

# **A STUDY ON THE ASSESSMENT OF HEMOGLOBIN LEVELS AMONG ADULT FEMALES IN BANGLADESH**

By

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A thesis submitted to the School of Pharmacy in partial fulfillment of the requirements for  
the degree of Bachelor of Pharmacy (B. Pharm.)

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## **Declaration**

It is hereby declared that

1. The thesis submitted is my own original work while completing degree at BRAC University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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## **Ethics Statement**

This project does not involve any kind of animal or human trial.

## Abstract

The significance of assessing hemoglobin levels among adult females in Bangladesh is vital for detecting low hemoglobin levels and preventing complications, particularly among this demographic. The study aims to evaluate the frequency and the criteria of low hemoglobin in the country, which is a considerable yet not well-recognized health problem of the population. Between January and June 2025, a cross-sectional survey was conducted, which covered 1,019 adult females aged 15-45 years from both rural and urban areas. The hemoglobin measurement was taken by a finger-prick process, where I collected one drop of blood. Moreover, Information related to demographic lifestyle, diet, and other health-associated criteria was obtained through self-prepared questionnaires. Results showed 51% of the respondents had decreased levels of hemoglobin, and this tendency was more common among the females aged 36 to 45. There were statistically significant associations between low hemoglobin and age, education, marital status, physical activity, and various symptoms, including loss of appetite, dizziness, and drowsiness. The most affected were the illiterate females, those who were regular at physical activities, and also the widowed women. The outcomes highlight the importance of conducting regular hemoglobin screenings, providing health education, and enhancing nutritional and social conditions to address complications associated with decreased hemoglobin levels. Given the current scarcity of research and data on hemoglobin tests in adult females in Bangladesh, this study is important for filling knowledge gaps and informing people to take necessary steps for adult females in the country.

**Keywords:** Hemoglobin levels; Adult females; Prevalence; Cross-sectional survey; Finger-pick process; Demographic lifestyle; Health complications; Screening.

## **Dedication**

The project was dedicated to my parents, who have supported me and motivated me to shape my journey; especially my mother, who has always been a great source of strength, and to my amazing husband, my source of inspiration, MD Isa Sayek Huda, who has been guiding me and advising me, and consistently made me strive to evolve.

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## List of Acronyms

|        |                                                        |
|--------|--------------------------------------------------------|
| WHO    | World Health Organization                              |
| BMI    | Body Mass Index                                        |
| Hb     | Hemoglobin                                             |
| OR     | Odds Ratio                                             |
| CI     | Confidence Interval                                    |
| df     | Degrees of Freedom                                     |
| SPSS   | Statistical Package for the Social Sciences            |
| NIPORT | National Institute of Population Research and Training |
| ICF    | International Center for Integrated Development        |

# Chapter 1: Introduction

## 1.1 Background and Importance of the Study

An essential metalloprotein that is present in red cells is hemoglobin. It is instrumental in the delivery of oxygen in the lungs to the rest of the tissues in the entire body. The average level of hemoglobin in the body of a female is 12.1-15.1 g/dl. When the range varies between 11-11.9 g/dl, 8-10.9 g/dl and less than 8 g/dl it can be classified as mild, moderate and severe respectively (Moawad, 2025). There is a higher likelihood that the females would present with lower hemoglobin counts as compared to males. In Bangladesh, 51% of females are affected with low levels of hemoglobin, and 22% have mild, 24% have moderate and 5% have severe diminished hemoglobin (Rahman et al., 2021). In many cases, older women experience lower hemoglobin levels caused by nutrition insufficiency, adverse effects, side effects of drugs, and chronic illnesses.

Reduced hemoglobin levels is a significant aspect of high global health priorities in females with a large percentage recorded in most regions of the world. The high prevalence in females who bear reduced hemoglobin level occurs in other countries as the following studies show:

In Africa: Ethiopia (23.6), Madagascar (35.3), Malawi (32.7), Uganda (31.1).

Between South Asia: India (57%), Nepal (40.6%), Pakistan (41.7%). South-East Asia: Myanmar (40.6%), Indonesia (40.6%) (Safiri et al., 2021).

Nonetheless, despite its worldwide reputation in its health and developmental impacts, further severe implementation and special research ought to be completed specifically in Bangladesh because it could guide prevention and cure guidelines in high burden regions of the earth (Sunuwar et al., 2020). However, the original researches indicate that moderate and severe prevalence of the low hemoglobin levels affect a range of 39.9% to 51.9% of the Bangladeshi

adult females (WHO, 2016). Thus, it is of great essence to establish the hemoglobin levels as we observe, there are still few studies that have already been carried out in Bangladesh regarding the low levels of hemoglobin but they are not sufficient to calculate accurate estimation.

## **1.2 Significance of Hemoglobin Levels in Adult Females**

The continuation of the correct physiological processes is impossible without a sufficient amount of hemoglobin in the body to maintain optimal energy metabolism, and health. The low level of hemoglobin may lead to many health-related complications, which may include weakness, fatigue, shortness of breath, and cognitive dysfunctions. Furthermore, it could also cause more serious problems like an even higher chance of getting infected, related poor pregnancy outcomes, and impaired quality of life (Wendt et al., 2023).

The problem of low hemoglobin levels on a large scale in Bangladesh is usually associated with the lack of nutrition and chronic illnesses especially among adult females. The world health organization (WHO) reports that low hemoglobin levels may be used to indicate a host of critical diseases or conditions including:

- Iron deficiency anemia (certain intake or absorption of iron),
- Anemia due to vitamin deficiency (as a result of reduced food consumption or malabsorption),
- Chronic disease anemia (chronic infections, inflammations, malignancies etc.),
- Hemolytic anemia (due to premature destruction of RBC),
- Sickle cell diseases (caused due to inherently mutated gene, which in-turn results in abnormal hemoglobin thus causing low hemoglobin levels),

- Thalassemia (which can be a congenital mutated version of a gene that produces hemoglobin and causes the level of hemoglobin to dip),
- Chronic kidney diseases (related to reduced erythropoiesis, resulted in the lack of producing RBC in the blood, thereby, reduced concentration of hemoglobin),
- Nutritional malabsorption (which results in gastrointestinal disorders, trauma, surgery),
- Gastrointestinal tract bleeding (acute blood loss) (Kassebaum et al., 2014).

Iron deficiency anemia is identified to affect 5% to 36% of adult women according to population studies, which are necessary to change how nutrients are processed (Barton et al., 2024). Further research indicates that on average 1.3g/dl decline of hemoglobin occurs during pre and post menstruation (Columbia Doctors, 2024). Women susceptible to elongated menstrual flow are more likely to develop iron deficiency anemia, which might result in a widespread condition observed in females before the menopause that results in iron deficiency by roughly 20% to 65% (Chai et al., 2021).

Consequently, it is more important that adult females have adequate hemoglobin levels. Given that hemoglobin acts as a catalyst for different diseases, the analysis of hemoglobin is closely related to early detection and treatment of health issues that are potentially fatal (Healthline, n.d.).

### **1.3 Prevalence of Low Hemoglobin Levels in Bangladesh**

Decreased level of hemoglobin is a prevalent but at the same time under-recognized health problem in Bangladesh, particularly in adult females. Research studies on health surveys consistently indicate that more than 40% of adult females who are in their reproductive age have hemoglobin levels that fall below the recommended level as the ideal internal level to

maintain optimal health, in Bangladesh (Sultana et al., 2025). Nevertheless, such statistics could not reflect the actual scale of the issue. Limitations on screening, irregular medical examination, and less availability of screening services in underprivileged and rural settings make many of these women with a marginally low hemoglobin level undetected (Bhowmik et al., 2021). Dietary patterns and temporary complications related to health issues were followed by undiagnosed persistent ones and seasonal changes in hemoglobin may lead to serious diseases (Shahjahan et al., 2024).

Moreover, national data is based on approximate measures such as anemia prevalence, which is correlated but does not necessarily record cases of low hemoglobin level (Hossain et al., 2024). This creates a false fallacy in the perception that there is a smaller number of women whose oxygen-conveying capacity and the overall health of women have been jeopardized and crippled. Low hemoglobin is not detected sooner because women do not get to attend preventive health services due to social and cultural requirements in most societies (Sultana et al., 2025).

A multi-pronged approach is required to achieve more accurate estimations. These involve the use of regular based hemoglobin screening programs with portable screens, the incorporation of routine testing into the females' and reproductive health, and having long-term health records to assess the change over time, which are not yet available in Bangladesh (Rahman et al., 2023). Females often lack access to education, which could inform them that checking hemoglobin levels before symptoms appear is crucial (Billett, 1990). Hence, this can be sorted by having regular assessment and screening of the hemoglobin levels within the whole country. Additionally, sharing information among public health authorities, local NGOs, and nutrition programs will ensure a representative and comprehensive data collection method, enabling the implementation of tailored interventions to address the low hemoglobin problem in the population (Hossain et al., 2024).

## **1.4 Global and Bangladesh Perspective on Female Hemoglobin Status**

### **1.4.1 The Hemoglobin Status in Global Perspective**

The hemoglobin level among adult females is a highly vital indicator for maintaining general health conditions globally. Low hemoglobin level has been identified among the population by The World Health Organization (WHO), where most of which leads to anemia, and this is the most common public health problem in the world among adult females. To be very specific, WHO estimation shows that low levels of hemoglobin affect around 1.9 billion individuals (roughly a quarter of the world population), with the most susceptible ones being women of childbearing age and young children (WHO, 2021).

The rates of low hemoglobin occurrence differ vastly in terms of regions and countries. Dietary iron deficiencies, parasite infections, and limited access to medicine contribute to low hemoglobin levels in South Asia, Sub-Saharan Africa, and parts of South-East Asia, particularly. The rate of anemia among adult women in these areas may be shocking:

- Approximately 50% of the females of childbearing age in India are afflicted by anemia (Kassebaum et al., 2014).
- The prevalence of hemoglobin level among adult females may be as high as 60% in Sub-Saharan Africa, especially in nations like Ethiopia and Nigeria (WHO, 2021).
- In Indonesia, the prevalence of decreased levels of hemoglobin in adult females is about 37% (Balarajan et al., 2011).
- Studies indicate that, in South India, about 43% of university students suffer from decreased levels of hemoglobin (Subramaniyan et al., 2016).

High prevalence rates of decreased hemoglobin levels are observed in contrast to high-income countries, which have access to improved nutrition. Notwithstanding, some vulnerable groups,

or rather, populations that are at risk of low hemoglobin such as pregnant women, older women, and immigrants who come to places with a high prevalence of anemia:

- Low hemoglobin affects approximately 10% of adult women in the USA. However, these rates in particular ethnic groups are higher among Hispanic and Black American women (Centers for Disease Control and Prevention, 2020).
- About 8-10% of adult females complain of decreased hemoglobin level in Canada, with an increased risk among Indigenous people (Health Canada, 2017).

### **1.4.2 The Hemoglobin Status in Bangladesh Perspective**

The decreased level of hemoglobin is on the rise in Bangladesh, nearly 41.8% in females between the ages of 15 and 49 and 53.2% in children younger than five years, because iron deficiency dominates (NIPORT, Mitra and Associates, & ICF, 2019). Even higher is the prevalence in rural places, where 47% of females experience decreased levels of hemoglobin (Bhowmik et al., 2021).

The decreased level of hemoglobin in pregnant women reaches the level of 44%, and in adolescent girls, it reaches 42.5% (Khatun et al., 2018; Sultana et al., 2020). Such a high level of low hemoglobin is dangerous to society in terms of maternal and fetal health complications of babies and cognitive development of teenagers. Combating decreased levels of hemoglobin in Bangladesh should involve strategies that encompass regular assessment of hemoglobin, better nutritional dietary choices, increasing access to supplements, and health education to ease the influence of low hemoglobin levels (Bhowmik et al., 2021; NIPORT et al., 2019).

## 1.5 Reasons for Low Hemoglobin Levels in Adult Females

The factor that has been a major concern to the public in general in Bangladesh is the fact that there are levels of hemoglobin among adult females which is not satisfactory and that leads to several cases of anemia, amongst other health issues. The low hemoglobin level in women is getting crucial in the country due to several reasons which could be physiological, dietary, socio-economic and partly due to cultural influences (Subramaniyan et al., 2016). There are the following key determinants:

- **Greater Demand of Iron:** The requirements of iron increase during menstruation, conception, and breastfeeding. The persistence of menstrual bleeding and particularly those women who have heavy menstruation weakens iron needs and contributes significantly to deficiency of this nutrient (Subramaniyan et al., 2016).
- **Less Iron Absorption:** Eating antagonists (e.g. phytates, calcium), and gastrointestinal disorders (e.g. celiac disease) interfere with absorption of iron (Islam et al., 2023).
- **Dietary Deficiencies:** Deficiency in the intake of iron-rich foods (meat, legumes and green leafy vegetables) would also result in low hemoglobin level (Cleveland Clinic, n.d.).
- **Socio-economic Factors:** Iron deficiency is aggravated by poverty and poor accessibility of health services, especially in rural households (Cleveland Clinic, n.d.).
- **Cultural Practices:** The eating habits associated with the cultural differences could restrict iron intake or avoid nutrients that are rich in iron (Hematology-Oncology Associates of CNY, n.d.)

## **1.6 Low Hemoglobin Level: A Serious but Preventable Problem**

Low hemoglobin levels and particularly iron deficiency anemia among the adult females in Bangladesh can be controlled by adopting practices of regular monitoring and early intervention. Periodic hemoglobin screening is indispensable as it will help identify the condition in time when a person has no serious symptoms such as fatigue, weakness, and dizziness (MedlinePlus, n.d.).

A simple and low-cost blood test called routine hemoglobin testing assists the medical staff to determine whether hemoglobin level is too low and highlights the correct treatment approaches. With routine programs of screening of hemoglobin, the women get early guidance on ways to change diet, the iron supplements, and treatment of the underlying diseases causing the anemia (MedlinePlus, n.d.). It is also possible to observe the level of hemoglobin to see how properly the treatment is performed and change the process to achieve restoration and avoid complications (Billett, 1990).

Moreover, with the early identification of the disease and subsequent treatment, it is possible to have a great positive impact on the physical and mental productivity of women, as well as maintaining high quality of life. Realistically, institutions promoting regular hemoglobin tests during annual health exams or community health programs will enable females to keep their iron levels at the necessary degree (Billett, 1990). With health education on iron rich foods, intake to enhance iron absorption (vitamin C) and avoidance of such infections that exacerbate anemia can be very helpful (MedlinePlus, n.d.). In such a way, management of anemia becomes a proactive process but not a reactive one, decreasing the burden of the disease and enhancing health outcomes in adult females of Bangladesh.

## **1.7 Purpose of the Study**

The research aimed to determine the rate of hemoglobin and the level of reduction in hemoglobin levels among females in Bangladesh. It will assist in drawing attention to the role of routine hemoglobin testing and support the use of effective measures. Health outcomes will be enhanced, economic costs will decrease, and the productivity of women will increase by addressing the issue of hemoglobin levels. Hence, a reduction in hemoglobin levels among women is a worrisome health condition, and the practical determination of hemoglobin levels is limited. Therefore, the estimation of hemoglobin level has not been widely established among the people in Bangladesh. The level of hemoglobin is crucial in the diagnosis of most primary conditions. Repeated hemoglobin testing would enable us to present the information to inform health policy and allocate sufficient resources. It also assists in targeting nutritional programs for iron deficiency and in improving dietary intake. Regulation of hemoglobin level avoids the complications during pregnancy (i.e., preterm births, low birth weight, postpartum hemorrhage). Besides, quick diagnosis also lowers treatment expenses and increases productivity, particularly in cases of life-threatening diseases characterized by low hemoglobin values. Addressing these objectives, the project aims to enhance the healthcare system, raise awareness, and facilitate the integration of hemoglobin post-assessment into Bangladesh's healthcare system.

## **Chapter 2: Methodology**

### **2.1 Study Design and Participant**

The study was conducted through a cross-sectional in-person survey to investigate the hemoglobin levels among adult females in Bangladesh, examining their demographic lifestyle, and dietary habits. From January 2025 to June 2025, we collected my information. The survey had 1019 responses, with 495 respondents aged 15 to 25 years, 275 aged 26 to 35 years, and 249 aged 36 to 45 years. We extracted responses from Bangladesh's rural and urban areas. The responses were separated into the following categories: there were 459 urban adult females and 560 rural adult females. We visited various areas of Mirpur, Motijheel, the Dhaka University area, and Brac University with friends and family to collect urban data. We have visited several villages in Brahmanbaria, Bikrampur, Srinagar and Narayanganj, Kishoreganj to gather the rural responses. We have visited Sijuye Kindergarten in Bikrampur School and Srinagar Government Girls School to collect responses from teachers and staff.

Each participant was personally approached and requested to fill out my survey. I gave them an explanation of the study's objectives and approaches before they responded. Before gathering their answers, I got each participant's verbal or written agreement. I observed that rural women were less willing to provide information. I took great care to ensure their comfort while following ethical standards. I maintained the confidentiality of the participants' information and showed complete respect for their privacy. They were free to stop participating at any moment; it was entirely voluntary. The information I collected was used for research only.

## **2.2 In-depth Questionnaire**

The questionnaire of this study was designed with two primary sections: demographic lifestyle, dietary habits and hemoglobin rate in g/dl, to collect necessary information. Basic information like age, education, profession, marital status, weight, height, monthly income, area of residence (urban/rural), number of family members, smoking habit, addiction, diet, change in appetite, intake of supplements, frequency of medications, sleeping problem present or not, blurred vision present or not, physical activity/ exercise habit were all included in the demographic section. Measurement of hemoglobin value with one drop blood hemoglobin testing equipment named “VivaDiag Plus Hemoglobin Meter”. To make sure it was understandable to everyone, we first created the questionnaire in English and then translated it into Bangla. Before starting the full-scale data collection, we assessed the questionnaire with a small group of randomly chosen urban participants to ensure the questions were clear and useful. We made a few little changes to enhance comprehension based on their input. We collected responses by distributing paper forms by hand and interviewing individuals who required help in person.

## **2.3 Assessment of Hemoglobin Levels**

Hemoglobin levels were assessed through a minimally invasive finger-prick method that requires only a single drop of capillary blood. I cleaned the fingertip with an alcohol swab first, then used a sterile lancet to obtain the blood sample, which was then placed into a disposable microcuvette. The cuvette is inserted into a point-of-care hemoglobin analyzer, “VivaDiag Plus Hemoglobin Meter,” which has provided an immediate reading of hemoglobin concentration in grams per deciliter (g/dL). This method is widely used in community and clinical settings because it is rapid, reliable, and requires minimal equipment. It is suitable for large-scale screenings and field surveys while ensuring participant comfort and safety.

## 2.4 Data Collection Experience

Firstly, for collecting the responses, my friends and I were going to the rural side. The first day, we visited Bikrampur and paid a visit to the higher authority of Sijuye Kindergarten School. We provided them with the required documents when they requested ethical authorization. They reviewed them on the second day, allowing me to collect responses and draw blood from the teachers and staff members. As a group, everyone was helpful and could also fill in the form independently. In addition, the following week, we visited Srinagar Girls' High School to collect responses and measure hemoglobin using the same procedure. We also visited the slum zones of Narayanganj and Brahmanbaria, where we discovered that many of the women in the countryside were unwilling to disclose their details. We assisted individuals through face-to-face interviews who were unable to read. There were some problems that we encountered; however, we could handle them easily. My family and I have also visited Kishoreganj which is my hometown, to gather information.

We began to get the urban responses after completing the rural section. We also gathered feedback from my relatives and other family members in various places, including Motijheel, Mirpur, and other parts of Dhaka. We have also selected responses from women who work as helping hands in households. We have gathered answers from even my university students, my juniors, seniors, classmates, and the female staff as well. Everybody was so supportive towards me and contributed so much to help me get my answers all together. We had an exciting experience when we visited the Dhaka University premises to gather responses. One of the pharmacy students we met assisted me in gathering information through my questions to the students of the pharmacy department. This support affected me immensely, and it further added to the importance of my fieldwork.

## **2.5 Data Analysis Tools**

We have used Office 365 Excel 2024 and IBM SPSS Statistics V29.0.2 for analyzing data. We coded and tabulated the information that we had gathered with the help of Microsoft Excel. It helped me in organizing the data effectively, creating tables, and drawing graphs in a way that allowed me to communicate my findings successfully. I relied on SPSS (Statistical Package for the Social Sciences) to perform statistical tests and seek trends in the data in order to carry out a deeper study. In these ways, it became easier to study the hemoglobin and identify level patterns and understand how different variables can affect hemoglobin levels.

## **2.6 Criteria for Inclusion and Exclusion**

### **2.6.1 Criteria for Inclusion**

The following are the inclusion criteria for this study:

1. Participants must be an adult female between 15 to 45 years old.
2. People who live in Bangladesh's rural and urban areas.
3. Participants who agreed to participate in the study after being informed.
4. Those who were able to comprehend and answer the survey.

### **2.6.2 Criteria for Exclusion**

The following are the inclusion criteria for this study:

- 1) Females under the age of 15 or above 45.
- 2) Individuals with serious cognitive impairments or illnesses that made responding to questions challenging.
- 3) Individuals who declined to give their consent for the research.
- 4) Participants who were unable to participate due to severe illness.

## **2.7 Ethical Permission**

SOUTHEAST UNIVERSITY in Dhaka granted ethical approval for the study. After reviewing the study, the Committee for Ethical Compliance in Research gave its approval. The reference number for CECR is SEU/Pharm/CECR/022/2024. We have already covered the objective and purpose of the study in the questionnaire's introduction, and we have taken consent from individual participants.

## Chapter 3: Result

### 3.1 Socio-demographic measures:

From the table 1, we got the highest proportion of decreased hemoglobin level amongst the variables are age 36-45 (59%), BMI normal and overweight (both 51%), widowed (68%), illiterate (64%), service (60%), middle-income (55%), rural (53%), nuclear/joint family (Both 51%), non-smokers (51%), physical exercise no (51%), physical work too much (64%) and no specific diet (52%), on dietary supplement (54%), taking medications (57%), loss of appetite (61%); presence of tiredness/drowsiness (56%), presence of dizziness/blurred vision (60%), difficulty sleeping (54%) and aware of own Hb level (56%).

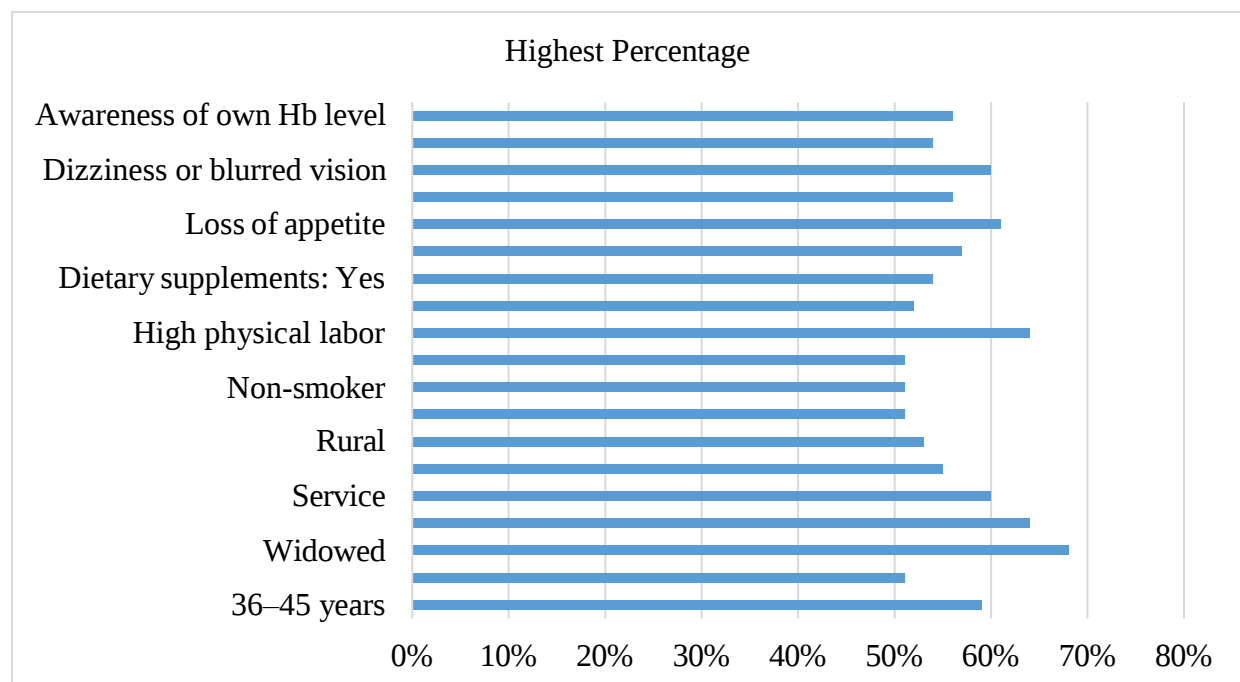


Figure 1: Categories with highest percentage of Low Hb

## 3.2 Low Hemoglobin Levels:

### 3.2.1 About Chi-Square Data Sheet

Given the prevalence of low hemoglobin levels among adult Bangladeshi females, it is essential to monitor hemoglobin levels regularly to prevent the associated health challenges. The research was conducted on 1019 adult female respondents, among whom 520 demonstrated a depressed hemoglobin level, constituting 51%.

The yielded data is allocated into different age groups. They observe that the level of hemoglobin is reduced when comparing the age groups ( $p < 0.001$ ). There are 45% with low hemoglobin level aged between 15 and 25 years, 54% in the 26 to 35 years, and 59% in the 36 to 45 years group. In this manner, it indicates that the prevalence of lowered hemoglobin gradually increases with age.

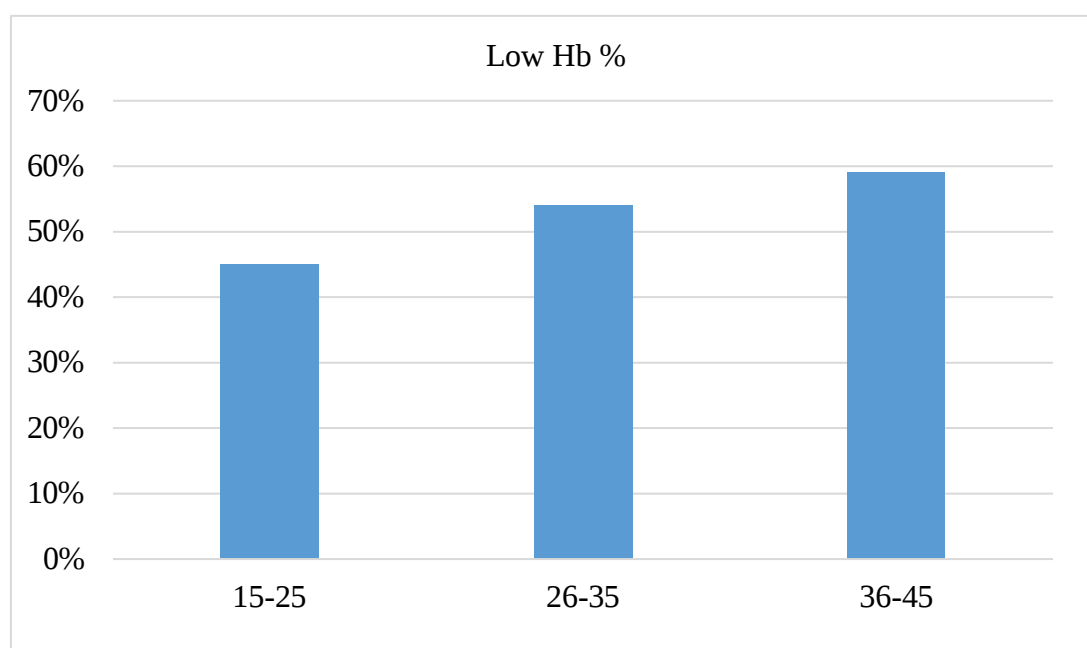


Figure 2: Association between Age and Low Hb level

There was no significant association found between decreased hemoglobin level and BMI ( $p=0.952$ ). The prevalence rates were almost equalized between the groups: 49% of the respondents had CED (BMI < 18.5), 51% of the respondents had a normal BMI, and 51% of the respondents were overweight.

There was a significant association between decreased hemoglobin level and marital status ( $p=0.007$ ). The highest rate was observed for widowed women, which is 68%, followed by divorced women, which is 50% and married women, which is 55%. On the other hand, unmarried women had the lowest rate, which is 45%. Women in particular, such as widows may experience poorer emotional stress, have less access to nutritious food or be disadvantaged in terms of healthcare resources, these can influence hemoglobin level. The moderately high rate indicated by married women may be related to pregnancy, lactation, or family demands caused by nutrition. On the other hand, unmarried women can be offered more freedom in their nutrition and health care which may be the reason behind their lower rates.

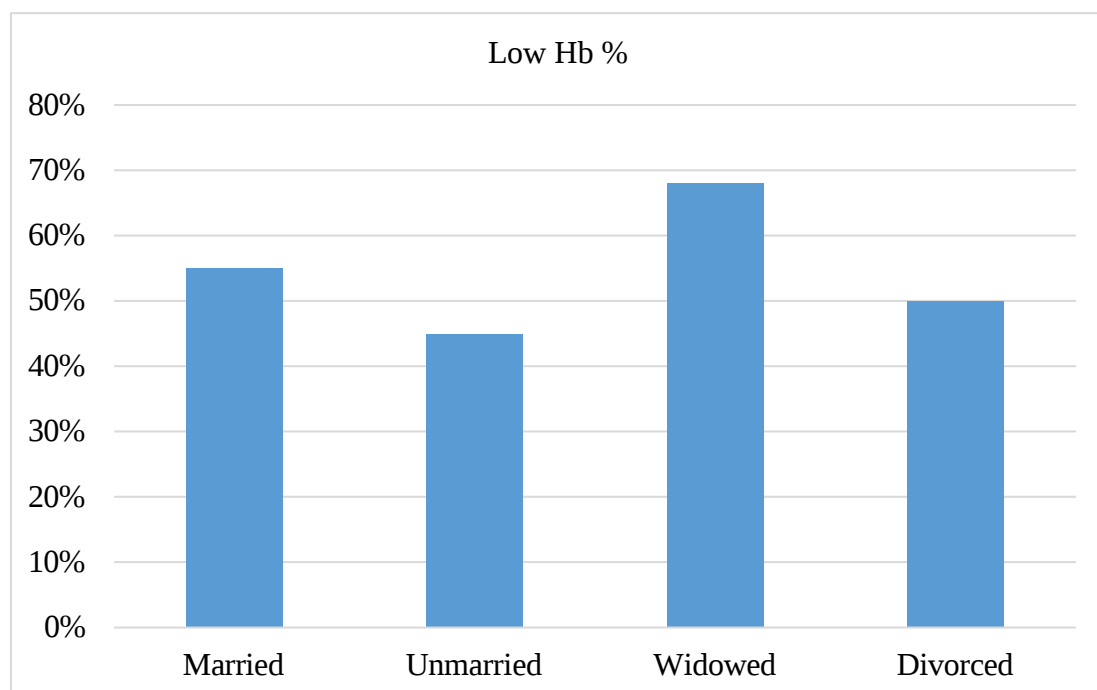


Figure 3: Association between Marital status and Low Hb level

A significant relation between educational level and decreased hemoglobin level was observed ( $p = 0.039$ ). The highest prevalence was in illiterate participants at 64%, followed by primary and secondary, both at 51%. A comparatively lower prevalence 48% was noticed among the respondents who had graduated or higher education. There was also a significant relation between decreased hemoglobin level and occupation ( $p=0.012$ ). Illiterate people are more likely to have a decreased level of hemoglobin due to their limited understanding of the importance of adequate hemoglobin levels in maintaining health.

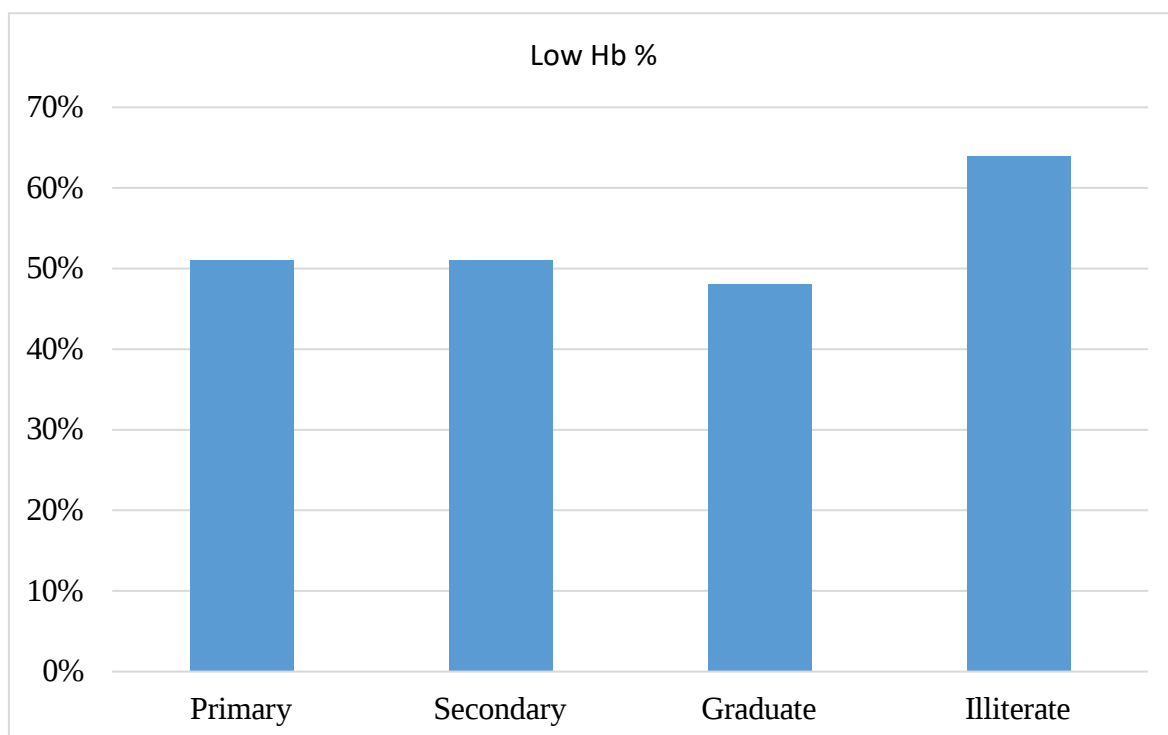


Figure 4: Association between Educational qualification and Low Hb level

A higher percentage of homemakers (54%) and service holders (60%) had the lowest and highest prevalence, respectively, compared to the students, which was 45%. The percentage of

the businesswomen and unemployed respondents were 50% and 46%, respectively. As a result, we can say that the service holders are holding the highest percentage.

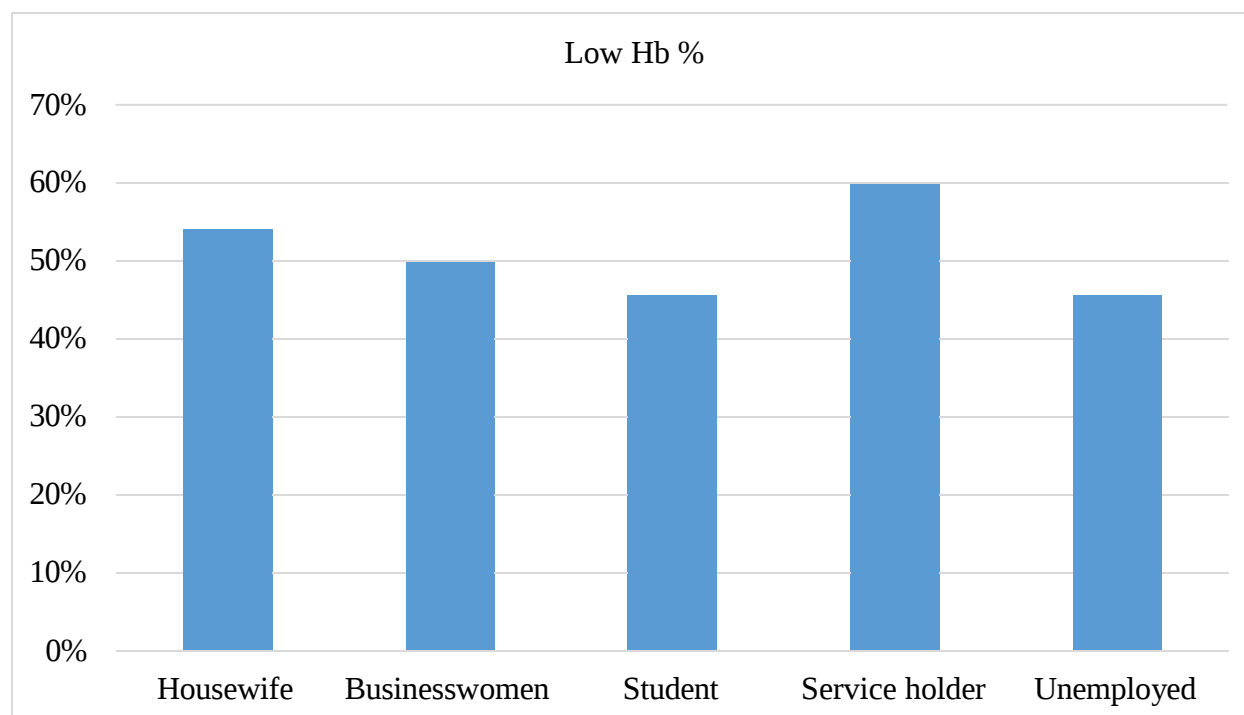


Figure 5: Association between Professions and Low Hb level

A significant association was found between low hemoglobin levels and daily physical activity ( $p = 0.012$ ). The prevalence of decreased hemoglobin levels was predominantly high among respondents who were engaged in high physical labor (64%), compared to those with medium physical activity (51%) and those with no physical activity (46%). This suggests that women who were engaged in physical activities prone to hemoglobin reduction are more likely to experience hemoglobin reduction.

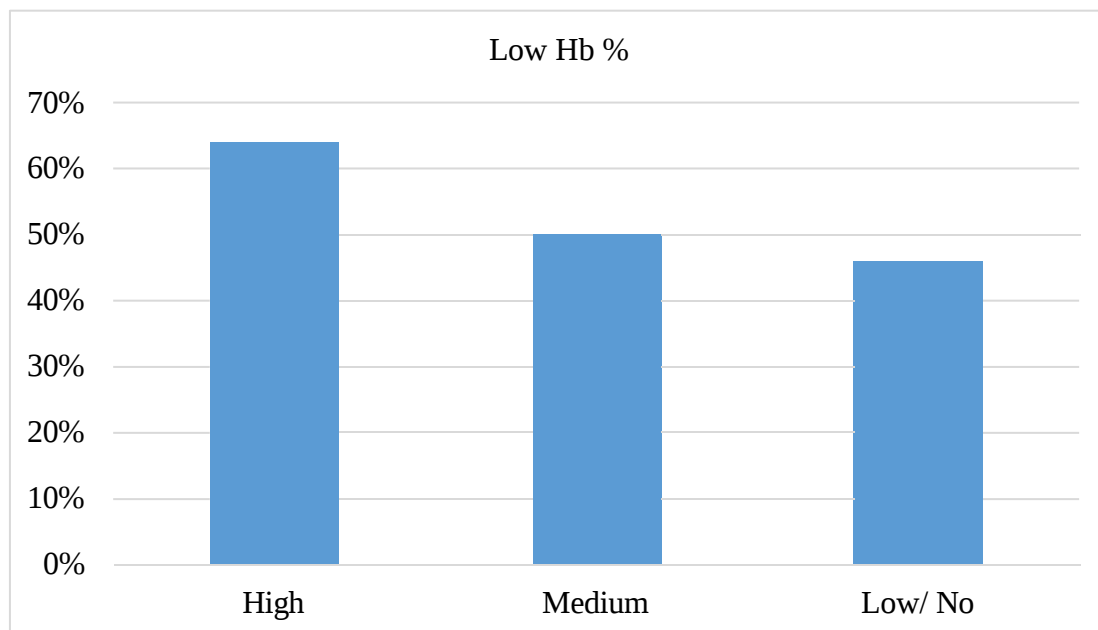


Figure 6: Association between Physical activity and Low Hb level

The use of medication has a significant association with the decreased level of hemoglobin ( $p = 0.025$ ). Among the participants who had the habit of taking medications regularly, 57% of their respondents had low hemoglobin as opposed to 49% of those who were not taking medications. Health conditions that may require medication can also lead to reduced hemoglobin levels.

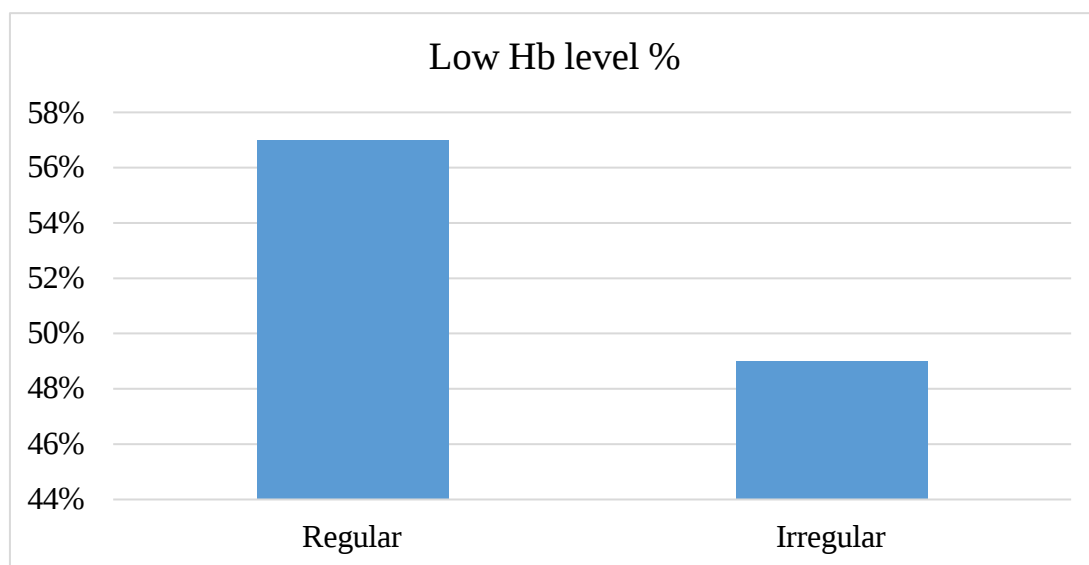


Figure 7: Association between Use of medication and Low Hb level

A significant association was found in decreased hemoglobin level with changes in appetite ( $p < 0.001$ ). Patients with reduced appetite exhibited the highest prevalence of reduced hemoglobin levels, at 61%, compared to those who overate (46%) and those who did not notice any change (46%). This underscores loss of appetite as a possible indicator that is attributed to decreased hemoglobin.

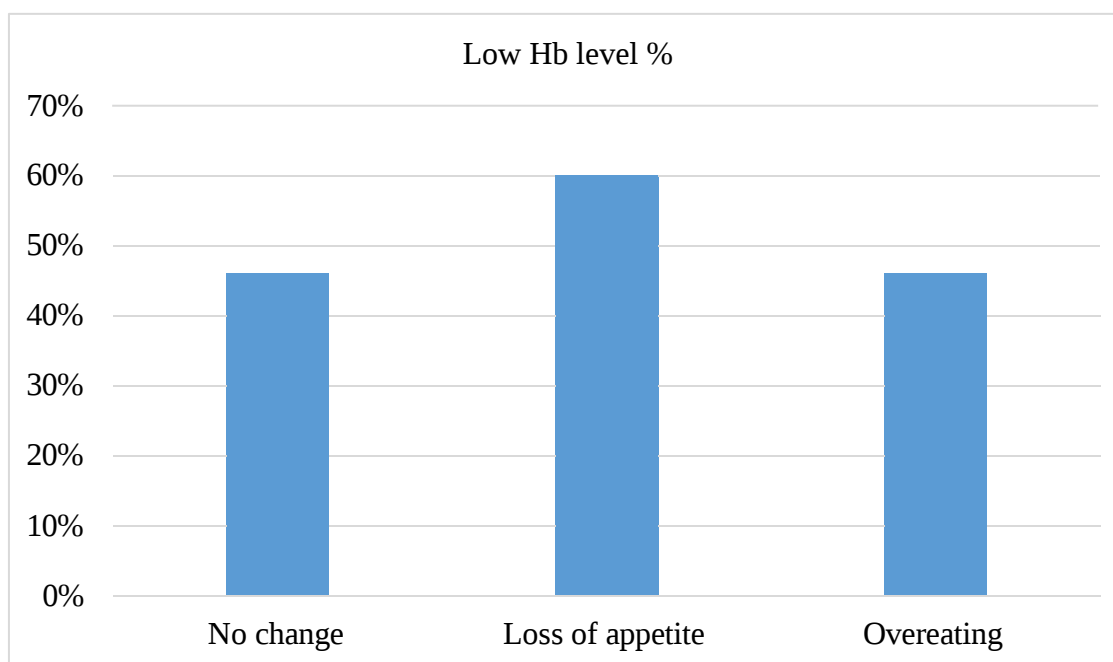


Figure 8: Association between Appetite change and Low Hb level

There was also a significant association between lack of energy and low levels of hemoglobin ( $p < 0.001$ ). When the respondent reported persistent tiredness or drowsiness, more than half, which is 56% developed decreased hemoglobin level, whereas 45% did not experience such symptoms. This is due to one of the most prevalent symptoms of fatigue amongst people with diminished hemoglobin.

Another symptom that was considerably associated with a decreased level of hemoglobin was dizziness or blurred vision ( $p < 0.001$ ). The prevalence was 60% among those tested for symptoms, compared to 42% among those without dizziness or blurred vision, and a decreased

level of hemoglobin. It implies that visual discomfort and dizziness are deemed eminent red flags of low hemoglobin.

**Table 1:** Distribution of variables and their association with decreased hemoglobin level and different criteria among the respondents.

|                                | Total<br>N=1,019 |     | Low Hb Level<br>N=520 |    | $\chi^2$ | df | p-value |
|--------------------------------|------------------|-----|-----------------------|----|----------|----|---------|
|                                | n                | %   | n                     | %  |          |    |         |
| <b>Age (years)</b>             |                  |     |                       |    |          |    |         |
| 15-25                          | 495              | 49  | 224                   | 45 | 14.092   | 2  | <0.001  |
| 26-35                          | 275              | 27  | 149                   | 54 |          |    |         |
| 36-45                          | 249              | 24  | 147                   | 59 |          |    |         |
| <b>BMI (kg/m<sup>2</sup>)</b>  |                  |     |                       |    |          |    |         |
| CED (<18.5)                    | 79               | 8   | 39                    | 49 | 0.098    | 2  | 0.952   |
| Normal (18.5–24.9)             | 564              | 55  | 289                   | 51 |          |    |         |
| Overweight ( $\geq 25.0$ )     | 376              | 37  | 192                   | 51 |          |    |         |
| <b>Marital status</b>          |                  |     |                       |    |          |    |         |
| Married                        | 561              | 55  | 308                   | 55 | 12.054   | 3  | 0.007   |
| Unmarried                      | 422              | 41  | 190                   | 45 |          |    |         |
| Divorced                       | 14               | 1   | 7                     | 50 |          |    |         |
| Widowed                        | 22               | 2   | 15                    | 68 |          |    |         |
| <b>Level of education</b>      |                  |     |                       |    |          |    |         |
| Illiterate                     | 102              | 10  | 65                    | 64 | 8.358    | 3  | 0.039   |
| Primary                        | 231              | 23  | 117                   | 51 |          |    |         |
| Secondary                      | 306              | 30  | 157                   | 51 |          |    |         |
| Graduate or above              | 380              | 37  | 181                   | 48 |          |    |         |
| <b>Occupational status</b>     |                  |     |                       |    |          |    |         |
| Student                        | 410              | 40  | 185                   | 45 | 12.899   | 4  | 0.012   |
| Housewife                      | 402              | 39  | 218                   | 54 |          |    |         |
| Service                        | 155              | 15  | 93                    | 60 |          |    |         |
| Business                       | 6                | 0.6 | 3                     | 50 |          |    |         |
| Unemployed                     | 46               | 5   | 21                    | 46 |          |    |         |
| <b>Economic status</b>         |                  |     |                       |    |          |    |         |
| Low                            | 344              | 34  | 172                   | 50 | 4.164    | 2  | 0.125   |
| Middle                         | 414              | 41  | 226                   | 55 |          |    |         |
| High                           | 261              | 26  | 122                   | 47 |          |    |         |
| <b>Residence area</b>          |                  |     |                       |    |          |    |         |
| Urban                          | 459              | 45  | 224                   | 49 | 1.660    | 1  | 0.198   |
| Rural                          | 560              | 55  | 296                   | 53 |          |    |         |
| <b>Family type</b>             |                  |     |                       |    |          |    |         |
| Nuclear                        | 671              | 66  | 342                   | 51 | 0.003    | 1  | 0.956   |
| Joint                          | 348              | 34  | 178                   | 51 |          |    |         |
| <b>Smoking habit</b>           |                  |     |                       |    |          |    |         |
| Smoker                         | 11               | 1   | 5                     | 45 | 0.138    | 1  | 0.710   |
| Non-smoker                     | 1008             | 99  | 515                   | 51 |          |    |         |
| <b>Physical exercise</b>       |                  |     |                       |    |          |    |         |
| Yes                            | 96               | 9   | 45                    | 47 | 0.732    | 1  | 0.392   |
| No                             | 923              | 91  | 475                   | 51 |          |    |         |
| <b>Daily physical activity</b> |                  |     |                       |    |          |    |         |
| No activity                    | 185              | 18  | 85                    | 46 | 8.874    | 2  | 0.012   |
| High physical labor            | 98               | 10  | 63                    | 64 |          |    |         |
| Medium level                   | 736              | 72  | 372                   | 51 |          |    |         |

|                                    |     |    |     |     |        |   |                  |
|------------------------------------|-----|----|-----|-----|--------|---|------------------|
| <b>Specific diet</b>               |     |    |     |     |        |   |                  |
| Yes                                | 58  | 6  | 24  | 41  | 2.292  | 1 | 0.130            |
| No                                 | 961 | 94 | 496 | 52  |        |   |                  |
| <b>Dietary supplements</b>         |     |    |     |     |        |   |                  |
| Yes                                | 169 | 17 | 92  | 54  | 0.941  | 1 | 0.332            |
| No                                 | 850 | 83 | 428 | 50  |        |   |                  |
| <b>Intake of medications</b>       |     |    |     |     |        |   |                  |
| Yes                                | 235 | 23 | 135 | 57  | 5.032  | 1 | <b>0.025</b>     |
| No                                 | 784 | 77 | 385 | 49  |        |   |                  |
| <b>Changes in appetite</b>         |     |    |     |     |        |   |                  |
| Loss of appetite                   | 326 | 32 | 199 | 61  | 19.253 | 2 | <b>&lt;0.001</b> |
| Excessive eating                   | 103 | 10 | 47  | 46  |        |   |                  |
| No change                          | 590 | 58 | 274 | 46  |        |   |                  |
| <b>Tiredness or drowsiness</b>     |     |    |     |     |        |   |                  |
| Yes                                | 556 | 55 | 313 | 56  | 13.572 | 1 | <b>&lt;0.001</b> |
| No                                 | 463 | 45 | 207 | 45  |        |   |                  |
| <b>Dizziness or blurred vision</b> |     |    |     |     |        |   |                  |
| Yes                                | 501 | 49 | 303 | 60  | 35.210 | 1 | <b>&lt;0.001</b> |
| No                                 | 518 | 51 | 217 | 42  |        |   |                  |
| <b>Difficulty in sleeping</b>      |     |    |     |     |        |   |                  |
| Yes                                | 345 | 34 | 185 | 54  | 1.403  | 1 | 0.236            |
| No                                 | 674 | 66 | 335 | 50  |        |   |                  |
| <b>Low Hb level (Anemia)</b>       |     |    |     |     |        |   |                  |
| Yes                                | 520 | 51 | 520 | 100 | -      | - | -                |
| No                                 | 499 | 49 | 0   | 0   |        |   |                  |
| <b>Awareness of own Hb level</b>   |     |    |     |     |        |   |                  |
| Yes                                | 54  | 5  | 30  | 56  | 0.467  | 1 | 0.494            |
| No                                 | 965 | 95 | 490 | 51  |        |   |                  |

Abbreviation: df, degrees of freedom;  $\chi^2$ , chi-square; N or n, number; BMI, body mass index; CED, chronic energy deficiency; Hb, hemoglobin.

p-value < 0.05 indicates statistically significant (bold).

### 3.2.2 Chi-Square Test Significance (p-Value)

I have applied Pearson chi-square tests in the bivariate analysis to check whether low vs. normal hemoglobin meant different things in separately stratified groups of participants. Statistical significance has been established was 0.05. The value  $p < 0.05$  denotes that it is reasonable to argue or conclude that there is some relationship between the attribute and low hemoglobin. In contrast, a non-significant ( $p > 0.05$ ) value implies that there is no likely discernible variation in this sample. In each test, we provide chi-square statistics ( $\chi^2$ ), p-value, and degrees of freedom (df).

Revealed significant differences in the low vs normal hemoglobin distribution regarding age ( $p < 0.001$ ), marriage ( $p = 0.007$ ), level of education ( $p = 0.039$ ), the occupational status ( $p = 0.012$ ), physical activity daily ( $p = 0.012$ ), consumption of medication ( $p = 0.025$ ), changes in appetite ( $p < 0.001$ ), fatigue/ drowsiness ( $p < 0.001$ ) and dizziness/blurred vision ( $p < 0.001$ ).

In comparison, BMI ( $p = 0.952$ ), financial state ( $p = 0.125$ ), residence ( $p = 0.198$ ), type of family ( $p = 0.956$ ), smoking ( $p = 0.710$ ), exercise ( $p = 0.392$ ), specific diet ( $p = 0.130$ ), dietary supplements ( $p = 0.332$ ), sleeping problems ( $p = 0.236$ ) and knowing your own Hb level ( $p = 0.494$ ) could not be considered significant ( $p > 0.05$ ) which means that the data cannot reveal the association between these factors.

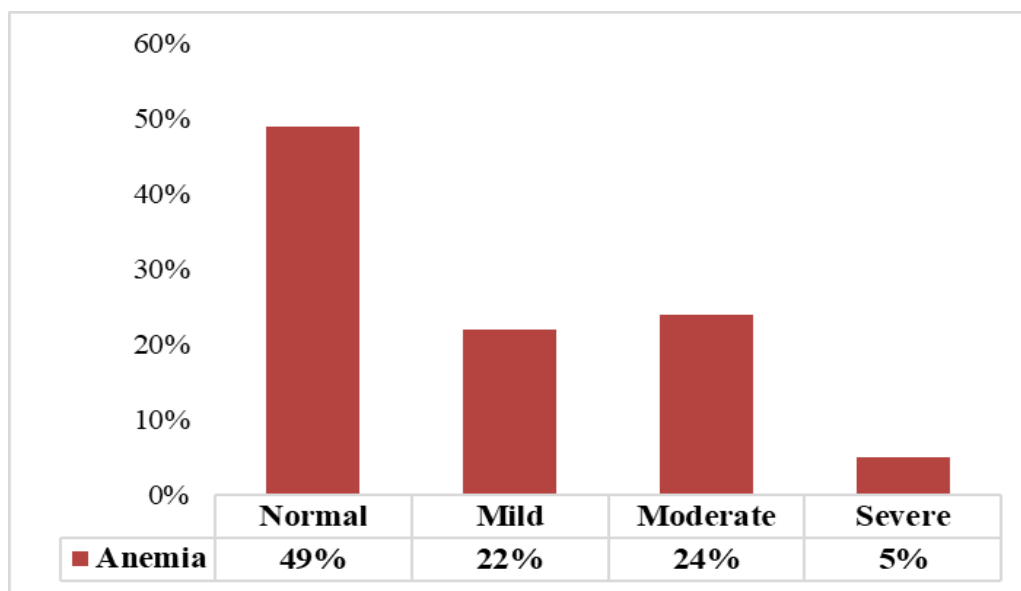
### **3.3 Regression Analysis**

The leading risk score of decreased hemoglobin level amongst the illiterate women was 1.851 fold altogether relative to those with a graduate degree or higher (OR 1.851, 95% CI 1.067 to 3.212,  $p = 0.028$ ). The likelihood of a decreased level of hemoglobin was 1.772 times higher in women who noted a loss of appetite than those who had no alteration in that regard (OR = 1.772, 95% CI 1.332 to 2.358,  $p < 0.001$ ). Among subjects reporting dizziness/blurred vision, the likelihood that a decreased level of hemoglobin would occur was 1.776 times more probable than the likelihood that a decreased level of hemoglobin would not occur (OR = 1.776, 95% CI 1.323 to 2.383,  $p < 0.001$ ).

On the other hand, the leading risk score of decreased level of hemoglobin amongst the illiterate women was 1.851-fold altogether relative to those with a graduate degree or higher (OR 1.851, 95% CI 1.067 to 3.212,  $p = 0.028$ ). The likelihood of decreased hemoglobin level was 1.772 times higher in women who noted a loss of appetite than those who had no alteration in that regard (OR = 1.772, 95 percent CI 1.332 to 2.358,  $p < 0.001$ ). Among subjects reporting

dizziness/blurred vision, the likelihood that a decreased level of hemoglobin would occur was 1.776 times more probable than the likelihood that a decreased level of hemoglobin would not occur (OR = 1.776, 95% CI 1.323 to 2.383,  $p < 0.001$ ). Exposures related to diet were not such: specific diet yes vs no (OR = 0.769, 95% CI 0.424 to 1.396,  $p = 0.388$ ) and dietary supplements yes vs no (OR = 1.018, 95% CI 0.709 to 1.462,  $p = 0.923$ ) and excessive eating vs no change (OR = 1.077, 95% CI 0.699 to 1.659,  $p = 0.737$ ). No associations were seen with medication use (yes vs no: OR = 1.177, 95% CI 0.849 to 1.631,  $p = 0.328$ ), tiredness/drowsiness (yes vs no: OR = 1.323, 95% CI 0.987 to 1.773,  $p = 0.061$ ), difficulty sleeping (yes vs no: OR = 0.941, 95% CI 0.704 to 2.424,  $p = 0.342$ ) were not significant.

It also shows that 49% of the respondents have a normal hemoglobin level, 22% show mild anemia, 24% moderate, and 5% severe.



**Figure 9:** Prevalence of the decreased Hb level (anemia) among female participants categorized by severity

**Table 2:** Regression analysis of variables by low hemoglobin level among the respondents.

|                                | Low Hb Level<br>N=520 |                |              |
|--------------------------------|-----------------------|----------------|--------------|
|                                | OR                    | 95% CI         | p-value      |
| <b>Age (years)</b>             |                       |                |              |
| 15-25                          | 0.650                 | 0.411 to 1.028 | 0.066        |
| 26-35                          | 0.826                 | 0.574 to 1.189 | 0.304        |
| 36-45                          | 1                     |                |              |
| <b>BMI (kg/m<sup>2</sup>)</b>  |                       |                |              |
| CED (<18.5)                    | 1.022                 | 0.616 to 1.698 | 0.932        |
| Normal (18.5–24.9)             | 0.996                 | 0.758 to 1.309 | 0.978        |
| Overweight (≥25.0)             | 1                     |                |              |
| <b>Marital status</b>          |                       |                |              |
| Married                        | 0.737                 | 0.285 to 1.905 | 0.528        |
| Unmarried                      | 0.645                 | 0.217 to 1.918 | 0.431        |
| Divorced                       | 0.463                 | 0.112 to 1.917 | 0.288        |
| Widowed                        | 1                     |                |              |
| <b>Level of education</b>      |                       |                |              |
| Illiterate                     | 1.851                 | 1.067 to 3.212 | <b>0.028</b> |
| Primary                        | 1.232                 | 0.808 to 1.879 | 0.332        |
| Secondary                      | 1.179                 | 0.829 to 1.678 | 0.360        |
| Graduate or above              | 1                     |                |              |
| <b>Occupational status</b>     |                       |                |              |
| Student                        | 1.417                 | 0.695 to 2.890 | 0.337        |
| Housewife                      | 1.285                 | 0.659 to 2.507 | 0.462        |
| Service                        | 1.575                 | 0.777 to 3.195 | 0.208        |
| Business                       | 0.765                 | 0.133 to 4.418 | 0.765        |
| Unemployed                     | 1                     |                |              |
| <b>Economic status</b>         |                       |                |              |
| Low                            | 0.851                 | 0.565 to 1.280 | 0.438        |
| Middle                         | 1.361                 | 0.963 to 1.924 | 0.081        |
| High                           | 1                     |                |              |
| <b>Residence area</b>          |                       |                |              |
| Urban                          | 0.809                 | 0.583 to 1.123 | 0.205        |
| Rural                          | 1                     |                |              |
| <b>Family type</b>             |                       |                |              |
| Nuclear                        | 1.019                 | 0.773 to 1.344 | 0.892        |
| Joint                          | 1                     |                |              |
| <b>Smoking habit</b>           |                       |                |              |
| Smoker                         | 0.790                 | 0.213 to 2.939 | 0.725        |
| Non-smoker                     | 1                     |                |              |
| <b>Physical exercise</b>       |                       |                |              |
| Yes                            | 0.781                 | 0.497 to 1.229 | 0.285        |
| No                             | 1                     |                |              |
| <b>Daily physical activity</b> |                       |                |              |
| No activity                    | 0.969                 | 0.690 to 1.362 | 0.858        |
| High physical labor            | 1.463                 | 0.924 to 2.314 | 0.104        |
| Medium level                   | 1                     |                |              |
| <b>Specific diet</b>           |                       |                |              |
| Yes                            | 0.769                 | 0.424 to 1.396 | 0.388        |
| No                             | 1                     |                |              |
| <b>Dietary supplements</b>     |                       |                |              |
| Yes                            | 1.018                 | 0.709 to 1.462 | 0.923        |

|                                    |       |                |                  |
|------------------------------------|-------|----------------|------------------|
| No                                 | 1     |                |                  |
| <b>Intake of medications</b>       |       |                |                  |
| Yes                                | 1.177 | 0.849 to 1.631 | 0.328            |
| No                                 | 1     |                |                  |
| <b>Changes in appetite</b>         |       |                |                  |
| Loss of appetite                   | 1.772 | 1.332 to 2.358 | <b>&lt;0.001</b> |
| Excessive eating                   | 1.077 | 0.699 to 1.659 | 0.737            |
| No change                          | 1     |                |                  |
| <b>Tiredness or drowsiness</b>     |       |                |                  |
| Yes                                | 1.323 | 0.987 to 1.773 | 0.061            |
| No                                 | 1     |                |                  |
| <b>Dizziness or blurred vision</b> |       |                |                  |
| Yes                                | 1.776 | 1.323 to 2.383 | <b>&lt;0.001</b> |
| No                                 | 1     |                |                  |
| <b>Difficulty in sleeping</b>      |       |                |                  |
| Yes                                | 0.941 | 0.704 to 1.258 | 0.682            |
| No                                 | 1     |                |                  |
| <b>Low Hb level (Anemia)</b>       |       |                |                  |
| Yes                                | -     | -              | -                |
| No                                 | -     |                |                  |
| <b>Awareness of own Hb level</b>   |       |                |                  |
| Yes                                | 1.335 | 0.735 to 2.424 | 0.342            |
| No                                 | 1     |                |                  |

Abbreviation: OR: odds ratio, CI: confidence interval, N or n: number; BMI: body mass index, CED: chronic energy deficiency, Hb: hemoglobin.

p-values are significant at 95% CI ( $p < 0.05$ ). Significant p-values are shown in bold.

## Chapter 4: Discussion

The study aims to identify the hemoglobin levels of adult females in Bangladesh, as their prevalence and causative factors contribute to lowered hemoglobin levels. The findings reflect an overall reduction in hemoglobin concentration among Bangladeshi adult females, with socio-demographic lifestyle and health variables being factors that play a significant role in the dominance of low hemoglobin. The research indicates that 51% of the sampled adult females had low levels of hemoglobin, which aligns with the country's problems regarding the decline in hemoglobin.

On further data analysis, a strong correlation was found between low hemoglobin and age group whereby women aged 36-45 years had the highest percentage (59%). It agrees with the findings of other scholars who also mention that reduced hemoglobin levels can also be more common in the aged groups due to the cumulative impact of the lack of dietary intakes, fertility history, and chronic illnesses (WHO, 2016). The highest rates were the prevalence of illiterate adult females (64%), and that is why the introduction of awareness-raising education programs connected with nutrition management and health management has to be mentioned. Likewise, widowed women have the highest level of low hemoglobin (68%), which can be due to emotional and economic struggles. Those findings are in line with the other literature that states that social support, marital status, and access to education are the significant factors influencing health outcomes (Rahman et al., 2021; Haque et al., 2022). Moreover, the study reported a higher incidence of low hemoglobin (64%) among women who participated in high physical activities, which could also be explained by the physical exertion leading to increased iron demands and inadequate nutrition (Haque et al., 2022). Symptoms such as loss of appetite, fatigue/drowsiness, and dizziness were highly associated with the low hemoglobin value, where the report of such symptoms was significantly higher in the low hemoglobin group ( $p <$

0.001). To illustrate, women with anorexia or dizziness were more likely to provide lower levels of hemoglobin, which refers to the latter as possible early reactions to decreased hemoglobin level (Espie et al., 2018). Remarkably, no significant association was observed between low hemoglobin and other lifestyle indicators (BMI, smoking, or dietary supplements), which could be more likely to influence nutritional status and hemoglobin concentrations. This could denote that weaker influences of lifestyle factors on hemoglobin than other variables like age, education, and occupation are present (Espie et al., 2018).

By focusing on these contributing elements, the prevalence of decreased levels of hemoglobin may be minimized cost-effectively, and the health and well-being of Bangladeshi adult females in general will be increased (WHO, 2016; Haque et al., 2022). This study is important as it addresses critical gaps in research on factors contributing to low hemoglobin levels in Bangladesh, where decreased hemoglobin levels are a leading population concern. The results reiterate the importance of socio-demographic variables, such as marital status and education, in defining health related consequences, and thus require both social and health-motivated intervention procedures. Regarding the inability of screening programs to be extensive enough, the current lack of awareness, this study promotes the systematic character of preventing and curing decreased levels of hemoglobin, which policy-makers, relevant health care providers, and social organizations should perform.

The proposed study is necessary since it will report on a serious but frequently disregarded public health problem in Bangladesh. It underlines that decreased hemoglobin level is not the only condition that depends on nutritional change, but also social and emotional factors. This finding of links allows the study to demand multicomponent intervention strategies that combine nutrition, social support, and access to care to fight anemia. These holistic strategies will play a key role in enhancing the health of women, improving their living standards, and ultimately contributing to the well-being of the overall society.

## Chapter 5: Conclusion

This study highlights the importance of assessing hemoglobin levels in adult females in Bangladesh. Moreover, it indicates that more than half of the adult female respondents have low levels of hemoglobin, with a prevalence that increases with age, mostly after the ages of 36 to 45 years. The scales of low levels of hemoglobin were proven to be highly associated with physical activity, marital status, and level of education. Additionally, decreased levels of hemoglobin were also the highest in illiterate women and those who do physical activities in a regular basis. Nonetheless, these findings will help professionals create awareness and conduct regular screenings to identify problems in their early stages by enabling effective treatment (Espie et al., 2018).

To conclude, this study presents a favorable approach to address the decreased hemoglobin level, providing valuable insights for the alterations in hemoglobin levels in Bangladeshi adult females. To mitigate the effects of low hemoglobin level and promote health, incorporating regular hemoglobine estimation, implementation of proper diet, awareness, screening and establishment of health education is important among adult females in Bangladesh (Bhowmik et al., 2021).

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## Appendix

### Appendix-1

#### QUESTIONNAIRE FOR THE INFORM-CONSENT

১. এই গবেষণা কবমরে ধরণ, উবেশ্য এং পদ্ধতি সম্পবকে তক পুবরা জানবি পপবরবেন?

: হয়/াঁ না

২. এই গবেষণায় পে আপনাবক শ্রীরীতরক, মানতসক এং সামাজজক পকান ঝুঁতকর সম্মুতিন হবি হবে না, এ তেষবয় তক েবেষ্ট অেতহি হবয়বেন?

: হয়/াঁ না

৩. এই গবেষণায় আপনার শ্রীর অেো পকান অঙ্গ-প্রিষবঙ্গ পে ক্ষি ো আঘাি তিরী করা হবে না, এ সম্পবকে তক অেতহি হবয়বেন?

: হয়/াঁ না

৪. এই গবেষণার ফলাফল এং সম্ভােয কলযাবণর তেষবয় আপনার ধারণাটি স্পষ্ট হবয়বে তক?

: হয়/াঁ না

৫. এই গবেষণা কবম েঅংশগ্রহণ, সহবোতগিদান, অেো তেরি োকার তসদ্ধাল্ডগাপতন তক স্বাধীন ভাবে গ্রহণ করবি পারবেন?

: হয়/াঁ না

৬. গবেষণা কবম েঅংশগ্রহণর ফবল আপনার পমৌতলক মানোতধকার তক ক্ষুন্ন হবে?

: হয়/াঁ না

৭. আপতন তক, পতরপূণ েভাবে জ্ঞাি পে, আপনার িেযােলীর পগাপনীয়া েজায় রািা হবে?

: হয়/াঁ না

৮. গবেষণা কবম েঅংশগ্রহণর জনয আপনাবক পকান পাতরশ্রতমক অেো ভ্রমণভািা পদয়া হবে না, এ তেষয়টি তক েবেষ্ট অেগি আবেন?

: হয়/াঁ না

## অনুমতি পত্র

এই গবেষণা কবমরে উবেশ্য, পদ্ধতি ও উপবোতগিা সম্পবকে পূর্ণ েধারণা পপবয়, এর নীতিগি তেতশ্টিয় সমূবহর প্রতি আমার সম্মতি প্রকাশ্ করতে। গবেষণা কবম েঅংশ্গ্রহবণর জনয আতম পকান েষজি ো পগাটি দ্বারা প্রভাোতিি ইইতন অোো আমার পমৌতলক মানোতধকার ক্ষুন্ন হয়তন। অিএ, োোোেে পোবেলাচনা সাবপবক্ষ আতম স্ব-প্রবণাতদি হবয় এই অনুমতি পবে স্বাক্ষর করতে।

## Appendix-2

|                                                                                                             |                                                                                              |
|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
|                            |                                                                                              |
| <b>SOUTHEAST UNIVERSITY</b>                                                                                 |                                                                                              |
| 291/A & 292, Tejgaon 1/A<br>Dhaka-1208, Bangladesh<br>Phone: 96179502, 96179497<br>01766348518, 01632261591 | Fax: 9602-55034109<br>E-mail: info@seu.edu.bd<br>Web: www.seu.edu.bd<br>FB: @seuofficialinfo |

Ref: SEU/Pharm/CECR/022/2024 Date: 17.11.2024

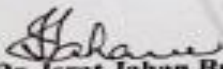
**Project Title: A study on the hemoglobin levels and mental health status among the adult females in Bangladesh**

**Name of the Investigators:** Dr. Md. Rabiul Islam, School of Pharmacy, BRAC University and Dr. Md. Siddiqui Islam, Department of Pharmacy, Southeast University

**CECR Reference No.:** SEU/Pharm/CECR/022/2024

**Ethical Approval**

This is to certify that the research project entitled "A study on the hemoglobin levels and mental health status among the adult females in Bangladesh" presented by Dr. Md. Rabiul Islam, School of Pharmacy, BRAC University and Dr. Md. Siddiqui Islam, Department of Pharmacy, Southeast University was reviewed by Committee for Ethical Compliance in Research and was found to be compliant with Ethical Standards of Department of Pharmacy, SEU.

  
**Dr. Israt Jahan Bulbul**  
Convener (Acting)  
Committee for Ethical Compliance in Research

## Appendix-3

### A Study on Hemoglobin Levels and Mental Health Status Among Adult Females in Bangladesh

[বাংলাদেশে প্রাপ্তবয়স্ক মহিলাদের হিমোগ্লোবিনের মাত্রা এবং মানসিক স্বাস্থ্যের অ্যার উপর একটি সমীক্ষা]

This survey has been designed to evaluate any correlation between hemoglobin levels and the mental health of adult females (15-45 years) in Bangladesh. The research has received ethical approval from the Committee of Ethical Compliance of Southeast University (SEU/Pharm/CECR/022/2024). This is a completely anonymous survey, ensuring your identity remains confidential and your privacy is respected. All collected information will be used solely for this study and kept confidential. Your consent to participate in this survey is crucial. Thank you for your cooperation in this important initiative.

[এই সমীক্ষাটি বাংলাদেশে প্রাপ্তবয়স্ক মহিলাদের (১৫-৪৫ বছর) হিমোগ্লোবিনের মাত্রা এবং মানসিক স্বাস্থ্যের মধ্যকার সম্পর্ক মূল্যায়ন করবে। তথ্যসংগ্রহ করা হবে। গবেষণাটি সাউথইস্ট ইউনিভার্সিটির তত্ত্বাবধানে (SEU/Pharm/CECR/022/2024) পূর্ণাঙ্গ তত্ত্বাবধানে অনুষ্ঠিত হবে। একটি সম্পূর্ণ গোপনীয় সমীক্ষা, যা আপনার গোপনীয়তা এবং আপনার গোপনীয়তার সুরক্ষা নিশ্চিত করে। সমস্ত সংগৃহীত তথ্য শুধুমাত্র এই গবেষণার জন্য ব্যবহার করা হবে। এই সমীক্ষায় অংশগ্রহণের জন্য আপনার সম্মতি অত্যন্ত গুরুত্বপূর্ণ। এই গুরুত্বপূর্ণ উদ্দেশ্যে আপনার সহযোগিতার জন্য ধন্যবাদ।]

Please Express Your Consent to Participate in the Research and Processing of Anonymous Data for Scientific Purposes [গোপনীয় সমীক্ষার জন্য গোপনীয় পদ্ধতি গবেষণা এবং প্রক্রিয়াকরণ অংশগ্রহণের জন্য আপনার সম্মতি প্রকাশ করুন]

- I am an adult female from Bangladesh and have no objection to the privacy policy of this survey and the information collected. I voluntarily agree to take part in this study.

[আমি একজন বাংলাদেশি প্রাপ্তবয়স্ক মহিলা এবং এই সমীক্ষার গোপনীয় নীতি এবং সংগৃহীত তথ্য আমার গোপনীয়তাকে প্রভাবিত করে না। আমি স্বাভাবিকভাবেই এই গবেষণায় অংশ নিব।]

☐ আমি একমত (I do agree)

☐ আমি একমত নই (I do not agree)

স্বাক্ষর:

তারিখ:

Please tick one box for each statement [প্রতিটি উক্তি জন্য একটি বক্সে আপনার মতামত চিহ্নিত করুন]

## Section 1: Demographic questions

### 1.1 বয়স (Age in years)

- ☐ ১৫-২৫ (15-25)
- ☐ ২৬-৩৫ (26-35)
- ☐ ৩৬-৪৫ (36-45)

### 1.2 শিক্ষার স্তর (Level of education)

- ☐ পড়াবিলি কতর নাই (Illiterate)
- ☐ প্রাথমিক (Primary)
- ☐ মাধ্যমিক (Secondary)
- ☐ স্নাতক/উর্ধ্ব (Graduate/above)

### 1.3 পেশা (Profession)

- ☐ চাকর (Service)
- ☐ বেসা (Business)
- ☐ গৃহী (Housewife)
- ☐ াে (Student)
- ☐ াে াবন কাজ করবেন না (Unemployed)
- ☐ অন্যান্য (Others) (Please specify)

### 1.4 তোতহক অসা (Marital Status):

- ☐ অতোতহি (Unmarried)
- ☐ তোতহি (Married)
- ☐ ালাকপ্রাপ্ত (Divorced)
- ☐ তেধা (Widowed)

1.5 ওজন-পকজজবি (Body weight in Kg):

1.6 উচ্চা- ফুি ও ইজিবি (Height in Feet and Inches):

1.7 পতরোবরর মাতসক আয়- হাজাবর (িকা) (Monthly family income) (BDT in thousand):

1.8 েসোবসর এলাকা (Area of residence)

☐ শহর (Urban)

☐ গ্রাম (Rural)

1.9 আপনার সাবে েসোসরি মানুবষর সংিয়া (Number of people living with you):

1.10 ধূমপাবনর অভ্যাস? (Smoking status?)

☐ ধূমপায়ী (Smoker)

☐ অধূমপায়ী (Non-smoker)

☐ প্রািন ধূমপায়ী (Ex-smoker)

1.11 অযালবকাহল ো পকাবনা তেবনাদনমূলক ওষুধ পসেবনর অভ্যাস (Alcohol or any recreational drugs consumption habit?)

☐ হয়াঁ (Yes)

☐ না (No)

## **Section 2: Lifestyle and diet history** (জীেনধারা এং িাদয সম্পতকেি িেয)

2.1. আপতন তক পকাবনা তনতদেষ্টডাবয়ি অনুসরণ কবরন? (Do you follow a specific diet e.g., vegetarian, keto)?

☐ হয়াঁ (Yes)

☐ না (No)

2.2 আপতন আপনার ক্ষুধায় পকান সাম্প্রতিক পতরেিনে অনুভে কবরবেন? (Did you experience any recent change in your appetite?)

☐ হয়াঁ, াঁ অতিতরি িাওয়ার অভ্যাস (Yes, overeating habit)

☐ ক্ষুধা কবম োওয়া (Loss of appetite)

☐ পকান পতরেিনে                      পনই (No change)

2.3 আপতন তক পকাবনা পুটষ্ট ো তভিতমন সম্পূরক গ্রহণ কবর োবকন? (Do you take any Food/Nutritional/vitamin supplements):

☐ হয়্যাঁ (Yes)

☐ না (No)

2.4. আপতন তক ঘুমাবি অসুতেধা অনুভে কবরন ো ঘুবমর েযাতধর পকান অতভজ্জি আবে? (Do you experience difficulty sleeping or have any experience of sleeping disorders)

☐ হয়্যাঁ (Yes)

☐ না (No)

2.5. আপতন তক প্রায়শই পকাবনা ধরবনর ওষুধ পনন? (Do you take any sort of medications frequently?)

☐ হয়্যাঁ (Yes)

☐ না (No)

েতদ হয়্যাঁ হয়, অনুগ্রহ কবর েলুন [If yes, name of medicine(s)]

2.6. আপতন তক তদনজিন কাবজ স্বাভাতেবকর পচবয় পেতশ্ ক্লান্ত ো িদ্রােন্ন হবয় পবড়ন? (Do you feel tired or drowsy doing daily chores more than usual?)

☐ হয়্যাঁ (Yes)

☐ না (No)

2.7. আপতন তক প্রায়ই স্বাভাতেক কাজ করবি মােো পঘারা অনুভে কবরন ো ঝাপসা পদিবি পান? (Do you often feel dizzy or have blurred vision while doing normal work?)

☐ হয়্যাঁ (Yes)

☐ না (No)

2.9. আপনার তদনজিন শ্রীরিতরক কােকে লাবপর মােো তক? (Are you involved in daily physical activity?)

☐ উচ্চ শ্রীরিতরক শ্রম (High physical labor)

☐ মাঝাতর স্তর (Medium level)

☐ পকান কােকে লাপ পনই (পডস্ক কাজ) (No activity at all (desk job))

2.10. আপতন তক সপ্তাবহ অন্তি পান্চোর তনয়তমি েযায়াম কবরন? (Do you perform regular exercise at least five times a week?)

☐ তনয়তমি (Regular)

☐ অননয়তমি (Irregular)

\*\* Blood Hb level:\_\_\_\_\_ g/dL

\*\* Are you aware about your Hb level?

Yes

No

Any comments

---

Thank you for completing this survey.

গবেষকৰ নাম:

স্বাক্ষর:

িতরি:

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