MULTIDISCIPLINARY SCIENTIFIC RESEARCH

ANAEMIA AMONG THE ADOLESCENT, NON-PREGNANT AND PREGNANT WOMEN IN THE RURAL NORTHERN BANGLADESH

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ABSTRACT

The study investigates the nutritional deficiency resulting in anemia among girls and women in northern Bangladesh. The severity of the anemia problem was measured by observing the anemia patient who visited two Clinics in Dinajpur Sadar Upazila. In a cross-sectional survey of 120 rural non-pregnant pregnant women and adolescents, severe anemia (Hb<7.0 g/dL) was uncommon. Data on socio-demographic and weekly diet diversity was collected by questionnaire survey during May and June 2021 in health care centers randomly among those women and adolescents. The study found that 37.0% suffered moderate anemia (Hb=7.0-9.9g/dl), and 83% sustained mild anemia (Hb=10-12g/dl). When evaluating the effect of iron-rich food consumption on hemoglobin concentration, a difference was found in daily or weekly dose schedules. The study showed that 81.7% of participants suffered from prolonged menstrual bleeding, and the remaining 18.3% didn't. As menorrhagia can cause iron deficiency anemia, differences were found in hemoglobin levels. In the case of the moderate anemic group, the major percentage had prolonged menstrual bleeding and also suffered from dysphagia, glossitis, and cheilitis. Mild anemia is higher in the low monthly household food expenditure group. The findings of the study suggest that socio-economic factors influence anemia.

INTRODUCTION

In recent years anemia has been a global public health issue. It can be defined as a "fall of hemoglobin concentration below a statistically defined threshold laying at two standard deviations below the median of a healthy population of the same age, sex, and stages of pregnancy". Anemia could be mild anemia, moderate anemia, severe anemia, low serum ferritin, high serum transferrin receptor, iron deficiency anemia, etc. Although pregnant women are most frequently affected, it is also prevalent in non-pregnant women and other population groups, including children and adolescents. It has been estimated that around 2 billion people worldwide are anemic, most of which are found in low-income countries in Asia and Africa (WHO, 2015). In Bangladesh, anemia affects 46% of pregnant women, 64% of children aged 6-23 months, 42% of children aged 24-59 months, 30% of adolescent girls, and 33% of non-pregnant women (BBS/UNICEF, 2004). Adolescence is a period of life with specific health and developmental needs and rights. It is also a time to develop knowledge and skills, learn to manage emotions and relationships, and acquire attributes and abilities that will be important for enjoying the adolescent years and assuming adult roles (Sen & Kanani, 2006).

There are about 1.2 billion adolescents in the world, which is 1/5th of the world's population, and their numbers are increasing daily. Out of these, 5 million adolescents live in developing countries (Mathur, 2007). In Bangladesh, there are 28 million adolescents. 13.7 million of them are girls, and 14.3 million are boys. Furthermore, in our country, around 12 percent of the whole population are adolescent girls (Lloyd, 2005). Adolescence is a particularly unique period in life because it"s criteria of intense physical, psychosocial, and cognitive development. Increased nutritional needs at this stage

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relate to adolescents gaining up to 50% of their weight.

Moreover, more than 20% of their adult height and 50% of their adult skeletal mass during this period happened (Khara & Mates, 2015). The main nutrition problems which are affecting adolescent populations worldwide include undernutrition in terms of stunting and thinness, catch-up growth, and intrauterine growth retardation in pre-adolescent girls, iron deficiency and anemia, iodine deficiency, vitamin A deficiency, calcium deficiency, other specific nutrient deficiencies, e.g., zinc, folate, and obesity. All, iron deficiency anemia (IDA) constitutes the major anemia during the adolescent period. Accelerated development, hormonal changes, malnutrition, and starting of menstrual periods in girls are major causes of this period (Sölvell, 1970). Anemia has serious consequences in adolescence with growth retardation and impaired physical and cognitive performance. Iron is also an essential nutrient for the functioning of neurotransmitters having a role in cognition, and in scarcity of hemoglobin, hypoxia develops with decreased cardiac output. Several studies reported that iron supplementation among anemic adolescents had a role in cognition. Higher behavioral disturbances, reduced learning capacities, and suboptimal school performance have also been documented among anemic school children.

Moreover, adolescent girls with anemia tend to commence their pregnancy with an increased risk of morbidities and mortality for both mother and child—anemia during pregnancy results in serious health impacts. If there is anemia, the blood doesn't have enough healthy red blood cells to carry oxygen to her tissues and the baby. If the pregnant mother is not getting enough iron or certain other nutrients, her body might not be able to produce the number of red blood cells it needs to make this additional blood. It's normal to have mild anemia when someone is pregnant. But she may have more severe anemia from low iron or vitamin levels or other reasons. Anemia can leave her feeling tired and weak. If it is severe but goes untreated, serious complications like preterm delivery can increase (Grantham-McGregor & Ani, 2011).

Pregnancy during adolescence deprives the girls of achieving their total growth according to their genetic potential. One way to break the intergenerational malnutrition cycle is to improve adolescent girls' nutrition before conception. The vicious cycle of malnutrition, if not broken, will go on, resulting in more severe consequences. Iron deficiency anemia is the main type of anemia among young children in Bangladesh due to poor dietary iron intake. Therefore, this study aims to assess the prevalence of anemia and its risk factors so we can create awareness among people (Pathak et al., 2003).

As outlined above, anemia is widespread during pregnancy and adolescent period. The objectives of this study were to measure the severity of anemia in rural women of the Dinajpur district. The specific objectives were to determine the participants' socio-demographic status and measure the severity of anemia.

MATERIALS AND METHODS

Study Design

The investigation was a cross-sectional observational study. The current observational study analyzed data from a representative subset at a specific time. The study was conducted in the Dinajpur district of Bangladesh. It mainly covers 'Surjer Hashi Clinic' and 'Marie Stopes Clinic' of Dinajpur Sadar, Birol, Kaharol, Chirirbandar, Birampur, and Parbotipur. This study assessed the severity of nutritional anemia among adolescent and pregnant women.

A questionnaire containing closed and open-ended questions were developed to obtain relevant information on anthropometric, socio-economic, diet diversity scores, and health status. The questionnaire was divided into five sections:

- Demographic information
- Anthropometry
- Socio-economic information
- Diet diversity score
- Health status

All questions were designed, pre-tested, modified, and resettled to obtain and record information easily. Any modifications necessary were then made, and a final pre-coded, pre-tested questionnaire was drawn up.

A total of 120 adolescents and pregnant women aged between 15 and 50 years were selected purposively. A pre-coded and pre-tested questionnaire was administered to the adolescent and pregnant women by asking questions. Both qualitative and quantitative data were collected by interviewing and measurement from their record file. The record files were collected from local 'Surjer Hashi clinic' and 'Marie Stopes's clinic'. The anthropometric data were collected based on standard methods. The following anthropometric data were collected:

Body mass index (BMI): For the study population, body mass index (BMI) was calculated. BMI was calculated by dividing weight in kilograms by the square of height in meters. Classification of nutritional status by BMI was done according to the WHO (1995) classification and Asian BMI classification.

$$BMI = Weight (kg)/Height (square meter)$$

Table 1. Nutritional status based on the WHO and Asian criteria values

Nutritional status	WHO cut-off	Asian cut-off
Underweight	<18.5	<18.5
Normal	18.5-24.9	18.5-22.9
Overweight	25-29.9	23-24.9
Pre-obese	-	25-29.9
Obese	≥30	≥30
Obese type 1	30-40	30-40
Obese type 2	40.1-50	40.1-50
Obese type 3	>50	>50

Dietary Information
A diet diversity score card that covered their daily dietary consumption in a week was formed. The food groups attached to the questionnaire were different vitamin A-rich vegetables and iron-rich foods. Other cereals, roots, and tubers, as well as different poultry food items (milk and milk product, fleshy meat and fish), and fruits were attached.

Health Status
Different health statuses of subjects were determined by asking them frequent questions. Other important data were collected from their record files provided by their local 'Surjer Hashi Clinic' and 'Marie Stopes Clinic' if necessary.

Variables Selection and Measurement Dependent Variable
Anaemia status was the dependent variable in this study. Based on hemoglobin concentration (g/dL), World Health Organization (WHO) guidelines were followed to measure anemia status (WHO, 1994). Stratification of anemia status was limited to mild, moderate, and severely anemic.

Covariates
Socio-economic, demographic, and different health statuses were categorized in the following way:
- Types of respondents: adolescent and pregnant and non-pregnant women;
- Educational qualification of respondents and spouse
- Occupation of respondents and spouse
- Monthly household income
- Monthly household food expenditure
- Weekly dietary intake
- Category of BMI
- Category of hemoglobin
- Diagnosis of anemia before
- Prolonged menstrual bleeding

Data Analysis
All characteristics were presented using descriptive statistics and group comparisons, viz., mild anemic, moderate anemic, and severely anemic, were shown by cross-tabulation. Pearson's Chi-square tests were performed to check for statistical association among mild, moderate, and severe anemic groups for food security status and the socio-economic variables. All the dependent and independent variables were categorized to facilitate the analysis. All tests were two-tailed, and statistical significance was set at a p-value less than 0.05. Data analyses were performed with SPSS 16 (SPSS Inc., Chicago, IL, USA)

RESULTS

The severity of anemia of adolescent and pregnant women according to socio-demographic characteristics and food intake patterns.

Table 2. Frequency distribution of socio-demographic status

Variables	Categories	Frequency distribution		
		Frequency	Percent (%)	
A. Type of respondents	Adolescent	21	17.5	
	Women	25	20.8	
	Pregnant women	74	61.7	
B. Marital status	Married	78	65	
	Unmarried	42	35	
C. Education of respondent	PSE	18	15	
	JSC	41	34.2	
	SSC	27	22.5	
	HSC	12	10.0	
	Honors	7	5.8	
	MS	11	9.2	
	No formal education	4	3.3	
D. Education of the spouse	1. PSE	1	8	
	2. JSC	28	23.3	
	3. SSC	24	20.0	
	4. HSC	7	5.8	
	5. Honors	16	13.3	
	6. MS	1	8	
E. Respondent's occupation	1. Student	53	44.2	
	2. Housewife	67	55.8	
F. Husband's occupation	1. Farmer	2	1.7	
	2. Auto-biker	15	12.5	
	3. Service holder	8	6.7	
	4. Day-labor	38	31.7	
	5. Business	12	10.0	
	6. Student	1	0.8	

	7. Others	1	0.8
G. Monthly household income	1. 5000-10000	38	31.7
	2. 11000-15000	32	26.7
	3. 16000 to above	50	41.7
H. Monthly household food expenditure	1. 2000-3000	52	43
	2. 3500-5000	30	25
	3. Above 5000	38	31.7

Frequency Distribution of Socio-Demographic Status

Types of Respondents
Among the respondents, there were 17% adolescents, 20.8% non-pregnant women, and 61.7% pregnant women.

Marital Status
Sixty-five percent of the representatives were married, and the rest, 35%, were unmarried.

Educational Qualification of Respondents
It was observed that 15%, 34.2%, 22.5%, and 10.0% of respondents had studied up to Primary School Certificate, Junior School Certificate, and Secondary and Higher secondary levels, respectively. 5.8% of respondents studied up to honors, 9.2% of respondents studied up to master's level, and 3.3% of respondents didn't have any formal education.

Respondent's Occupation
From the frequency distribution in Table 2, it was observed that 44.2% of respondents were studying, and the rest, 55.8%, were housewives. According to this, they were categorized into students and housewives.

Husband's Occupation
Table 2 represented that the major percentage of married respondents' husbands was day labor, and it comprised 31.7%. The rest, 12.5%, 10.0%, and 6.7 %, husbands were auto-bikers, businessmen, and service holders, respectively. From the results, it was determined that lots of people are leading a lower-middle-class life which has a significant impact on household food expenditure.

Monthly Household Income
Respondents' monthly household income was categorized into three groups. Those were 5000-10000, which was 31.7%, 11000-15000, which was 26.7%, and 16000 to above which was 41.7% of the total population (Table 1).

Monthly Household Food Expenditure
It was observed from Table 2 that the monthly household food expenditure of respondents was categorized into three different ranges, *i.e.*, 2000-3000, which comprised 43.3%, 3500-5000%, which was 25.0%, and above 5000 which was 31.7% of total respondents.

Table 3. Frequency distribution of weekly dietary intake

		Frequency distribution	
Variables	Categories	Frequency	Percent (%)
Consumption of cereals	2-3 days a week	0	0
	4-5 days a week	48	40
	Daily	72	60
Consumption of tea or coffee	Yes	77	64.2
	No	42	35.0
Dark green leafy vegetables and tubers	2 days per week	36	30
	3 days per week	43	35.8
	4 days per week	39	32.5
	Everyday	2	1.7
Milk and milk products	2 days per week	16	13.3
	4 days per week	83	69.2
	Everyday	21	17.5
Legumes and pulses	2 days per week	50	41.7
	3 days per week	70	58.3
Egg	1. 2 days per week	37	30.8
	2. 3 days per week	41	34.2
	3. 4 days per week	40	33.3
	4. Everyday	2	1.7
Fleshy meat and fish	1. 1 day per week	69	57.5
	2. 2 days per week	30	25.0
	3. 3 days per week	21	17.5
Citrus fruits	1. 1 day per week	77	64.2
	2. 3 days per week	40	33.3

	3. Daily	3	2.5
Other fruits	1. 2 days per week	37	30.8
	2. 3 days per week	41	34.2
	3. 4 days per week	40	33.3
	4. Everyday	2	1.7

Frequency Distribution of Weekly Dietary Intake
Consumption of Cereals
According to table 3, respondents' weekly consumption was categorized into three groups. Those were consumption of cereals two to three days a week, four to five days a week, and daily. And the percentages were 0%, 40%, and 60%.

Consumption of Tea or Coffee
Table 3 showed that, of the total respondents, 64.2% of respondents consumed tea or coffee, and the yield 35.8% didn't consume tea or coffee.

Weekly Consumption of Dark Green Leafy Vegetables and Root Vegetables
Consumption of dark green leafy vegetables and root vegetables was categorized into four groups. Those were: two, three, four days per week and every day. And the resultant amount was 30%, 35.8%, 32.5% and 1.7% respectively.

Weekly Consumption of Milk and Milk Products
This data was categorized into three groups. These are 2 days, 4 days, and every day in a week. From the results, the percentage of respondents' consumption of milk and milk products were 13.3%, 69.2%, and 17.5%, respectively.

Weekly Consumption of Legumes and Pulses
From Table 3, it was observed that 41.7% consumed legumes and pulses 2 days per week, and the rest, 58.3%, consumed 3 days per week.

Weekly Consumption of Egg
From the frequency distribution of weekly dietary intake, it was seen that the weekly consumption of eggs is categorized into three groups. The categories with their percentages were: two days per week (30.8%), three days per week (34.2%), four days per week (33.3%), and daily (1.7%).

Weekly Consumption of Fleshy Meat and Fish
It was observed that 57.5% of respondents consumed fleshy meat and fish 1day per week, 25.9% consumed 2 days per week, and left 17.5% consumed 3 days a week.

Weekly Consumption of Citrus Fruits
Table 3 showed that people who consumed various citrus fruits (mainly orange and lemon) daily was 2.5%, those who consumed three days per week was 33.3%, and one day per week was 64.2%.

Other Fruits Per Week
It was observed from Table 3 that people who consumed various fruits daily was 1.7%, who consumed four days per week was 33.3%, who consumed three days per week was 34.2%, and finally, those who consumed 2 days per week was 30.8%.

Table 4. Frequency distribution of health status

Variables	Categories	Frequency distribution	
		Frequency	Percent (%)
Category of BMI	Underweight	23	19.2
	Normal	71	59.2
	Overweight	21	17.5
	Obese	5	4.2
Category of hemoglobin	Moderate	37	30.8
	Mild	83	69.2
Diagnosis of anemia before	Yes	49	40.8
	No	71	59.2
Prolonged menstrual bleeding	Yes	98	81.7
	No	22	18.3
Headache, chest pain, abdominal pain in pregnancy	Yes	71	59.2
	No	5	4.2
Dysphagia, glossitis, cheilitis	Yes	95	79.2
	No	25	20.8

Frequency Distribution of Health Status
Category of BMI
The body mass index (BMI) of respondents was categorized into four groups in Table 3. Those are underweight, normal, overweight, and obese people, and their percentages were 19.2%, 59.2%, 17.5%, and 4.2%, respectively.
Category of hemoglobin: According to the collected values of hemoglobin of all respondents, hemoglobin level was categorized into four groups. These were: severe, moderate, mild, and normal anemia. From the results, it was obtained that 30.8% of respondents were suffering from moderate anemia, and the rest, 69.2% of respondents were suffering from mild anemia.

Diagnosis of Anemia Before
It was observed that, from all the respondents, 59.2% of respondents didn't have a diagnosis of anemia before, and the rest, 40.2% had. Anemia isn't an uncommon diagnosis, and there is some likelihood that someone may have been diagnosed with it. So, it may have positive significance.

Prolonged Menstrual Bleeding
According to Table 4, 81.7% of respondents were suffering from prolonged menstrual bleeding, and the left 18.3% didn't. Menorrhagia can be a cause of iron deficiency anemia. So, this may have significance.
Headache, chest pain, abdominal pain in pregnancy: Respondents who were suffering from headache, chest pain, and abdominal pain in pregnancy were 59.2%, and the rest, 33.3%, didn't have that symptom. Preeclampsia is a very serious condition that, in addition to the above symptoms, can cause a type of anemia. So, it might have significance.

Dysphagia, Glossitis, and Cheilitis
Respondents who were suffering from difficulty with swallowing (Dysphagia) or noticed any changes in the appearance of their tongue or lips (glossitis and cheilitis) were 79.2%, and the rest, 20.8%, who didn't have any of those signs.

Bivariate Analysis
Chi-square test is a method of bivariate analysis that is used to know the association among several covariates with the response variable. In this section, the obtained results are illustrated by using this chi-square method.

Table 5. Results of the severity of anemia for socio-demographic status

		Category of hemoglobin		
Variables	Categories	Moderate anemia (%)	Mild anemia (%)	P-value
Monthly Household income	5000-10000	37.8	28.9	
	11000-15000	32.4	24.1	0.208
	16000 to above	29.7	47.0	
Monthly household food expenditure	1. 2000-3000	62.2	34.9	
	2. 3500-5000	18.9	27.7	0.019
	3. Above 5000	18.9	37.3	

Results of Severity of Anemia for Socio-Demographic Status
Monthly Household Income
From Table 5, it was observed that respondents whose monthly household income was 5000-10000, 37.8% and 28.9% were suffering from moderate and mild anemia, respectively. Whose monthly household income was 11000-15000, 32.4% and 24.1% were suffering from moderate and mild anemia, respectively. Whose monthly household income was above 16000, 29.7% and 47.0% were suffering from moderate and mild anemia, respectively. From the chi-square test, the resultant p-value was 0.208, which means there hasn't been a strong association between monthly household income and the severity of anemia.

Monthly Household Food Expenditure
For the monthly household food expenditure, it was observed that whose monthly household food expenditure was between 2000 to 3000, 62.2% and 34.9% were suffering from moderate and mild anemia, respectively. Respondents whose monthly household food expenditure was between 3500 to 5000, 18.9% and 27.7% were suffering from moderate and mild anemia, respectively. Whose monthly household food expenditure was above 5000, 18.9% and 37.3% were suffering from moderate and mild anemia, respectively. It was observed from the resultant p-value (0.019) that there exists an association between monthly household food expenditure and the category of hemoglobin.

Table 6. Results of the severity of anemia for weekly dietary intake

		Category of hemoglobin		
Variables	Categories	Moderate anemia (%)	Mild anemia (%)	**P-value**
Consumption of tea or coffee	Yes	97.3	49.4	
	No	2.7	50.6	**0.000**

Dark green leafy vegetables and tubers	2 days per week	91.9	2.4	
	3 days per week	2.7	50.6	**0.000**
	4 days per week	5.4	44.6	
	Everyday	0	2.4	
Milk and milk products	2 days per week	24.3	8.4	
	4 days per week	54.1	75.9	**0.028**
	3. Everyday	21.6	15.7	
Fleshy meat and fish	1 day in a week	70.3	51.8	
	2 days a week	13.5	30.1	**0.111**
	3 days a week	16.2	18.1	
Eggs	2 days per week	94.6	2.4	
	3 days per week	2.7	48.2	**0.000**
	4 days per week	2.7	47.0	
	Everyday	0.0	2.4	
Citrus fruits	1 day per week	100	48.2	
	3 days per week	0.0	48.2	**0.000**
	Daily	0.0	3.6	
Other fruits	2 days per week	100	0	
	3 days per week	0.0	49.4	**0.000**
	4 days per week	0.0	48.2	
	Everyday	**0.0**	**2.4**	

Results of Severity of Anemia for Weekly Dietary Intake
Consumption of Tea or Coffee
It was observed that 97.3% of respondents who consumed tea or coffee were suffering from a moderate level of anemia, and the rest 2.7% of respondents were suffering from mild anemia. Conversely, 50.0% of respondents who didn't drink tea or coffee were suffering from moderate anemia, and the rest, 50.0%, were suffering from mild anemia. From the p-value (0.000), it can be said that there exists a highly significant association between the consumption of tea or coffee and the category of hemoglobin.

Dark Green Leafy Vegetables, Roots, and Tubers
From Table 6, it was observed that among those respondents who consumed dark green leafy vegetables two days a week, 91.9% of them were suffering from moderate anemia, and 2.4% were suffering from mild anemia. On the other hand, 2.7% and 50.6% of respondents were suffering from moderate and mild anemia, respectively, by consuming dark green leafy vegetables three days a week. Furthermore, 5.4% and 44.6% of respondents were suffering from moderate and mild anemia, respectively, by consuming dark green leafy vegetables four days a week. The rest, 2.4%, of respondents were suffering from mild anemia by consuming those vegetables daily. From the resultant p-value (0.000), it can be said that there exists a significant association between weekly consumption of dark green leafy vegetables and tubers with the category of hemoglobin.

Milk and Milk Products
It was found that 21.6% and 8.4% of respondents were suffering from moderate and mild anemia, respectively, by drinking milk and milk products two days a week. Again, 56.8% and 75.9% of respondents were suffering from moderate and mild anemia, respectively, by drinking milk and milk products four days a week. Finally, 21.6% and 15.7% of respondents were suffering from moderate and mild anemia by drinking milk and milk products daily. And according to the resultant p-value (0.067), it can be said that there does not exist any strongly significant association between drinking milk and milk products with the category of hemoglobin.

Eggs
It was found that 94.6% and 2.4% of respondents were suffering from moderate and mild anemia, respectively, by consuming eggs two days a week. Again, 2.7% and 48.2% of respondents were suffering from moderate and mild anemia, respectively, by consuming eggs three days a week. After that, 2.7% and 47.0% of respondents were suffering from moderate and mild anemia, respectively, by consuming eggs four days a week. Finally, 1% of respondents had mild anemia, and they consumed eggs daily. According to the resultant p-value (0.000), it can be said that there exists a strongly significant association between the consumption of eggs and the category of hemoglobin.

Fleshy Meat and Fish
Table 6 showed that 70.3% and 51.8% of respondents were suffering from moderate and mild anemia, respectively, by consuming fleshy meat and fish one day a week. Again 13.5% and 30.1% of respondents were suffering from moderate and mild anemia, respectively, by consuming those food items two days a week. The rest, 16.2% and 18.1% of respondents, were suffering from moderate and mild anemia, respectively, by consuming three days a week. The p-value was 0.111, and it shows that there did not exist a strong association between the severity of anemia and the weekly consumption of fleshy meat and fish.

Citrus Fruits

For the covariate consumption of citrus food in a week, it was found that 100% and 48.2% of the respondents consumed one day in a week, and their status was moderate and mild anemia, respectively. Again, the table showed that 48.2% consumed three days a week and were suffering from moderate and mild anemia, respectively. Finally, those who consumed daily were suffering from only mild anemia (3.6%). The resultant p-value was 0.000, which means there exists a strong significant association between the consumption of citrus fruits and the category of hemoglobin.

Other Fruits

It was observed that 100% of the respondents were suffering from moderate anemia by consuming locally available fruits two days a week. Again, 49% of them were suffering from mild anemia by consuming three days a week. Besides these, 48.2% were suffering from mild anemia by consuming four days a week. Finally, 2.4% were suffering from mild anemia by consuming daily. The resultant p-value was 0.000, which means there exists a strong significance between consuming locally available fruits and the category of hemoglobin.

Table 7. Result of the severity of anemia with another health status

Variables	Category of hemoglobin			
	Categories	Moderate anemia (%)	Mild anemia (%)	P-value
Prolonged menstrual bleeding	Yes	94.6	75.9	0.015
	No	5.4	24.1	
Long time illness	Yes	86.5	57.8	
	No	13.5	42.2	0.002
Dysphagia, glossitis, cheilitis	Yes	97.3	71.1	0.001
	No	2.7	28.9	
Headache, chest pain, abdominal pain in pregnancy	Yes	95.7	92.5	0.605
	No	4.3	7.5	

Result of Severity of Anemia with Other Health Status
Prolonged Menstrual Bleeding
It was found that 94.6% and 75.9% of respondents were suffering from moderate and mild anemia and both had prolonged menstrual bleeding. Conversely, 5.4% and 24.1% were suffering from moderate and mild anemia, and both did not have prolonged menstrual bleeding. The resultant p-value was 0.015. This value shows that there must have significance between prolonged menstrual bleeding and the category of anemia.

Long-Time Illness
For the covariant long-time illness, it was found that 86.5% and 57.8% of respondents were suffering from moderate and mild anemia, and they both had the long-time illness. And the remaining 13.5% and 42.2% of respondents were suffering from moderate and mild anemia, but they did not have a long-time illness. The resultant p-value was 0.002, which represents that there isasignificant association between long-time illness and the category of hemoglobin.

Dysphagia, Glossitis, and Cheilitis
It was observed from Table 7 that 97.3% of respondents had dysphagia or glossitis or cheilitis, were suffering from moderate anemia, and the remaining 2.7% did not have any of there. Again, 71.1% of respondents had dysphagia or glossitis or cheilitis, were suffering from mild anemia, and the remaining 28.9% did not have any of these. From the p-value of 0.000, it can be said that there is a strong significant association between dysphagia, glossitis, and cheilitis with the category of hemoglobin.

Headache, Chest Pain, Abdominal Pain in Pregnancy
Table 7 showed that 95.7% and 92.5% of respondents from pregnant women were suffering from moderate and mild anemia and had a headache, chest pain, and abdominal pain during pregnancy. Conversely, 4.3% and 7.5% of pregnant women were suffering from moderate and mild anemia, respectively. The resultant p-value was 0.605, and it shows that there does not have a strong association between the severity of anemia and headache, chest pain, and abdominal pain in pregnancy.

DISCUSSION
Socio-Demographic Features of the Respondent
In this cross-sectional study, a total of 120 participants attended for the study. Most of them are studied up to primary as well as secondary school level. It is a common belief that educated peoples are conscious of consuming the requisite and balanced diet. The number of moderate anemic is higher in the low monthly household income group (PPRC, 2015), but at the same time, mold and anemic are also equally high in this income group. Moderate anemic is higher in the low monthly household food expenditure group. A slight difference in percentages can be taken as significant, which is evident from the chi-square value and p-value (p=0.019) of the test of association. It is seen that the participants who expend the highest, moderate anemic is lowest there. To justify the fact statistically whether the monthly household food expenditure status of participants does influence the anemic condition, the chi-square test was employed, which shows that there is a significant association.

Relationship of Severity of Anemia with Weekly Dietary Intake of the Respondent

Within-group analysis shows that the majority percentage of participants in the moderate anemic group were consuming tea or coffee regularly, whereas, in the mild anemic group, respondents were not consuming tea or coffee regularly. The association between the two groups with respect to the category of hemoglobin was found to be statistically significant as the p-value (p=0.000) is less than the level of significance of 0.05. A large amount of tea or coffee and these types of drinks make it harder for our bodies to absorb iron (Sivasankar, 2002).

The weekly consumption of dark green leafy vegetables and tubers plays an important role in the category of hemoglobin in individuals. Table E envisages that almost a major percent of the respondents having moderate anemia was from the categories having consumption of those kinds of diet irregularly. A gradual decrease in the percentage of moderate anemic girls was seen in groups as the consumption level increased. A significant association was found between the categories of dark green leafy vegetable consumption and the category of hemoglobin, suggesting that both the groups are affected by that consumption (p=0.000). Most vegetables contain ascorbic acid, riboflavin, and thiamine. Root vegetables, including carrots, are rich in carotene, a precursor for Vitamin A. Fruit vegetables, including tomatoes, eggplant is rich in calcium, and Vitamin c. besides these, and dark green leafy vegetables are a good source of iron. Respondents whose consumption level of these vegetables was lower, i.e., two days a week, were suffering from a moderate level of anemia.

The highest percentages among the moderate anemic group consumed milk or milk-based products and eggs irregularly. In order to ascertain whether there is any association between the two groups with respect to the consumption of milk or milk-based products and eggs by the respondents, the chi-square test was employed, which shows that there is a statistically significant association (p=0.028 and p=0.000) between the two groups.

Similarly, the highest percentages among moderate anemic group citrus and other locally available fruits irregularly. In order to ascertain whether there is any association between the two groups with respect to the consumption of these kinds of fruits by the respondents, the chi-square test was employed, which shows that there is a statistically significant association (p=0.000 and p= 0.000) between the two groups. Consumption of citrus fruits like orange and lime has importance in a regular diet. And that is, it helps in iron absorption from the diet. This is positively associated with rising hemoglobin concentration.

Relationship of Anemia with Certain Conditions of the Respondent

Pregnancy causes increased physiological requirements of iron and folate. Anemia occurs in many pregnant women because their iron stores need to serve their own increased blood volume as well as be a source of hemoglobin for the growing fetus (Luke, 1991). Table 7 shows that in the case of the moderate anemic group, the major percentages had prolonged menstrual bleeding. The association between the two groups with respect to the category of hemoglobin was found to be statistically significant as the p-value (p=0.015) is less than the level of significance of 0.05. Heavy periods and pregnancy are very common causes of iron deficiency anemia. Blood contains iron within red blood cells. So, if someone loses blood, she loses some iron. Women with heavy periods are at risk of iron deficiency anemia because they lose blood during menstruation (Luke, 1991). In the case of the moderate anemic group, the highest percentage had a duration of long-time illness. The association between the two groups with respect to the category of hemoglobin was found statistically significant as the p-value is less than the level of significance (0.05). Actually, chronic disease can have long-term effects on other aspects of human health, such as the way in which the human body produces blood. These diseases can cause anemia or chronic disease.

It can also be seen from Table 6 that the highest percentages of moderate anemic groups are suffering from dysphagia, glossitis, and cheilitis. In order to ascertain whether there is any association between the two groups with respect to the health status of the respondents, the chi-square test was employed, which shows that there is a statistically significant association (p=0.001) between the two groups. Along with iron deficiency anemia, respondents had difficulty with swallowing (dysphagia) or noticed changes in the appearance of their tongue or lips (glossitis, cheilitis).

CONCLUSIONS

Early marriage and not sufficient educational background are prevalent in the rural area of Dinajpur, i.e., in northern Bangladesh. Promotion of community and nutrition is a necessity for those people. Many interrelated socio-economic factors are influencing anemia. The promotion of iron-rich food and urban living conditions is a necessity in the study to combat anemia.

Based on that, some recommendations could be presented. The introduction of balanced diets rich in vitamin A and iron during pregnancy and lactation is a necessity. Nutrition education should be introduced and enhanced among mothers to accept knowledge about the source of iron-rich foods and other nutritious food sources. More care should be provided to adolescence. It is essential to increase awareness about taking more iron during the adolescent period to reduce the prevalence of anemia.

The urban poor should be supported by appropriate socio-economic development programs to curb financial inflation, which adversely deprives this segment of society. Promotion of urban living conditions could be through provisioning adequate housing conditions; income generation sources to poor urban households, stopping accelerated financial inflation; and reducing rates of rural-urban migration to avoid the addition of more urban poor and growth of squatter settlements.

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