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Prevalence and Risk Factors Associated with Anaemia among Pregnant Women Receiving Antenatal Care at Jalalabad Ragib-Rabeya Medical College and Hospital, Sylhet, Bangladesh

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Original Research Article

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ABSTRACT

Background: Anaemia during pregnancy is a major public health problem worldwide. The prevalence is high in developing countries compared to developed countries. In Bangladesh, anaemia during pregnancy is a leading cause of maternal mortality and morbidity as it is an additional risk factor for pregnancy complications. This study aimed to estimate the prevalence of anaemia among pregnant mothers and determine associated risk factors.
Methodology: A cross-sectional study was conducted among pregnant women attending antenatal care (ANC) at Jalalabad Ragib-Rabeya Medical College and Hospital (JRRMCH), Sylhet, from February to May 2022. A total of 400 study participants were selected by systematic random sampling technique. A semi-structured questionnaire was used for data collection. Data were analyzed by using SPSS. A Chi-square test and binary logistic regression test were carried out to determine associated risk factors. A *p*-value less than 0.05 was considered statistically significant.
Result: Among 400 study participants, the prevalence was 53.50%. Among them 32.25% had mild anaemia, 20.25% had moderate anaemia, and 1% had severe anaemia. The prevalence was higher in rural areas (58.09%) than urban areas (46.54%). The majority of them were in the age group between 15-26 years. About 44.75% were primi gravida and 55.25% were multi gravida.

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About 70.25% of the respondents had taken iron supplementation. Maternal age 27-38 year (Adjusted odd ratio (AOR=1.847)), family monthly income (BDT) 50000-75000 (AOR=2.145), nuclear family (AOR=2.045), para (AOR=2.949), and gravida (AOR=1.636) were found to be independent factors of anaemia among pregnant mothers. Iron and folic acid supplement was protective of anaemia (AOR=0.432).

Conclusion: In our study, more than half of pregnant mothers were anaemic and most had mild to moderate anaemia. Based on identified risk factors it is highly recommended to improve socio-economic condition, level of education, family planning services and nutritional status. Iron supplementation should be encouraged for pregnant mothers.

Keywords: Anaemia; Antenatal Care (ANC); prevalence; Hemoglobin percentage (Hb%); socio-demographic characteristics; dietary characteristics; obstetrical characteristics.

1. INTRODUCTION

Anaemia is a major public health problem throughout the world. A total of 2.36 billion people worldwide were affected by anaemia in 2015 [1]. Institute for Health Metrics and Evaluation HDN, The World Bank stated that, anaemia is responsible for 3.4% of global disability [2]. World Health Organization (WHO) stated that, the global anaemia prevalence in 2019 was 29.9% in women of reproductive age (15-49 years) and it was 29.6% in non-pregnant women of reproductive age and 36.5% in pregnant women [3]. Anaemia is a common medical disorder during pregnancy [4]. According to WHO, anaemia in pregnancy can be defined as a haemoglobin concentration of less than 11 gm/dl [5]. Clinical features of anaemia in pregnant women include fatigue, weakness, dizziness, headache, pale skin, shortness of breath, tachycardia, and hypotension [6]. During pregnancy, iron deficiency anaemia is more common [6]. Iron deficiency is the cause of 75% of anaemia cases [7]. During pregnancy, inadequate intake and less bioavailability of iron-rich foods also contribute significantly to the onset of anaemia [7]. Other types of anaemia include folate deficiency anaemia and megaloblastic anaemia due to vitamin B12 deficiency. According to the latest report of WHO, the global prevalence of anaemia among pregnant women (15-49 yrs.) is 36.5% and the prevalence is highest (47.8%) in Southeast Asia [8]. Anaemia is more prevalent in developing countries (42.8%) compared to developed countries (9.1%) [9]. Between 1995 and 2011, the global prevalence of anaemia during pregnancy decreased from 43% to 38% and in South Asia, declined from 53% to 52% due to progress in socio-economic and health status [10]. Based on nationally representative Demographic and Health Surveys Program data collected from women of reproductive age (15–49 years) in 2011, the prevalence of anaemia in Bangladesh was 41.8% [11]. According to WHO, prevalence of anaemia during pregnancy was 44.2% in 2012, 43.9% in 2013, 43.6% in 2014, 43.3% in 2015, 43.1% in 2016, 42.8% in 2017, 42.5% in 2018 and 42.2% in 2019 in Bangladesh [8]. Several survey-based studies have been conducted at various places in Bangladesh. Those studies estimated that the prevalence of anaemia during pregnancy was 37% in 2015, 42.7% in 2016, 56.52% in 2017, 58.9% in 2019 and 62.5% in 2021 [12,13,14,15,16]. It indicates a substantial variation in the prevalence of anaemia among pregnant women in Bangladesh. Multiple adverse maternal and neonatal outcomes have been attributed to anaemia [17]. These outcomes vary according to the severity of anaemia [18]. Anaemia increases the risk of placental abruption, severe Post-Partum Haemorrhage (PPH), maternal shock and maternal death [19]. Severe anaemia causes approximately 20% of maternal deaths, and it acts as an additional risk factor for 50% of all maternal deaths in developing countries [20]. According to the WHO survey of maternal mortality causes, anaemia is the second highest cause of maternal death in Asia and responsible for 12.8% of all maternal deaths resulting from PPH [21]. Pregnancy outcomes with anaemia result in preterm delivery, Low Birth Weight, fetal impairment, fetal death, Intra-Uterine Growth Retardation (IUGR), fetal malformation, still birth and, in severe cases, it may cause perinatal mortality and neonatal mortality [15,19,22,23].

Determinants of anaemia in low- and middle-income countries can be classified into three major groups: nutritional deficiencies, infectious diseases, and genetic haemoglobin disorders [24]. Factors that are responsible for anaemia among pregnant mothers include poor nutritional status, inadequate diet, poor antenatal care services, socio-demographics, genetics,

abortions, multi-parity, repeated childbirth, inadequate dietary iron intake, lack of proper water and sanitation hygiene, regional variation, and parasitic infection [7,25,26,27]. Several studies conducted in different cities in Bangladesh determined various risk factors of anaemia which include maternal age, maternal education, living area, family size, monthly family income, parity, gravidity, contraception and iron supplementation, gestational age, birth spacing, excessive blood loss during previous surgery and food frequency [12,13,14]. The prevalence of anaemia in pregnancy varies in women with different socioeconomic conditions, diets, lifestyles, or health-seeking behaviours across different cultures. A study has shown that anaemia prevalence in pregnancy is more in rural areas than in urban areas in Bangladesh and the reasons of this variation are considered due to the differences in educational level, socioeconomic status, and lifestyle [11]. In various studies, the salutary effect of iron supplementation on the improvement of haemoglobin levels in pregnancy has been documented [28]. Routine prophylaxis of iron is commonly recommended for pregnant women. Initiation of supplementation before conception is needed to reduce maternal anaemia during early pregnancy [29].

To our information, no studies have ever been conducted in the area we selected for our investigation. Therefore, the main goal of this study was to estimate the prevalence of anaemia and determine its associated risk factors among pregnant women attending Antenatal Care (ANC) at JRRMCH, a tertiary-level hospital in Sylhet, Bangladesh.

2. MATERIAL AND METHODS

2.1 Study Design and Population Selection

A Cross-sectional study was carried out at the department of Obstetrics and Gynecology of JRRMCH, Sylhet, Bangladesh. JRRMCH is a tertiary-level hospital, established in 1995. It is in the center of divisional city Sylhet. There are more than one thousand beds to provide the health care to people coming from all the four districts of Sylhet division. This hospital has more than three thousand employee including doctors, nurses, and other staffs. The department of Obstetrics and Gynecology provides various pregnancy and gynecological health services. It provides ANC services to more than one hundred patients every day. Our study population was all pregnant women who came to attend ANC at JRRMCH. The inclusion criteria were pregnant women at the study site willing to participate in the study. The study period was from February to May 2022.

2.2 Sample Size and Sampling Technique

The following formula was used to determine the minimum sample size (n) by considering a 95% confidence interval (CI) and 5% marginal error (E).

$$n = \left(\frac{Z}{E}\right)^2 p(1-p) = 374.81 \approx 375$$

Where, critical value at 95% confidence, $Z = 1.96$, marginal error, $E = 5\%$, anaemia prevalence in pregnancy in Bangladesh, $p = 42.2\%$ [8]. To be more accurate the final sample size was taken 400 for this study. Sample data were drawn by using systematic random sampling technique. One in every three patients was systematically chosen as study participants. Since the population is in a random order, systematic sampling can imitate the benefit of simple random sampling.

2.3 Data Collection Instrument

A semi-structured questionnaire was prepared at the beginning of the study by considering the objectives and variables of the study and it was pretested before finalization. To ensure the validity of research instrument (Questionnaire), a pilot test was done in similar settings before finalizing questionnaire. The questionnaire was also verified by taking expert opinions regarding its validity. Data was collected by conducting face to face interviews, clinical examination and collecting investigation reports of the respondents with their informed consent. According to WHO, Hemoglobin percentage (Hb%) >11 gm/dl is considered as non anaemic, 9-10.9 gm/dl is considered as mild anaemia, 7-8.9 gm/dl as moderate anaemia and <7 gm/dl is considered as severe anaemia [5]. The interviews were conducted in the department of Obstetrics and Gynecology at JRRMCH. Data was recorded in Microsoft excel and it was checked to exclude any error or inconsistency at the end of every working day. Incomplete data was completed by further interview. Collected data from the selected hospital was checked, rechecked, and verified by the investigator at the end of every working day. To ensure reliability and validity of data, randomly selected 5% data

was recollected and compared with the previous data within 72 hours.

2.4 Data Analysis

Data was analyzed by Statistical Package for the Social Science (SPSS). Frequency and percentage were computed for categorical data and mean and standard deviation for quantitative data. The summarized data was presented through Frequency tables and graphs. A Chi-square test and binary logistic regression test were carried out to determine the association of the variables with anaemia. In every case, *p*-value < 0.05 was considered statistically significant.

3. RESULTS

3.1 Socio-demographic Characteristics of Respondents

Among 400 study participants, majority, 169 (42.25%) of pregnant mothers were from Sunamganj district and more than half of women, 241 (60.25%) resided in rural area. Most of the study participants, 212 (53%) were in the age group ranges from 15 years to 26 years and only 21 (5.25%) were found to be 39 years or older. The mean (±SD) age and weight of all participants were 26.9 (±6.4) years and 57.2 (±10.3) kilograms respectively. Most of the women, 312 (78%) were housewife by occupation. 62 (15.50%) of all attendants had no education, 102 (25.50%) had primary education and 73 (18.25%) had education from college or university. About two-third of the respondents, 307 (76.75%) were Muslim by religion. The number of participants from joint family was more than double of that of nuclear family. More than half of the respondents, 243 (60.75%) belonged to a family with 2-5 members and only 19 (4.75%) participants had a big family containing 10-13 members. Almost half of the participants, 184 (46%) lived in a socio-economic condition with monthly family income <25000tk. About 387 (97%) were using safe water and hygienic sanitation (Table 1).

3.2 Nutritional Status and Obstetrical Characteristics of Respondents

In our study, 312 (78.0%) of pregnant mothers were well-nourished. Co-morbidity was found in only 55 (13.75%) mothers. 56 (14.0%) had previous history of major surgery and only 12 (3%) had history of excessive blood loss during previous surgery. About 39 (9.75%) of all participants mentioned that they were previously infected with hookworm (Table 2).

Table 1. Socio-demographic characteristics of respondents

Characteristic	Total N (%)	Prevalence of anaemia, N (%)		p-value
		Anaemic	Non anaemic	
Age	400			0.24
15-26 years	212 (53.00)	112 (52.83)	100 (47.17)	
27-38 years	167 (41.75)	87 (52.10)	80 (47.90)	
39-50 years	21(5.25)	15 (71.43)	6 (28.57)	
Weight	400			0.38
30-51 Kg	121 (30.25)	66 (54.55)	55 (45.45)	
52-73 Kg	248 (62.00)	128 (51.61)	120 (48.39)	
74-96 Kg	31 (7.75)	20 (64.52)	11 (35.48)	
Home district	400			0.63
Sylhet	142 (35.50)	71 (50.00)	71 (50.00)	
Moulvibazar	42 (10.50)	25 (59.52)	17 (40.48)	
Habiganj	47 (11.75)	24 (51.06)	23 (48.94)	
Sunamganj	169 (42.25)	94 (55.62)	75 (44.38)	
Geographic region	400			**0.02**
Rural	241 (60.25)	140 (58.09)	101 (41.91)	
Urban	159 (39.75)	74 (46.54)	85 (53.46)	
Education	400			**0.002**
Illiterate	62 (15.50)	41 (66.13)	21 (33.87)	
Primary	102 (25.50)	56 (54.90)	46 (45.10)	
Secondary	78 (19.50)	49 (62.82)	29 (37.18)	
Higher secondary	85 (21.25)	42 (49.41)	43 (50.59)	
College or university	73 (18.25)	26 (35.62)	47 (64.38)	

Characteristic	Total N (%)	Prevalence of anaemia, N (%)		p-value
		Anaemic	Non anaemic	
Religion	400			0.07
Hindu	93 (23.25)	42 (45.16)	51 (54.84)	
Muslim	307 (76.75)	172 (56.03)	135 (43.97)	
Occupational status	400			**0.002**
Housewife	312 (78.00)	182 (58.33)	130 (41.67)	
Govt. job	19 (4.75)	7 (36.84)	12 (63.16)	
Private job	53 (13.25)	21 (39.62)	32 (60.38)	
Student	16 (4.00)	4 (25.00)	12 (75.00)	
Family Type	400			**0.001**
Nuclear	127 (31.75)	53 (41.73)	74 (58.27)	
Joint	273 (68.25)	161 (58.97)	112 (41.03)	
Number of family members	400			**0.03**
2-5	243 (60.75)	117 (48.15)	126 (51.85)	
6-9	138 (34.50)	85 (61.59)	53 (38.41)	
10-13	19 (4.75)	12 (63.16)	7 (36.84)	
Family monthly income (in BDT)	400			**0.002**
0-25000 TK	184 (46.00)	113 (61.41)	71 (38.59)	
25000-50000 TK	155 (38.75)	80 (51.61)	75 (48.39)	
50000-75000 TK	38 (9.50)	15 (39.47)	23 (60.53)	
75000-100000 TK	23 (5.75)	6 (26.09)	17 (73.91)	
Water and Sanitation system	400			**0.001**
Hygienic	387 (96.75)	201 (51.94)	186 (48.06)	
Unhygienic	13 (3.25)	13 (100)	0 (0)	

** Chi-square test was done at 5% level of significance*

Table 2. Nutritional status and general health characteristics of respondents

Characteristic	Total N (%)	Prevalence of anaemia, N (%)		p-value
		Anaemic	Non anaemic	
Nutritional status (appearance)	400			**0.02**
Malnourished	88 (22.00)	57 (64.77)	31 (35.23)	
Well-nourished	312 (78.00)	157 (50.32)	155 (49.68)	
Comorbidity (DM, HTN, CKD, CLD)	400			0.11
Present	55 (13.75)	35 (63.63)	20 (36.37)	
Absent	345 (86.25)	179 (51.88)	166 (48.12)	
History of Hookworm infestation	400			0.21
Present	39 (9.75)	22 (56.41)	17 (43.59)	
Absent	262 (65.50)	132 (50.38)	130 (49.62)	
Could not mention	99 (24.75)	60 (60.61)	39 (39.39)	
History of previous surgery	400			0.24
Yes	56 (14.00)	34 (60.71)	22 (39.29)	
No	344 (86.00)	180 (52.33)	164 (47.67)	
Excessive blood loss during previous surgeries	400			0.35
Yes	12 (3.00)	8 (66.67)	4 (33.33)	
No	388 (97.00)	206 (53.09)	182 (46.91)	

** Chi-square test was done at 5% level of significance*

About half of study participants, 196 (49.0%) were in their third trimester, about one quarter, 113 (28.25%) were in their second trimester and the rest, 91 (22.75%) were in first trimester. 221 (55.25%) were multi gravida and 179 (44.75%) were primigravida. More than three-fourth of all participants, 318 (79.50%) had average age at marriage between 10-24 years. Less than half, 179 (44.75%) of all participants had no children. Out of 221 mothers who had at least one child, 183 (82.81%) had given birth to their first child at the age between 15 and 26 years, 198 (89.59%) had 1-3 children in their family and 55 (24.89%) had birth spacing less than 2 years between two subsequent pregnancies. Most of the pregnant women, 316 (79%) were at first decade of their

marriage. Only 43 (10.75%) participants were found to be on their fourth ANC visit during pregnancy. 45 (11.25%) had history of miscarriage. About one-fourth, 107 (26.75%) had history of contraceptive use (Table 3).

3.3 Dietary Practices of Respondents

Majority of respondents met the minimum dietary diversity of food consumption from at least five of the six food groups. 85 (21.25%) pregnant mothers were taking at least 3 meals per day and 163 (40.75%) were taking more than six meals per day. About 21 (5.25%) ate meat, 280 (70%) ate fish, 381 (95.25%) ate green leafy vegetables, 373 (93.25%) ate fruits, 276 (69%) ate egg and 254 (63.50%) drank milk every day. More than half of the participants, 281 (70.25%) had taken multivitamin containing iron and folic acid (Table 4).

Table 3. Obstetrical characteristics of respondents

Characteristic	Total N (%)	Prevalence of anaemia, N (%)		p-value
		Anaemic	Non anaemic	
Duration of marriage	400			0.17
0-10 years	316 (79.00)	160	156	
10-20 years	65 (16.25)	41	24	
20-30 years	19 (4.75)	11	8	
Age at marriage	400			**0.01**
10-24 years	318 (79.50)	180 (56.60)	138 (43.40)	
25-39 years	82 (20.50)	34 (41.46)	48 (58.54)	
Age at first child born	221			0.96
15-26 years	183 (82.81)	110 (60.11)	73 (39.89)	
27-39 years	38 (17.19)	23 (60.53)	15 (39.47)	
Age of last child	221			0.83
1-10 years	202 (91.40)	122 (60.40)	80 (39.60)	
10-19 years	19 (8.60)	11 (57.89)	8 (42.11)	
Average birth spacing	221			0.13
Less than two	55 (24.89)	35 (63.64)	20 (36.36)	
Two or more	166 (75.11)	90 (54.22)	76 (45.78)	
Number of children	400			**0.003**
None	179 (44.75)	81 (45.25)	98 (54.75)	
One	97 (24.25)	50 (51.55)	47 (48.45)	
Two	77 (19.25)	51 (66.23)	26 (33.77)	
Three or more	47 (11.75)	32 (68.09)	15 (31.91)	
Gestational age	400			0.40
First trimester	91 (22.75)	48 (52.75)	43 (47.25)	
Second trimester	113 (28.25)	55 (48.67)	58 (51.33)	
Third trimester	196 (49.00)	111 (56.63)	85 (43.37)	
Frequency of ANC visit	400			0.21
One	165 (41.25)	98 (59.39)	67 (40.61)	
Two	89 (22.25)	45 (50.56)	44 (49.44)	
Three	103 (25.75)	52 (50.49)	51 (49.51)	
Four	43 (10.75)	19 (44.19)	24 (55.81)	
Para	221			**0.02**
1-3	198 (89.59)	114 (57.58)	84 (42.42)	
4-7	23 (10.41)	19 (82.61)	4 (17.39)	
Gravida	400			**0.003**
Primi	179 (44.75)	81 (45.25)	98 (54.75)	
Multi	221 (55.25)	133 (60.18)	88 (39.82)	
History of miscarriage	400			0.77
Yes	45 (11.25)	25 (55.56)	20 (44.44)	
No	355 (88.75)	189 (53.24)	166 (46.76)	
History of contraceptive use	400			0.40
Yes	107 (26.75)	61 (56.01)	46 (42.99)	
No	293 (73.25)	153 (52.22)	140 (47.78)	

** Chi-square test was done at 5% level of significance*

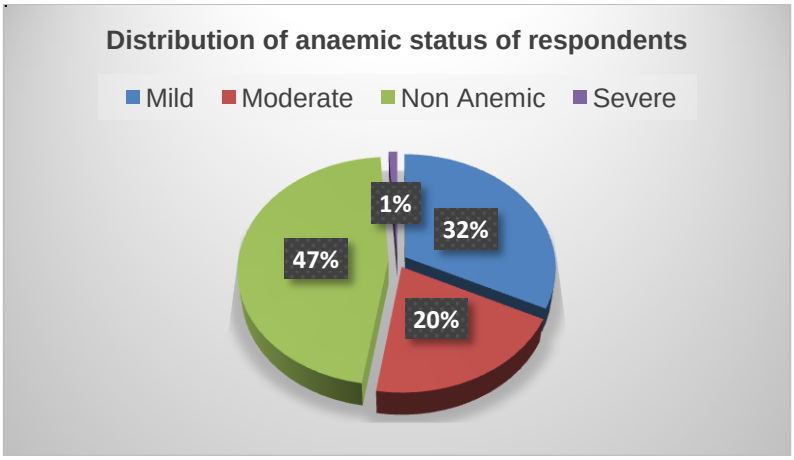
Table 4. Dietary characteristics of respondents

Characteristic	Total N (%)	Prevalence of anaemia, N (%)		p-value
		Anaemic	Non anaemic	
Iron intake	400			**<0.001**
Yes	281 (70.25)	123 (43.77)	158 (56.23)	
No	119 (29.75)	91 (76.47)	28 (23.53)	
Meat consumption	400			**<0.001**
Everyday	21 (5.25)	7 (33.33)	14 (66.67)	
Every alternate day	169 (42.25)	75 (44.38)	94 (55.62)	
Every week or less	210 (52.50)	132 (62.86)	78 (37.14)	
Fish consumption	400			**<0.001**
Everyday	280 (70.00)	130 (46.43)	150 (53.57)	
Every alternate day	89 (22.25)	59 (66.29)	30 (33.71)	
Every week or less	31 (7.75)	25 (80.65)	6 (19.35)	
Green leafy vegetables consumption	400			0.16
Everyday	381 (95.25)	204 (53.54)	177 (46.46)	
Every alternate day	19(4.75)	7 (36.84)	12 (63.16)	
Fruits consumption	400			0.54
Everyday	373 (93.25)	201 (53.89)	172 (46.11)	
Every alternate day	12 (3.00)	7 (58.33)	5 (41.67)	
Every week or less	15 (3.75)	6 (40.00)	9 (60.00)	
Egg consumption	400			**<0.001**
Everyday	276 (69.00)	130 (47.10)	146 (52.90)	
Every alternate day	42 (10.50)	22 (52.38)	20 (47.62)	
Every week or less	82 (20.50)	62 (75.61)	20 (24.39)	
Milk consumption	400			**<0.001**
Everyday	254 (63.50)	112 (44.09)	142 (55.91)	
Every alternate day	32 (8.00)	20 (62.50)	12 (37.50)	
Every week or less	114 (28.50)	82 (71.93)	32 (28.07)	
Food frequency in 24 hours	400			**<0.001**
1-3 meals	85 (21.25)	59 (69.41)	26 (30.59)	
4-6 meals	152 (38.00)	90 (59.21)	62 (40.79)	
> 6 meals	163 (40.75)	65 (39.88)	98 (60.12)	

** Chi-square test was done at 5% level of significance*

3.4 Prevalence of Anaemia

WHO classification of anaemia for pregnant women was used for the following distribution of anaemic status of respondents:



Graph 1. Distribution of anaemic status of respondents

According to WHO, Hemoglobin percentage (Hb%) >11 gm/dl is considered as non anaemic, 9-10.9 gm/dl is considered as mild anaemia, 7-8.9 gm/dl as moderate anaemia and <7 gm/dl is considered as severe anaemia [5]. In this study, almost half of the participants, 186 (47%) were within normal range of Hb%. About 32% had mild anaemia, about 20% had moderate anaemia and only 1% had severe anaemia. The overall prevalence of anaemia among the respondents was 53.50% (Graph 1).

3.5 Associated Risk Factors of Anaemia

Table 1, Table 2 and Table 3 show association of anaemia during pregnancy with several factors including socio-demographic variables, nutritional status, obstetrical characteristics, and dietary practices. $p<0.05$ was considered statistically significant. In our study, there was significant association of anaemia with geographic region ($p=0.02$), education ($p=0.002$), occupational status ($p=0.002$), family type ($p=0.001$), family size (p=0.03), monthly family income ($p=0.002$), water and sanitation system ($p=0.001$), nutritional status ($p=0.02$), age at marriage ($p=0.01$), number of children ($p=0.003$), parity ($p=0.02$), gravidity ($p=0.003$), iron intake ($p<0.001$), meat, fish, egg and milk consumption ($p<0.001$) and food frequency in 24 hours ($p<0.001$). But no significant association of anaemia was found with age, weight, home district, religion, duration of marriage, age at first child born, age of last child, average birth spacing, gestational age, frequency of ANC visits, comorbidity, previous surgery with or without excessive blood loss, miscarriage, contraceptive use, hookworm infestation, green leafy vegetables, and fruits consumption.

A binary logistic regression was conducted to identify the independent factors responsible for anaemia among pregnant women. After adjusted by other variables, age group 27-38 years (AOR=1.847, 95% CI: (1.236, 2.051), p<0.001), family monthly income (BDT) 50000-75000 (AOR=2.145, 95% CI: (1.714, 4.012), p=0.003), nuclear family (AOR=2.045, 95% CI: (1.987, 3.574), p=0.023), para (AOR=2.949, 95% CI: (1.089, 4.217), p<0.027), gravida (AOR=1.636, 95% CI: (1.081, 2.450), p<0.001) were found to be independent factors of anaemia among pregnant mothers. Iron and folic acid supplement was found to be protective of anaemia (AOR=0.432, 95% CI: (0.154, 0.898), p<0.001) (Table 5).

Table 5. Association of risk factors and anaemic status among pregnant women

Characteristic	Total N (%)	Anaemic, N (%)	Non-anaemic, N (%)	AOR (95% CI)	p-value
Age	400				
15-26 years	212 (53.00)	112 (52.83)	100 (47.17)	1	
27-38 years	167 (41.75)	87 (52.10)	80 (47.90)	1.847 (1.236, 2.051)	**<0.001**
39-50 years	21(5.25)	15 (71.43)	6 (28.57)	2.313 (1.167, 7.819)	0.057
Geographic region	400				
Rural	241 (60.25)	140 (58.09)	101 (41.91)	1	
Urban	159 (39.75)	74 (46.54)	85 (53.46)	0.839 (0.457, 2.027)	0.071
Education	400				
Illiterate	62 (15.50)	41 (66.13)	21 (33.87)	1	
Primary	102 (25.50)	56 (54.90)	46 (45.10)	1.623 (1.401, 3.925)	0.12
Secondary	78 (19.50)	49 (62.82)	29 (37.18)	1.117 (0.771, 4.874)	0.084
Higher secondary	85 (21.25)	42 (49.41)	43 (50.59)	1.898 (1.119, 2.175)	0.217
College or university	73 (18.25)	26 (35.62)	47 (64.38)	1.477 (0.778, 8.799)	0.414

Characteristic	Total N (%)	Anaemic, N (%)	Non-anaemic, N (%)	AOR (95% CI)	p-value
Occupational status	400				
Housewife	312 (78.00)	182 (58.33)	130 (41.67)	1	
Govt. job	19 (4.75)	7 (36.84)	12 (63.16)	2.045 (1.057, 4.124)	0.541
Private job	53 (13.25)	21 (39.62)	32 (60.38)	1.873 (0.459, 3.169)	0.308
Student	16 (4.00)	4 (25.00)	12 (75.00)	2.151 (0.849, 3.197)	0.221
Family Type	400				
Nuclear	127 (31.75)	53 (41.73)	74 (58.27)	1	
Joint	273 (68.25)	161 (58.97)	112 (41.03)	2.045 (1.987, 3.574)	**0.023**
Family monthly income (in BDT)	400				
0-25000 TK	184 (46.00)	113 (61.41)	71 (38.59)	1	
25000-50000 TK	155 (38.75)	80 (51.61)	75 (48.39)	1.839 (1.024, 2.451)	0.347
50000-75000 TK	38 (9.50)	15 (39.47)	23 (60.53)	2.145 (1.714, 4.012)	**0.003**
75000-100000 TK	23 (5.75)	6 (26.09)	17 (73.91)	1.797 (0.457, 3.512)	0.078
Nutritional status (appearance)	400				
Malnourished	88 (22.00)	57 (64.77)	31 (35.23)	1	
Well-nourished	312 (78.00)	157 (50.32)	155 (49.68)	1.847 (1.243, 2.147)	0.234
Para	221				
1-3	198 (89.59)	114 (57.58)	84 (42.42)	1	
4-7	23 (10.41)	19 (82.61)	4 (17.39)	2.949 (1.089, 4.217)	**0.027**
Gravida	400				
Primi	179 (44.75)	81 (45.25)	98 (54.75)	1	
Multi	221 (55.25)	133 (60.18)	88 (39.82)	1.636 (1.081, 2.450)	**<0.001**
Iron intake	400				
Yes	281 (70.25)	123 (43.77)	158 (56.23)	1	
No	119 (29.75)	91 (76.47)	28 (23.53)	0.432 (0.154, 0.898)	**<0.001**

** Binary logistic regression analysis was conducted at 5% level of significance. AOR = adjuster odds ratio; CI = confidential interval, 1 = Reference*

4. DISCUSSION

In this study, the prevalence and associated risk factors of anaemia among the pregnant women receiving ANC at JRRMCH; a tertiary-level hospital in Sylhet, Bangladesh were assessed. The prevalence of anaemia was found 53.50%. Out of 400 respondents, 214 women were found anaemic. Among those anaemic pregnant mothers 60.28% were mildly anaemic, 37.85%

were moderately anaemic and 1.86% was severely anaemic. To our knowledge, this is the first study to determine the prevalence and associated risk factors of anaemia during pregnancy in the divisional city, Sylhet, Bangladesh. A few relevant studies have been conducted on different parameters in other cities in Bangladesh [12,13,14,15,16]. A study carried out in Dhaka city reported that the prevalence of anaemia was 37% [14] that is quite less than our study result. A cross-sectional study conducted in Jessore has been reported that the overall prevalence of anaemia during pregnancy is 58.9% which is close to what we have found in our study [12]. According to that study, majority of anaemic mothers were moderately anaemic (62.4%) whereas the prevalence of mildly anaemic mothers was the highest (60.28%) in our study, but the percentage of severely anaemic mothers found nearly same in both studies. The prevalence of anaemia of a study conducted on government and private hospitals in Bangladesh was 62.5% which is almost 10% higher than that of our finding [13]. A study based on evidence from nationally representative survey data has been reported that the prevalence of anaemia in Bangladesh is 41.8% [11]. However, the prevalence found in our study is higher than the overall prevalence found in Bangladesh [8]. The prevalence found in our study may differ considerably due to changes in level of education, socio-economic condition and proper health education and family planning services.

The findings of our study determined several factors that are strongly associated with anaemia during pregnancy including geographic region, education, occupational status, family type, family size, monthly family income, water and sanitation hygiene, health status, age at marriage, parity, gravidity, iron intake, and food frequency which is almost like the findings of some other studies [12,13,14,15,16,19]. A study conducted on government and private hospitals in Bangladesh reported that, anaemia during pregnancy is significantly associated with maternal age, monthly family income, parity, gravidity, contraception, and iron supplementation [13]. Another study conducted in Jashore, Bangaldesh reported that there is a significant association of anaemia with family size, gestational age, birth spacing, excessive blood loss during previous surgery and food frequency [12]. A study based on capital city, Dhaka, in Bangladesh reported that anaemia in pregnancy is strongly associated with maternal age, maternal education, monthly income and living area [14]. Above mentioned studies [12,13,14] found association with maternal age, birth spacing <2 years, gestational age, blood loss during previous surgery and contraceptive use but our study found no association of anaemia with these factors. In our study, anaemia prevalence was found high among pregnant mothers with no education, those who were living in rural area compared to urban area, in a socio-economic condition with monthly family income <25000 BDT which aligns with some other studies [11,12,14]. According to the findings of a study conducted in the capital city Dhaka, Bangladesh, anaemia prevalence was low among pregnant mothers those were taking oral iron supplementation throughout their pregnancy [14], we also found same finding in our study. It has been observed in our study that most of anaemic mothers were in their second and third trimester. This is due to an increase in iron absorption as pregnancy progresses [30]. In this study, participants who had family income 50000-75000 BDT (AOR=2.145, 95% CI: (1.714, 4.012), p=0.003) were less likely to be anaemic compared to the participants who had family income 0-25000 BDT. It was observed in our study that only age group 27-38 years (AOR=1.847, 95% CI: (1.236, 2.051), p<0.001) were significantly associated with anaemia whereas several age groups have been found significantly associated with anaemia during pregnancy in a study conducted on government and private hospitals [13]. Anaemia was more prevalent in nuclear family (AOR=2.045, 95% CI: (1.987, 3.574), p=0.023), para (1-3) (AOR=2.949, 95% CI: (1.089, 4.217), p<0.027) and multi gravida (AOR=1.636, 95% CI: (1.081, 2.450), p<0.001). Similar results have also been reported on other Bangladesh based studies [13,14]. We also found significance association between iron and folic acis sumpliment and anaemia (AOR=0.432, 95% CI: (0.154, 0.898), p<0.001). A study conducted on pregnant mothers in Dhaka city also reported similar results [14]. The findings indicate that the high prevalence of anaemia may be due to iron deficiency. Therefore, it is recommended that pregnant mothers should be more careful about their health during pregnancy so that they can prevent the life-threatening risk of anaemia.

5. CONCLUSION

Anaemia during pregnancy has become a serious public health problem in Bangladesh. In our study more than half of pregnant mothers

were anaemic and majority of them had mild anaemia. Our study result suggests that it is highly recommended to improve socioeconomic condition, the level of education, water and sanitation hygiene and the quality of ante-natal services to prevent anaemia among pregnant mothers. As all the women during pregnancy are the most vulnerable group to have anaemia, proper knowledge and health education about anaemia can reduce the severity and adverse outcomes of anaemia. Iron supplementation during pregnancy should be encouraged by the government. Iron and folic acid supplementation for 3 months prior to pregnancy can reduce the chance of developing anaemia in early pregnancy. Preventing anaemia during pregnancy requires special attention in improving maternal health status. Government should take pragmatic interventions to ensure maternal health. Besides, non-governmental organizations should also work in the field level to raise awareness among people especially in rural areas. Moreover, educating people by providing proper knowledge about the cause and adverse effect of anaemia in pregnancy as well as all the preventive measures may help to reduce the prevalence of anaemia in pregnancy in Bangladesh.

CONSENT

Author declares that 'written informed consent was obtained from the patient (or other approved parties) for publication of this article. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

Author hereby declares that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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