects had haemoglobin concentration <90 g/L, <120 g/L and <130 g/L respectively.

#### Age and gender

Table 3 shows mean haemoglobin concentration and anaemia prevalence by age and gender. There

was no overall gender difference in anaemia prevalence among males and females. A higher trend in mean haemoglobin concentration was observed among males aged 20 years and above than the females of the similar age group. Age did not show any association to anaemia prevalence among males ( $p=0.55$ ) and females ( $p=0.14$ ). However, means of haemoglobin concentration of females seemed to be positively associated to increased age ( $p=0.04$ ) (Table 3).

**Table 3.** Mean blood haemoglobin level and anaemia prevalence by age and sex.

Age group	Mean $\pm$ sd (g/L)		Anaemia prevalence (%)	
	Males	Females	Males	Females
All	118 $\pm$ 17	112 $\pm$ 18	69	70
10-17	115 $\pm$ 16	116 $\pm$ 17	69	61
18-60	120 $\pm$ 17	111 $\pm$ 17	76	72
61-65	120 $\pm$ 18	108 $\pm$ 18	62	76

#### Economic status

A higher proportion of females in the economically deficit households were anemic than the non-deficit households ( $p=0.03$ ). The perceived SES did not show any association with the anaemia prevalence in males ( $p=0.68$ ) (Table 4).

**Table 4.** Anaemia prevalence by respondent's perceived household economic status and gender.

Perceived household economic status	Anemia prevalence (%)	
	Males	Females
Economically deficit	65	79
Economically non-deficit	73	61

#### Level of education

Anaemia prevalence in males and females was not significantly different by literacy level (Table 5) (Females:  $p=0.35$ , males:  $p=0.10$ ).

**Table 5.** Anaemia prevalence by respondent's level of education and sex.

Education level	Anemia prevalence (%)	
	Males	Females
Illiterate	59	76
Non-formal and primary	67	62
Primary and above	61	72

#### Discussion and Conclusion

This study clearly indicates that anaemia is prevalent in the Rajshahi city of Bangladesh affecting about 69% males and 70% non-pregnant

females (Table 2). The prevalence figure for adult women corresponds to the findings of the 1981-82 Bangladesh National Nutrition Survey where about 74% of the women were found to be anaemic<sup>6</sup>. However, it is surprising to notice a very high anemia prevalence in men in the present study which is at the same level as that of women. It contradicts the previous study finding where only 40% of men were found to be anaemic<sup>6</sup>.

This survey was undertaken in a typical rural population of Bangladesh. The area was selected purposively to be similar to most rural areas of the country. Since the subjects were drawn from Rajshahi City, they do not necessarily represent the whole Bangladesh population. More females compared to males were included in the study. Males in Bangladesh are still considered as the major 'bread earners' who are traditionally involved in outdoor activities like farming, marketing of agricultural products, and manual labour. Females, to a large extent, are engaged in home-based activities which in general require lesser mobility. This is perhaps a major reason why comparatively higher proportion of females compared to males was included in the study. Sick individuals, pregnant women and individuals aged lower or higher than 10-65 years were purposively excluded from the study as it aimed at investigating the anaemia prevalence in a healthy population aged 10-65 years. Furthermore, when discussing the results of the study, one should keep in mind that only one outcome measure, i.e., haemoglobin concentration, was used to assess anaemia. Thus, the present study does not provide any indication to what extent the observed anaemia was linked to nutrition or to infections, infestations or other factors.

The study was conducted in the day time and, therefore, it might be so that a small proportion of men who were present at home during that time could not go out to work because of mild sicknesses which they did not feel to report. However, all subjects were reportedly healthy and no obviously sick person was included in the survey.

A perceived poor economic situation was associated to a higher prevalence of anaemia among females, but not among males while no or limited land holding was linked to anaemia prevalence among males and females. Education was not associated to anaemia prevalence. The presence of ascaris infestation, which may be interpreted as a poverty and poor hygiene indicator, was associated to anaemia among both males and females. The finding corresponds to the National Health and Nutritional Examination Survey II (NHNESII) of the United States where the prevalence of iron deficiency was higher in women fall below the poverty level<sup>21</sup>. This was partially explained in a study of Yip and Dallman wherein they observed that the higher anaemia prevalence in individuals of lower socioeconomic group may be related to persistent inflammatory conditions and iron deficiency<sup>15</sup>.

Because of the fact that this study was done on a population limited in a smaller geographical area, it does not claim to have assessed the anaemia prevalence among men and women in Bangladesh. However, it does point the fact that anaemia is highly prevalent in the communities equally affecting males and females. However, further research is needed to explore the causes of anaemia among both males and females in Bangladesh. Further studies should also be done to explore further programmatic strategies to strengthen on-going anaemia control programmes in Bangladesh presently targeted only to pregnant women.

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