Factors Associated with Anemia in Children: A Study in A Tertiary Care Hospital, Rangamati, Bangladesh

Dr. Mohammad Abu Morshed*, Dr. Md. Abdullah Al Mamun, Dr. Farid Ahmed, Dr. Muhammed Anisur Rashid, Dr. Mohammad Nazmul Ahsan

Department of Pediatric, Rangamati Medical College, Rangamati, Bangladesh

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*Corresponding author: Dr. Mohammad Abu Morshed

Abstract

Introduction: Anemia is a substantial public health problem that happens worldwide with higher prevalence noted in children less than 3 years. Objective of the study was to explore the key factors associated with anemia of study population in rural Bangladesh. Material & Methods: This cross-sectional study was conducted in the department of pediatrics, Rangamati Medical College, Rangamati, Bangladesh during the period from January 2017 to December 2017. Results: A total 258 under-five children aged 6-59 month were enrolled in this study. Among study children 158(61.8%) had anaemia and 100(38.2%) had normal haemoglobin level. Study population was featured with mean age 30±17 month, mean haemoglobin 10.36±1.68 gm/dl and mean corpuscular volume (MCV) 75.93±9.7fL. Mother was found as main primary caregiver 241(93.4%) out of 258 study children. The nutrition and food related factors associated with anaemia. Non-exclusive breast feeding (27.9%), delayed or early weaning (34%), low or no intake of animal protein (18.6%), low or no consumption of vegetable (41.9%) and fruits (45.3%) were found as important risk factors for childhood anaemia. In terms of nutritional status, underweight (15.5%), stunted (28.7%) and wasted (11.2%) children were found as vulnerable to develop anaemia. Conclusion: A huge number of hospitalized children under 3 years were found anemic. Rising consciousness of the problem and providing health care education in this group will be the key strategies to prevent and control this huge public health problem in Bangladesh.

Keywords: Anemia, Rural Areas, Haemoglobin, Mean Corpuscular Volume (MCV), Breast Feeding.

INTRODUCTION

Anemia is one of the major public health burdens in the world particularly for young or preschool children. Nearly 50% of the world’s under-five population are suffering from anemia [1]. Evidently, anemia is association with childhood cognitive disorders, low school performance, insufficient physical growth and behavioral development and low immunity, and that in adults is reduced productivity. Because of these adverse health and economic consequences, a prevalence of anemia ≥ 40% in any population is identified as a serious public health problem [2]. Anemia is the second leading nutritional cause of disability and has adverse effect on socioeconomic development [3]. Anemia still remain as one of the major causes of mortality and morbidity in developing countries like Bangladesh where resources to determine the underlying etiology remain poor [1]. According to recent information from the South Asian region, the prevalence of anemia among children 6–35 months aged was nearly 79% in India [3] and anemia was predominant in rural Indian children [4]. The etiology of anemia among children is multi-factorial [5, 4]. Different studies claimed that anemia is significantly associated with low birth weight child, sex, age, rural residence, IYCF/weaning practice, infectious disease (malaria, tuberculosis, intestinal parasitic infestation, and HIV/AIDS), undernutrition (stunting, wasting, and underweight), poor socioeconomic status, household food insecurity, duration of lactation and poor dietary iron intake, poor maternal educational status and maternal anemia [6]. In Bangladesh, several studies in the past have indicated that among under-five children anemia is a severe public health problem. According to BDHS-2011 the national overall prevalence of anemia in Bangladesh was 51% in 2011 [7]. The Nutritional Surveillance Project (NSP) indicated that prevalence of anemia was 68% in 2004 among the under-five aged children [8]. National Micronutrient Status Survey in 2011–12 showed that anemia prevalence was 33.1% in pre-school aged children and it was 37.0% in the rural and 22.8% in the urban area and Several studies indicated that the prevalence of anemia was higher among younger children below 3 years and anemia...
reduces as age progressed [9]. In Bangladesh, 62% of children start complementary feeding delayed at 6 to 8 months of age [7]. The suboptimal Infant and Young child feeding (IYCF) practices and delayed/early weaning beginning at six months of age were leading to high level of nutritional anaemia in early childhood [9]. Iron deficiency is the most common cause of nutritional anaemia in young children [10]. Prevalence of iron deficiency anaemia in developing countries varies and Villalpando notes its prevalence is four times higher than developed countries [11]. Iron deficiency anaemia also increases risk of mortality and morbidity from infectious disease [6, 4]. To eliminate childhood nutritional anaemia particularly iron deficiency is a public-health priority and believed to be the most common cause of preventable anaemia among children in Bangladesh [5]. ICDDR, B (2013) reported that the prevalence of IDA is 7.2% or nearly one fourth of total anaemia of under-five children is even lower, indicating that iron deficiency may not be the primary cause of anaemia in Bangladeshi population now. To examine the possible role of haemoglobinopathies (Thalassemias and its trait) as a determinant of anaemia in Bangladesh was also recommended [5]. As the thalassemia’s and its trait are not curable completely, so the only way to prevent the disease through carrier detection, prenatal diagnosis and premartial awareness through genetic counseling [11, 12]. So, these needed further studies with multiple parameters including Hb electrophoresis. So far as our knowledge goes, a very few studies have shown the relative contribution of these important factors to anaemia in rural under-five children of Bangladesh [4, 1]. In this study, we have performed a comprehensive investigation of anaemia of and its determinants among the under-five aged rural children in Bangladesh.

**OBJECTIVES**

To assess the factors associated with anaemia of study population in rural Bangladesh.

**METHODOLOGY AND MATERIALS**

This cross-sectional study was conducted in the department of paediatrics, Rangamati Medical College, Rangamati, Bangladesh during the period from January 2017 To December 2017. One of the laboratory parameters of this study was Hemoglobin Electrophoresis, so first 6-month aged children were not considered as fetal Hemoglobin-F turned out time might be needed at least 6 months. Principal Investigator developed a questionnaire sheet according to achieve the objectives of the study. It contained closed questions part, anthropometry and laboratory investigation report parts. After pre-tested with 10 children and necessary modifications, the questionnaire was finalized for data collection. Principal investigator conducted all face to face interviews and data collection.

**Inclusion Criteria**

- Child aged 6-60 months
- Rural residence
- Guardians were provided written consent

**Exclusion Criteria**

- Children resided at municipalities and City Corporation
- Children who need emergency care and hospitalization or had any acute severe illness
- Child had history of blood transfusion within the last three months
- Refuse to enroll or provide blood sample in the study by guardian or by the children

**RESULTS**

A total 258 under-five children aged 6-59 month were enrolled in this study. Figure I: Among study children 158(61.8%) had anaemia and 100(38.2%) had normal hemoglobin level. Study population was featured with mean age 30±17 month, mean hemoglobin 10.36±1.68 gm/dl and mean corpuscular volume (MCV) 75.93±9.7fL. Mother was found as main primary caregiver 241(93.4%) out of 258 study children. Table-1 shows the nutrition and food related factors associated with anaemia. Non-exclusive breast feeding (27.9%), delayed or early weaning (34%), low or no intake of animal protein (18.6%), low or no consumption of vegetable (41.9%) and fruits (45.3%) were found as important risk factors for childhood anaemia. In terms of nutritional status, underweight (15.5%), stunted (28.7%) and wasted (11.2%) children were found as vulnerable to develop anaemia. Table-2 shows health related factors of study population and their relation with anaemia. Chronic and recent illnesses of under-five children were found as significant contributor to develop anemia. There was no significant difference observed between anaemia prevalence of children of consanguineous (53.65%) and non-consanguineous (62.56%) parents. All study children were found EPI (Expanded Programme on Immunization) vaccinated appropriate for their age or fully vaccinated. Other health related factors were shown in Table. Table-3 summarizes factors associated with anaemia by logistic regression. Three socio-demographic factors, five food & nutrition related factors and one health related factor are found as statistically significant association with childhood anaemia. These were 6-24-month aged children, primary enrollment or below level of mother’s education, monthly family income 10000 BDT or below, early or late weaning, low consumption of animal protein and vegetable, stunting (chronic malnutrition), wasting (acute malnutrition) and children who had chronic or recent infection.
Fig-1: Shows the overall prevalence of Anaemia in rural study children (n=258)

Fig-2: Shows percent prevalence of Anaemia with Gender (n=258)

Fig-3: Shows percent prevalence of Anaemia with Age (n=258)
## Table-1: Nutrition and food related factors among the study population. (n=258)

| Variables                        | Study population (% (N = 258) | Anaemia in sub-category (n=158) | Percentage prevalence of anaemia | Chi square & p value |
|----------------------------------|-------------------------------|---------------------------------|----------------------------------|----------------------|
| Exclusive Breast feeding         |                               |                                 |                                  |                      |
| Yes                              | 186 (72.1%)                   | 106                             | 56.99%                           | $\pi^2=5.074$, df 1  |
|                                  | 72 (27.9%)                    | 52                              | 72.22%                           | $p=0.024$            |
| No                               | 169 (65.5%)                   | 89                              | 52.66%                           | $\pi^2=18.186$, df 1 |
|                                  | 89 (34.5%)                    | 69                              | 77.52%                           | $p=0.000$            |
| Timely weaning or IYCF           |                               |                                 |                                  |                      |
| Yes                              | 210 (81.4%)                   | 113                             | 53.80%                           | $\pi^2=26.257$, df 1 |
|                                  | 48 (18.6%)                    | 45                              | 93.75%                           |                      |
| No                               | 165 (64%)                     | 108                             | 53.76%                           | $\pi^2=3.425$, df 1 |
|                                  | 117 (45.3%)                   | 88                              | 65.45%                           | $p=0.064$            |
| Animal protein intake            |                               |                                 |                                  |                      |
| Yes                              | 93 (36%)                      | 50                              | 53.65%                           | $\pi^2=17.610$, df 1 |
|                                  | 156 (64%)                     | 108                             | 62.56%                           | $p=0.000$            |
| No                               | 141 (54.7%)                   | 70                              | 49.65%                           |                      |
|                                  | 117 (45.3%)                   | 88                              | 75.21%                           |                      |
| Plant protein (Pulses) intake    |                               |                                 |                                  |                      |
| Yes                              | 150 (58.1%)                   | 77                              | 51.33%                           | $\pi^2=14.817$, df 1 |
|                                  | 108 (41.9%)                   | 81                              | 75                               |                      |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           | $\pi^2=5.273$, df 1 |
|                                  | 210 (80.1%)                   | 132                             | 63.26%                           | $p=0.022$            |
| Fruits intake                    |                               |                                 |                                  |                      |
| Yes                              | 141 (54.7%)                   | 70                              | 49.65%                           | $\pi^2=3.425$, df 1 |
|                                  | 117 (45.3%)                   | 88                              | 75.21%                           |                      |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           |                      |
| Green leafy vegetable            |                               |                                 |                                  |                      |
| Yes                              | 150 (58.1%)                   | 77                              | 51.33%                           | $\pi^2=14.817$, df 1 |
|                                  | 108 (41.9%)                   | 81                              | 75                               |                      |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           | $\pi^2=5.273$, df 1 |
|                                  | 210 (80.1%)                   | 132                             | 63.26%                           | $p=0.022$            |
| Underweight                      |                               |                                 |                                  |                      |
| Yes                              | 40 (15.5%)                    | 31                              | 77.5                              | $\pi^2=5.273$, df 1 |
|                                  | 218 (84.5%)                   | 127                             | 58.26%                           | $p=0.022$            |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           |                      |
| Stunted                          |                               |                                 |                                  |                      |
| Yes                              | 74 (28.7%)                    | 55                              | 74.32%                           | $\pi^2=7.483$, df 1 |
|                                  | 184 (31.3%)                   | 103                             | 55.98                            | $p=0.006$            |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           |                      |
| Wasted                           |                               |                                 |                                  |                      |
| Yes                              | 29 (11.2%)                    | 26                              | 89.66                            | $\pi^2=11.114$, df 1 |
|                                  | 229 (88.8%)                   | 132                             | 57.64                            | $p=0.001$            |
| No                               | 218 (84.5%)                   | 127                             | 58.26%                           |                      |

## Table-2: Health related factors of study population. (n=258)

| Variables                     | Study population (% (N = 258) | Anaemia in sub-category (n=158) | Percentage prevalence of anaemia | Chi square & p value |
|-------------------------------|-------------------------------|---------------------------------|----------------------------------|----------------------|
| Consanguinity of parents:     |                               |                                 |                                  |                      |
| Yes                           | 39 (15.1%)                    | 21                              | 53.65%                           | $\pi^2=1.058$, df 1 |
|                               | 219 (84.9%)                   | 137                             | 62.56%                           | $p=0.30$             |
| No                            | 201 (77.91%)                  | 12                              | 5.97                             | $\pi^2=3.758$, df 2 |
| Maturity level at birth:      |                               |                                 |                                  |                      |
| Term                          | 45 (17.44%)                   | 32                              | 71.11                            | $p=0.153$            |
| Pre-term                      | 12 (4.65%)                    | 5                               | 41.67                            |                      |
| Post-term                     | 148 (57.4%)                   | 92                              | 62.16                            | $\pi^2=0.724$, df 2 |
| Size of baby at birth:        |                               |                                 |                                  |                      |
| Normal                        | 148 (57.4%)                   | 92                              | 62.16                            | $\pi^2=12.867$, df 1 |
| Small                         | 184 (31.3%)                   | 103                             | 55.98                            | $p=0.000$            |
| Large                         | 60 (23.2%)                    | 34                              | 56.67                            |                      |
| Chronic illness or recent illness | 97 (37.6%)                 | 73                              | 75.25                            |                      |
| No                            | 161 (62.4%)                   | 85                              | 52.80                            |                      |
Table-3: Multivariate logistic regression analysis of factors associated with anemia’s. (n=258)

| Variables                                      | N   | Percent prevalence of Anaemia | AOR (95% CI) | p- value |
|------------------------------------------------|-----|--------------------------------|--------------|----------|
| Age (in month)                                 |     |                                |              |          |
| >36-60                                         | 39  | 44.31%                         | 1            |          |
| >24-36                                         | 26  | 63.41%                         | 1.12 (0.37-3.44) | 0.842   |
| 6-24                                           | 93  | 72.09%                         | 0.29 (0.12-0.71) | 0.006   |
| Monthly (family) income in BDT                 |     |                                |              |          |
| More than 20,000 BDT                           | 24  | 38.71%                         | 1            |          |
| 5000 BDT or below                              | 21  | 72.41%                         | 0.27 (0.08-0.74) | 0.01    |
| 5001-10000 BDT                                 | 68  | 78.16%                         | 8.84 (1.39-57.66) | 0.02   |
| 10001-20,000 BDT                               | 45  | 56.25%                         | 2.27 (0.80-6.43) | 0.12   |
| Exclusive Breast feeding                       |     |                                |              |          |
| Yes                                            | 106 | 56.99%                         | .88 (0.32-2.2) | 0.08    |
| No                                             | 52  | 72.22%                         |              |          |
| Timely starting weaning (IYCF)                 |     |                                |              |          |
| Yes                                            | 89  | 52.66%                         | 1            |          |
| No                                             | 69  | 77.52%                         | 0.23 (.09-0.59) | 0.002   |
| Animal protein intake at least 4 days/week     |     |                                |              |          |
| Yes                                            | 113 | 53.80%                         | 1            |          |
| No                                             | 45  | 93.75%                         | 0.05 (0.01-0.32) | 0.001  |
| Green leafy vegetable intake                   |     |                                |              |          |
| Yes                                            | 77  | 51.33%                         | 1            |          |
| No                                             | 81  | 75.00%                         | 0.18 (.08-0.45) | 0.00    |
| Stunted                                        |     |                                |              |          |
| No                                             | 103 | 55.98%                         | 1            |          |
| Yes                                            | 55  | 74.32%                         | 0.36 (0.14-0.96) | 0.04   |
| Wasted                                         |     |                                |              |          |
| No                                             | 132 | 57.64%                         | 1            |          |
| Yes                                            | 26  | 89.66%                         | 0.14 (0.03-0.82) | 0.03   |
| Chronic illness or recent illness              |     |                                |              |          |
| No                                             | 85  | 52.80%                         | 1            |          |
| Yes                                            | 73  | 75.25%                         | 0.33 (0.14-0.75) | 0.008  |

**Discussion**

The prevalence of anemia differs extensively amongst the countries. Dissimilar surveys in the past have shown that anemia is a severe problem in Bangladesh among all age [13-15]. In this study 38.20% children had anemia (Hb<11g/dl). According to a National Surveillance Project (NSP) of Helen Keller International (HKI) in association with the Institute of Public Health Nutrition (IPHN), overall 68 % of Bangladeshi children aged 6-59 months had anemia [16]. The prevalence of anemia in India was 74.35% for 6-35 months age group, Nepal had 78% for 6-59 months age group and in Kazakhstan it was 73.7% for 0-23 months age group [17]. The prevalence of anemia in preschool children (0-4 yrs.) of WHO countries of Africa, south- east Asia and eastern Mediterranean were 67.6%, 65.5% and 46.7% cases respectively [18]. The prevalence of anemia is considerable more lower in developed countries such as in America 29.3% and Europe 21.7% [18]. In a study done in Nigeria showed that 70.5% (n=400) children had varying degrees of anemia. Among the anemic cases mild, moderate and severe anemia were 38.0%, 31.8% and 0.8% respectively. The most affected age group was 6-23 months (76.12%). This result was similar to study in Nigeria, where Onyemao et al found the most affected age group was 12-23 months (84.8%) [19]. In a study done in Bangladesh in 1994, the prevalence of anemia was 92% among 6-11-month age group and 85% among 12-23-month age group. The most affected group was 6-23 months (87%) [15]. In this study the prevalence of anemia in male was higher 123(61.2%) than female. So, a majority of undetermined cases might be a case of IDA which could be detected in subsequent follow up. The prevalence of microcytic anemia was high in this study.

**Limitations of the Study**

This was a cross-sectional type of study in a single community with comparatively small number of sample size. So, the study result may not reflect the exact scenarios of the whole country.

**Conclusion and Recommendations**

This study finding indicated that the high prevalence of Anaemia in rural Bangladesh is still existed. Nearly one third of Anaemia (30.7%) was
undetermined in terms etiology. Further large sample study with new determinants is recommended. Nationwide database on Anaemia on the basis of Hb electrophoresis by the age of 6 year is very helpful to prevent nutritional anemia by enhancing MNP supplementation and inherited thalassemia by community genetic counseling.

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