Estimation and Evaluation of Micronutrients and Vitamins intake during Pregnancy

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sincerely
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ABSTRACT

Iron deficiency anemia, folic acid deficiency, and calcium deficiency during pregnancy can lead to adverse outcomes for both the mother and the infant in developing countries, including Bangladesh. Preventive measures and managing approaches for iron, folic acid, and calcium deficiency before and during pregnancy can lower the rate of maternal and child mortality and morbidity in both evolving and established countries, including Bangladesh.

The purpose of the current research work was to find out the prevalence and outcomes of iron deficiency, folate deficiency, and Calcium deficiency during pregnancy as well as the steps to prevent and control them.

A whole of 50 blood trials (samples) of pregnant women were drawn into EDTA tubes from December,2019 to February,2020, from the Dhaka Medical College Hospital of Dhaka during the visits of the pregnant women to the Obstetrics & Gynaecology Department by using Sysmex XN-2000-a great pair for simple and advanced testing and a combination of two research modules that can be tailored to the clinical software specifically.

Among 50 pregnant women, total 13(26%) pregnant women had moderate iron deficiency anemia, 05 (10%) pregnant had severe iron deficiency anemia, and total 32 (64%) pregnant women had mild iron deficiency anemia during pregnancy, it is also shown from the result that, total 32 (64%) pregnant women had mild folate deficiency anemia, 13 (26%) pregnant women had moderate folate deficiency anemia, and total 05 (10%) pregnant women had severe folate deficiency anemia and total 38 (76%) pregnant women had normal calcium level and total 12 (24%) pregnant women had hypocalcemia or calcium deficiency.

During the gestational period, iron insufficiency, folic acid deficiency, and calcium shortage all these can cause potential risks to the mothers such as miscarriage, pre-eclampsia, hemorrhage, pregnancy induced hypertension (PIH) and also brings out negative outcomes to the infants such as prematurity, low birth weight, growth retardation, cleft lip, cleft palate, neural tube defects, and death. Increasing awareness, proper diagnosis and management of iron, folic acid, calcium deficiency during pregnancy will fill the nutritional gap and control the major causes of mortality and morbidity and poor maternal and fetal outcomes of pregnancy in Bangladesh.

Key Words: Anemia, iron deficiency anemia in pregnancy, folic acid deficiency in pregnancy, hypocalcemia in pregnancy, Dhaka Medical College Hospital, Bangladesh.

Chapter 2

INTRODUCTION

2.1 General Introduction

Iron deficiency during pregnancy:

Anemia in pregnancy is a major municipal health hazard that distresses both emerging and established nations, and it has significant medical, social, and economic consequences. It affects people at every aspects of their lives, but it is generally common in women with reproductive age and children. It happens if a person's hemoglobin content falls below what is considered natural for his or her age, gender, and climate and the outcome is the blood's oxygen carrying capacity is reduced. [1].

Anemia may also be divided as mild when Hb 9.0-11.0 g/dl, moderate with the Hb level of 7.0-9.0 g/dl, medium (Hb 4.0-7.0 g/dl), or highly severe (Hb less than 4.0 g/dl). It may also be categorized according to the proportion of Haematocrit (PCV) [2]. According to its etiology, it was identified there were three main anemia causative groups: Nutritional, marrow disease, and hemolytic diseases [2]. So far, the most common form of anemia is nutritional anemia in the world and include deficiencies in iron, folate and vitamin B12 in particular [3].

Anemia can affect both psychological and physical actions. Except for the most mild forms, all weaken one's sense of comfort, reduce lethargy resistance, worsen other symptoms, and impair one's ability to function[4]. Anemia can cause extreme morbidity and mortality in pregnant women and decreases susceptibility to blood loss, potentially leading to death from the blood loss associated with birth. The alleged physical anemia develops as plasma volume rises disproportionately during breastfeeding, contributing to a strong drop in erythroid cells, hemoglobin and hct (hematocrit) values.

The increased demand for nutrients, especially iron and folic acid, is caused by the growth of the fetus and placenta during pregnancy, as well as the increased amount of circulating blood in the pregnant mother. Since the majority of women in developing countries begin

pregnancy with low levels of these nutrients in their bodies, their extra requirement is even higher than average.

The average amount of iron required during pregnancy is estimated to be about 1000mg [5]. In the last trimester of pregnancy, the normal needs for both iron and folate are six times higher for a mother comparing to a mother who is not pregnant[6]. This requirement cannot be fulfilled solely by diet but must be met in part through maternal reserves. Around half of the total iron requirement for a well-nourished woman can meet from iron supplies. Anemia occurs because these supplies are still depleted due to starvation and/or repeated pregnancies. Even when enough food is eaten, it has been recorded that reloading body iron reserves after a birth will take up to two years. [7].

Anemia in the early days of breastfeeding is asymptomatic. The oxygen supply to main organs is decreased as the Hb level drops, and the pregnant woman starts to complain of general fatigue, exhaustion, and annoyances. Pale coloration of the skin and mucous membranes, along with the nail beds and tongue, does not appear until Hb falls to about 7.0g/dl. With a further drop in Hb concentration to 4.0g/dl, furthermost body tissues turn to less oxygenated, with the effect being most pronounced on the heart muscles, which can eventually malfunction [6]. Life expiry due to anemia is the consequences of weakness of the cardio-vascular system, tremor or inflammation which has been benefited from the patient's diminished susceptibility to disease.

While less severe anemia is unlikely to be a straight reason of maternal mortality, other causes, especially hemorrhages, may lead to death. Anemic mothers cannot handle decrease of blood level as well as healthier women. A stable mother can handle up to a liter of blood loss during childbirth. In a mother who is anemic, though, the condition is different; it can be

catastrophic to lose as little as 150 ml [8]. Anemic mothers are weak anesthetic and operating hazards are there because anemia decreases infection tolerance and inflammations may deteriorate to rebuild immediately following surgery or may fully collapse.

According to the WHO, anemia affects 14% of people in advanced countries and 51% of people in emerging countries. Anemia was estimated to be 65 to 75 % in India, for example.[9].

Breast feeding (88 %) often puts considerable emphasis on the mother's nutritional status [10]. Both these causes deplete the mother's micronutrient stores to the optimum level that she develops anemia that she experiences anaemia even during the first trimester of her subsequent pregnancy, resulting in a more severe outcome [11].

However, anemia and iron deficiency in the mother during the neonatal phase are not associated with a substantial degree of anemia in the infant. Nonetheless, iron reserves of these neonates are depleted, and iron level in the mother’s milk of anemic mothers is depleted as well [12]. In the study of anemia in the pregnant Jordan population, a large proportion of infants were anemic. Thus, maternal iron deficiency and anemia cause the offspring prone from infancy to developing iron deficiency and anemia [13]**.** Anemia during pregnancy is a civic health issue, exclusively in emerging countries like Bangladesh, and is widely linked to poor pregnancy outcomes. [14]. The World Health Organisation (WHO) describes pregnancy anemia as a hemoglobin (Hb) level of less than 11 g/dl [15].

Anemia was seen in 56 % of pregnant women in low- and middle-income countries (LMIC) according to global data. Pregnant women in Sub-Saharan Africa (SSA) have the highest rate of anaemia (57%) followed by pregnant women in Southeast Asia (48%) and pregnant women in South America respectively (24.1 %) [14].

Anemia during pregnancy is triggered by a variety of aspects in under-developed countries like Bangladesh, including a lack of calcium, folate, vitamin A, and B12 micronutrients, as well as parasitic infections like malaria and hookworm, as well as enduring contaminations like tuberculosis and HIV [16]. According to geographical location, nutritional activity, and season, inputs from each of the variables that cause anemia during pregnancy differ. In Sub-Saharan Africa, however, insufficient iron-rich dietary intake is identified as the principal cause of anemia amid expectant women [14]. Anemia in pregnancy is known to have a detrimental impact on maternal and infant welfare, as well as an augmented risk of maternal and perinatal death. For the mother, fatigue, reduced work bulk, a weakened resistant system, an increased hazard of heart disease, and death are all negative health outcomes [12]. Many studies showed that in developed countries, pregnancy related anemia leads to 23% of the subsidiary causes of maternal mortality [14]. Pregnancy anemia is allied with an elevated risk of preterm delivery and babies with a reduced birth weight and early delivery and LBW are also the foremost causes of infant mortality, contributing to 30 % of deaths in developed countries such as Tanzania [14]. Increased chance of intrauterine mortality (IUFD), poor 5-minute APGAR score and intrauterine growth restriction have also been linked with (IUGR).

Folic acid deficiency during pregnancy:

The natural source of vitamin B9 in food is folate, while folic acid is a synthetic form. High folic acid consumption can contribute to increased levels of unmetabolized folic acid in the

blood. Alternatives to folic acid supplements include 5-MTHT (levomefolate) or whole foods, such as leafy green vegetables [17].

Iron deficiency and folate deficiency are known as the first two sources of nutritional anemia. Anemia during pregnancy is a global issue. The efficacy of these measures in reducing maternal anemia has still been satisfactory in many antenatal treatment systems distributing iron and folic acid supplements to pregnant mothers. Some say that inadequate enforcement is the possible cause for such a program's ineffectiveness.

Inadequate food consumption is the primary cause of this shortage. Intakes of folate are usually insufficient in the diets of many women of childbearing age, and folate intake is further decreased by cooking losses and poor bioavailability [18]. Folate deficiency may also be caused by medical conditions, such as breastfeeding, lactation, malabsorption, kidney dialysis, liver failure, some anemias, alcoholism, and drugs that interfere with folate metabolism, which increase the need for folate or contribute to intensify folate elimination. Several health threats are linked with folate deficiency. Megaloblastic anemia leads to overt folate deficiency Suboptimal consumption of folate by preconception raises the likelihood of spontaneous clinical abortion, premature delivery, birth weight than normal and neonatal spinal cord defects [11]. Digestive diseases such as diarrhoea, loss of appetite, and weight loss may occur as a result of a folate deficiency as well as Folate deficiency can induce fatigue, sore tongue, headaches, heart palpitations, irritability, forgetfulness, and behavioral issues [19]. Furthermore, there is evidence that folate deficiency as a result of elevated homosysteine could be involved in the formation of osteoporosis [20]. Folate deficiency is, thus, a significant municipal health problem, predominantly in women of gestational age. Further research on the degree of folic acid deficit is required, particularly in broad, demonstrative groups of people within countries.

Calcium deficiency during pregnancy:

It is understood that maternal feeding during pregnancy has an impact on fetal growth and development. During pregnancy and lactation, it is advised that women increase their calcium intake, including the fact that specialist dose recommendations differ [21]. For fetal skeletal mineralization, secretion into breast milk, and development during infancy, a daily intake of 200 mg Ca is needed during pregnancy and the postpartum period [22]. The mother provides calcium for skeletal mineralization by the placenta during fetal development and breast milk during infancy. An infant's body stores 20–30 g of calcium at birth, nearly all of which is in the skeleton [23]. Hypocalcemia is a widespread clinical and laboratory abnormality in neonates. Early hypocalcemia is inversely proportional to pregnancy age and neonatal weight and occurs between birth weight and gestational age [24]. Vitamin D and its active form of vitamin D 1,25-dihydroxy vitamin D [1,25(OH)2 D] play a big role in calcium and bone synthesis in adults. in the presence of 1,25(OH)2 D, and in the absence of 1,25(OH)2 D, The skeleton lacks mineral component (secondary osteoporosis), and fresh bone inappropriately mineralized (rickets or osteomalacia), as a result of the body's inability to absorb calcium and phosphorus [24].

The purpose of this research was to ascertain the pervasiveness of hypocalcemia in pregnant women and their newborns, as well as the relationship between maternal calcium status and neonatal calcium and birth weight.

Calcium is essential for a number of physiological processes, including supplying physical sustenance for skeletal growth, signal transduction, muscle spasm, control of enzymes and blood coagulation [25]. Regulating for body structure, more nutritional calcium is suggested to promote development in babies and children, to improve osteoporosis in the elderly population, and to fulfill elevated physiological needs in maternal and lactating women [25].

While there has been debate about the data supporting the suggested intakes for particular populations, it does not extend across countries. Dietary calcium guidelines have ranged widely around the world for both reasons [26]. A new recommendation from the World Health Organisation (WHO) suggested that pregnant women living in low calcium consumption regions eat an average From 20 weeks of pregnancy to the conclusion of the pregnancy, they can consume 1.5 to 2.0 g of fundamental calcium per day to reduce their chance of pre-eclampsia [27].

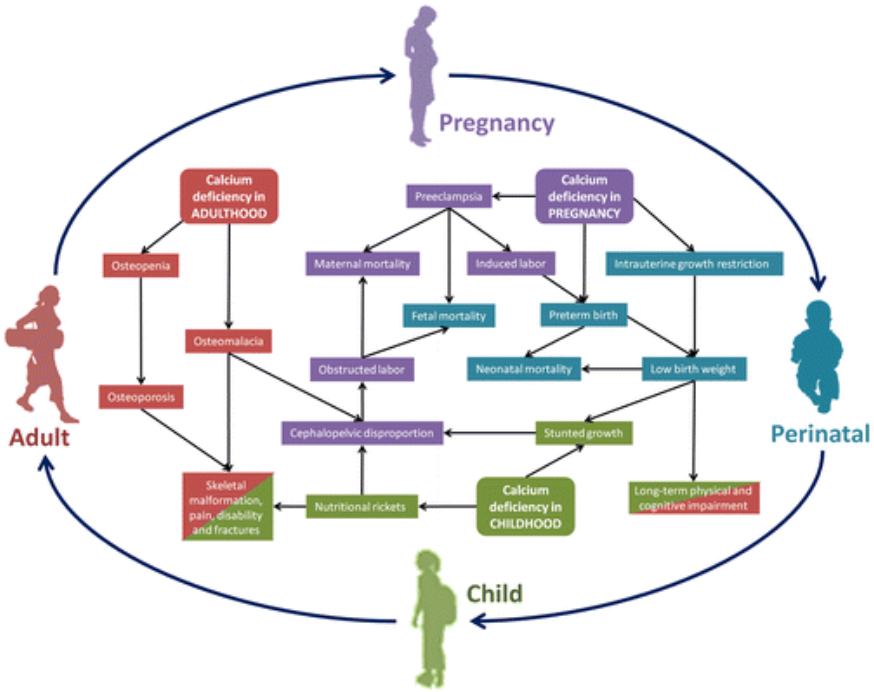

Figure1. Extreme calcium deficiency can have intragenerational and intergenerational consequences [28]**.**

Excessive calcium discrepancy will put the mother's health in jeopardy during pregnancy. Calcium deficiency may increase the risk of pre-eclampsia [24]. In developed regions, it is a significant source of maternal mortality [24]. Calcium deficiency can lead to spontaneous preterm birth [29], pre-eclampsia can lead to fetal loss or medically induced preterm birth, neonatal mortality and limitation of intrauterine growth. Both lead to low birth weight, which

is associated with a number of corporeal and intellectual long-term significances [30], including underdeveloped (which can be independently linked to juvenile calcium shortage) [31]. Children with calcium deficiency (also without hypovitaminosis D) are at increased hazards of nutritional rickets, which may cause discomfort, deformity, and fractures later in life [32]. If calcium deficiency occurs in puberty and adulthood, skeletal disorder can be aggravated, through which rickets are substituted with osteomalacia (for which laboratory data suggests vitamin D as a possible supplementary requirement) [32]. Adult calcium deficiency, in the absence of vitamin D deficiency, can result in osteopenia, which can lead to osteoporosis. Osteoporosis and osteomalacia predispose people to a wide range of acute and chronic bone and musculoskeletal complications [33]. Just a few of the diseases that may induce cephalopelvic discrepancy and congested labor are stunting, rickets, and osteomalacia. [28]. Even in mothers who consume very little calcium, calcium in breast milk continues to be relatively preserved [34].

2.2 Pregnant women sample collection pattern with different trimesters and period:

A whole of 50 blood trials (samples) of pregnant women were drawn into EDTA tubes from December,2019 to February,2020, from the Dhaka Medical College Hospital of Dhaka during

the visits of the pregnant women to the Obstetrics & Gynaecology Department by using

Trimester	Number of Pregnant mother samples collection	Time Period under sample collected

Sysmex XN-2000.

The first trimester yielded 23 pregnant women's blood samples, the second trimester yielded 13 pregnant women's blood samples, and the third trimester yielded 14 pregnant women's blood samples.

19 pregnant mother's blood samples were taken in December 2019, 14 pregnant mother's blood samples were collected in January 2020, and 17 pregnant women's blood samples were collected in February 2020.

During the month of December 2019, 9 blood samples were taken from pregnant women in their first trimester, 4 blood samples from pregnant women in their second trimester, and 6 blood samples from pregnant women in their third trimester.

In January 2020, 6 blood samples were taken from pregnant women in their first trimester, 5 blood samples from pregnant women in their second trimester, and 3 blood samples from pregnant women in their third trimester.

During February 2020, 8 blood samples were taken from pregnant women in their first trimester, 4 from pregnant women in their second trimester, and 5 from pregnant women in their third trimester.

Table 1: Number and Time of Sample Collection

1st	23	December’2019 - 9 sample
		January’2020 - 6 sample
		February’2020 - 8 sample
2nd	13	December’2019 - 4 sample
		January’2020 - 5 sample
		February’2020 - 4 sample
3rd	14	December’2019 - 6 sample
		January’2020 - 3 sample
		February’2020 - 5 sample
Total	50	100%

2.3 Pregnant women taken for investigations:

An overall of 50 blood samples of pregnant women of different three trimesters were collected. The first trimester lasts from week one to the end of week twelve, the second trimester lasts from week thirteen to the end of week twenty-six, and the third trimester lasts from week twenty-seven to the end of the birth.

Trimesters	Time periods (in months)	Time periods (in weeks)
1st	1-3	1-12
2nd	4-6	13-26
3rd	7-9	27-40

Table 2: Pregnancy with 3 trimesters time duration

Signs Symptoms of Pregnant women in different trimesters:

Signs Symptoms of Pregnant women in 1st trimesters: [35]

- Painful, bulge breasts.
- Biliousness with or without queasiness.
- Increased micturition.
- Lathery.
- Food hungers and distastes.
- Stomachache.
- Difficulty in defecation.

Signs Symptoms of Pregnant women in 2nd trimesters: [35]

- Increasing belly and breasts. As the uterus enlarges to make space for the baby, belly expands.
- Braxton Hicks contractions.
- Skin changes.
- Nasal problems.
- Dental issues.
- Dizziness.
- Leg cramps.
- Vaginal discharge.

Signs Symptoms of Pregnant women in 3rd trimesters: [36]

- Shortness of breath.
- Frequent urination.
- Swollen feet and ankles.
- Braxton Hicks contractions.

Measures to be taken and avoided during pregnancy: [37]

- Regular doctor or mid-wife visits.
- Proper eating.
- Intake supplements.
- Consciousness about food safety.
- Body movement/Yoga regularly.
- Begin doing pelvic floor exercises.
- Avoid smoking.
- Avoid liquor.
- Avoid caffeine.

Following foods and beverages should be avoided or minimized in pregnancy:

- Highly toxic element-Mercury Fish.
- Not properly cooked or uncooked Fish.
- Not properly cooked, fresh, and fortified Meat.
- Uncooked Eggs.
- Organ Meat.
- Caffeine.
- Unpasteurized Milk, butter, and Fruit Extract.
- Liquor.

Factors affecting outcomes of pregnancy: [38]

- Body weight – both being overweight and underweight may have a negative impact on fertility. Fertility and the odds of being pregnant are affected by becoming underweight or overweight.
- Smoking and pregnancy don't go together.
- Excessive burdens and stress confuse the hormones.
- Endometriosis: Proper nutrition may help to mitigate the disease's symptoms.

Risk factors for a high-risk pregnancy can include: [39]

- Elevated blood pressure,
- Diabetes,
- being HIV-Positive.
- Convulsion in pregnancy (Pre-eclampsia),
- Pregnancy induced diabetes,
- Death at birth,
- Spinal tube defects,
- Excessive weight and obesity,
- Overweight increases the risk for high blood pressure,
- Cesarean delivery.

2.4 Sources of iron, calcium, folic acid during pregnancy

Sources of iron:

Why is iron so necessary during pregnancy:

The blood flow rises by up to 50% during pregnancy [40]. This is where iron comes into play. The body uses iron to produce red blood cells.one will need more red blood cells and oxygen to produce the blood cells as the blood flow improves. Anemia will occur in a pregnant mother if she does not have enough iron in her body. Anemia is the most prevalent blood disease in pregnant women.

Anemia may place a pregnant mother and her baby at risk for a number of complications during infancy, including preterm birth and low birth weight.

Iron requirement during pregnancy:

Pregnant mother needs almost twice as much iron during pregnancy as she did before she got pregnant.

For women who are not pregnant, the recommended daily iron intake is about 18 mg. If someone is breastfeeding, the daily dosage can be raised to a minimum of 27 mg [41].

The World Health Organization's (WHO) guidelines are more rigorous. Pregnant women should eat 30 to 60 mg of iron every day, according to the World Health Organisation [42]

Pregnant mother should contact a doctor or a midwife for advice. They can differ based on a range of reasons, including the number of babies she is carrying, her history of anemia, and the baby's age.

Types of iron:

While iron is generally associated with animal protein, but vegetarians and vegans should not get panicked. Iron is present in a wide range of foods.

Heme and non-heme iron are the two forms of iron.

- **Heme iron**: One can get this form by eating beef, fish, and other animal protein sources. It is readily digested by the liver.
- **Non-heme iron**: This material is present in rice, beans, herbs, fruits, nuts, and seeds, and it takes our bodies a bit longer to turn into anything we can use.

Foods high in heme iron that are healthy to eat during pregnancy:

- While all animal proteins contain heme iron, some sources may be better than others during pregnancy.
- It's also a safe idea to avoid raw meat and fish because they can raise the risk of bacterial infection, which is particularly risky during pregnancy.

- **Lean beef:**

The best source of heme iron is red meat. Iron is present in around 1.5 mg per 3-ounce serving of lean sirloin beef [43].

But, before someone chucks the steak on the grill, check the temperature with the meat thermometer. Because of the possibility of bacterial infection, consuming undercooked or "rare" meat is not advised during breastfeeding.

- **Fully cooked beef:**

When beef reaches an internal temperature of 160°F (71°C), it is considered fully cooked. If pregnant mother is dining out while breastfeeding, order burger or steak well-done. This raises the probability that the meat she is consuming is thoroughly prepared [44].

- **Chicken:**

Every 8-ounce serving of chicken contains 1.5 mg of iron from a Reputable Source. It's okay to eat chicken when pregnant, but as for beef, make sure it's thoroughly cooked at 165°F (73.8°C) to prevent ingesting harmful bacteria like Listeria [45].

- **Salmon:**

Iron is plentiful in salmon, at 1.6 mg per 100 g. A half-pound filet of wild-caught Atlantic salmon from a reputable source. Salmon is healthy to eat when pregnant as long as it is thoroughly cooked to a temperature of 145°F (62.8°C) [45]

Salmon is a strong source of heme iron, as well as omega-3 fatty acids and other nutrients that can help a mother have a healthier pregnancy.

Salmon also contains less mercury than certain other seafood, such as tuna and swordfish, making it better to eat while breastfeeding.

Consume two to three servings of fish a week to increase iron and protein levels. Other fish that are healthy to consume while pregnant include: [45]

- shrimp
- pollock
- catfish
- scallops
- sardines
- herring
- trout
- cod
- light tuna

Pregnancy-friendly foods rich in non-heme iron: [46]

There are many plant-based forms of iron that one should pursue if a pregnant mother does not consume beef. Bear in mind the non-heme iron is more difficult for the body to consume and digest.

If non-heme iron is the primary iron source, ask the doctor if a pregnant mother should take an iron substitute.

- **Beans and lentils:**

Beans and lentils have a high iron content and are high in fiber and protein. A cup of cooked lentils will supply you with 6.6 mg of iron every day. White kidney beans, washed and fried, have the same volume of Trusted Source.

If pregnant mother wants to start adding lentils and beans into the diet, she should make them in bulk and scatter them in salads or cook up a few handfuls as a side dish at dinner.

- **Spinach and kale:**

Antioxidants, vitamins, and iron are both found in spinach and kale. One cup of cooked kale contains 1 mg Trusted Source of iron, and one cup of spinach contains 6.4 mg Trusted Source.

These greens can be used in a number of ways. Pregnant mother can have it with salad, omelet or simply sauté some in a saucepan. She can also add them to a smoothie for a sweet, soothing treat.

- **Broccoli:**

Broccoli is a classic kid favorite, but this quick-to-prepare vegetable also provides several nutrients that are helpful during pregnancy.

Per cup, this cruciferous vegetable contains just over 1 mg of iron from a stable source. Broccoli also contains a large amount of vitamin C, which aids iron absorption.

Broccoli is also rich in fiber and nutrients. Since pregnancy delays the digestive tract (hello, bloating and constipation), having high-fiber foods in the diet will help reduce these undesirable symptoms.

Roasting it whole with a little olive oil and salt or steam some broccoli and have it on hand as a snack. Broccoli is also a strong crop to have in your parental arsenal because it's straightforward to cook and often loved by small children. Broccoli has a strong odor when

baked, so if you're pregnant or have a strong aversion to strong odors, proceed with caution. [46]

Enhancement of iron absorption:

In addition to consuming iron-rich meals, someone can also support your body by eating foods that assist in iron absorption, such as foods high in vitamin C. Vitamin C can assist in the degradation and absorption of iron in the diet**.**

While eating citrus fruits, onions, red or yellow peppers, or a serving of broccoli or cauliflower with iron supplements, the body can consume the iron more quickly [47]. There are also foods that can impede iron absorption.

Dairy is infamous for messing with the body's ability to digest iron. This is because calcium in dairy products and calcium supplementation has been shown to reduce iron absorption. That isn't to suggest that dairy can be stopped. However, if doctor has told to take an iron supplement, wait at least two hours after eating cheese or milk items before taking it and If a pregnant mother is looking to increase iron intake by eating more mindfully, she may want to cut down on dairy until the iron levels are where they need to be.

Taking iron supplements:

If someone is taking an iron-fortified prenatal vitamin and consume iron-fortified foods, she will definitely get enough iron to sustain a safe pregnancy for most women.

However, some pregnant women can need additional iron supplements. If someone is pregnant after a previous pregnancy, for example, doctor may prescribe vitamins.

If the doctor or midwife doesn't recommend an iron replacement but pregnant mother thinks she may like one, discuss it with them.

Although iron supplements are safe to take while pregnant, there is such a thing as too much iron while you're pregnant.

Too much iron in the bloodstream during pregnancy will put pregnant mother at risk. Preterm pregnancy, gestational diabetes, and elevated blood pressure are all signs of preterm birth. Furthermore, overly high iron levels over time will affect the organs, especially your kidneys.[9]

Warning signs of an iron overdose include: [48]

- pale, clammy hands
- weakness and fatigue
- diarrhea and sharp stomach pain
- vomiting blood
- shallow, rapid breathing

If someone is experiencing these symptoms and are pregnant, contact the health provider right away and seek emergency treatment.

Process to take iron supplements:

Iron supplements can be taken with a bottle of water on an empty stomach. Iron supplements, on the other hand, can worsen pregnancy symptoms including nausea and vomiting. Iron supplements taken on an empty stomach can worsen these side effects.

It's likely that taking iron with a snack will help pregnant women to prevent nausea. As an extra bonus, enjoy a vitamin C-rich snack to boost the body's ability to digest the supplement. Taking iron before bedtime can also help to mask side effects.

Finding a schedule that fits for pregnant women is the most important thing. Consult the healthcare provider if pregnant women are having trouble holding the vitamins down. They may be able to prescribe a stomach-friendly iron substitute.

Sources of calcium:

Every day, everybody requires this important mineral. Calcium keeps the blood and tissues going and makes nerves relay signals from the brain to the rest of our body, in addition to building teeth and bones.

Since the body does not contain calcium, it must be obtained by diet or supplements. If a woman is pregnant, she must consume at least 1,000 mg of calcium per day. If a pregnant woman is under the age of 18, she needs minimum 1,300 mg of calcium every day [49]

Foods rich in Calcium: [50]

Dairy foods, like milk, butter, and tofu, are excellent calcium sources. Calcium can also be present in black, leafy green plants, albeit in far reduced quantities.

Calcium is applied to certain ingredients, such as calcium-invigorated cereal, bread, orange extract, and soy beverages. To make accurate, check at the product labels. Pregnant mother can choose from a range of calcium-rich foods.

- pure low-fat yoghurt
- orange juice
- sardines, 3 oz. tinned in oil with bones
- cheddar cheese
- nonfat milk
- firm tofu
- tinned salmon with bones
- calcium-fortified cereal
- cooked kale
- Tofu, solid, made with calcium sulphate
- calcium-fortified soy beverage

Here are a few ideas for achieving your 1,000 mg goal: select cornflakes with 1,000 mg of calcium or drink 3 cups of milk or calcium-stimulated orange juice.

Pregnancy and Calcium Supplements: [50]

Having enough calcium from food can be tough if a pregnant woman is allergic to beef, lactose intolerant, or vegan. The doctor can prescribe a calcium supplement if the pregnant woman doesn't get enough calcium from diet.

Choose the sort that best serves your needs. There are two kinds of calcium supplements: carbonate and citrate.

- Calcium carbonate is not costly and performs better when taken with meal,
- while calcium citrate shows efficacy as well with or without meal.

Many calcium additions often include vitamin D, which aids calcium absorption. Pregnant women should have less than 500 mg at a time. She can take just 500 mg of calcium at a time to ensure that the body consumes as much calcium as possible. This could entail having a 500 mg supplement with mealtime in morning and another with mealtime at night, for example. Lactating mother also necessitates a higher calcium intake. A lactating mother must continue to take calcium supplements [10]. According to studies, she may loss 3% to 5% of the bone mass when nursing, and some calcium is lost by breast milk. Fortunately, if she consumes calcium-rich foods and take calcium supplements as instructed, she should be able to recover the bone mass within 6 months of stopping breastfeeding [50]. Supplements can induce bloating, gassiness, or constipation. If this is the case, pregnant mother should take the calcium supplement with a meal. Alternatively, she should ask doctor about switching to a particular brand or form of calcium enhancement.

Calcium excess can cause stones in kidney and prevent the body from absorbing Zn and Fe, all of which are essential for a pregnant woman's health. If someone is pregnant, don't exceed 2,500 mg of calcium a day and 3,000 mg if you're at the age of 18 or younger [51]. If pregnant mother is worried that she is having too much calcium, contact the obstetrician before making any adjustments.

Calcium is important for good health. In fact, the body contains more calcium than any other mineral. It contributes to heart wellbeing, muscle control, and nerve signaling by making up a significant portion of the bones and teeth.

Women more than the age of 50 and those over the age of 70 should consume 1,200 mg of calcium per day, whereas children aged 4 to 18 should consume 1,300 mg [49] . However, a substantial part of the population does not get enough calcium from their food. The most calcium-rich foods are dairy products like milk, butter, and curd. Non-dairy forms, on the other hand, are abundant in this mineral. Just a few examples are sea fish, green vegetables, legumes, dried fruit, tofu, and calcium-invigorated foods.

Followings are 15 calcium-rich ingredients, all of which are not dairy products [52].

1. Seeds

Seeds are nutrient powerhouses in a small box. Poppy, sesame, celery, and seeds, for example, are rich in calcium. One tablespoon (9 g) of poppy seeds, for example, contains 126 mg of calcium.

Chia seeds, for instance, are high in plant-based omega-3 fatty acids.

1 tablespoon (9 g) of sesame seeds contains 9% of the RDI for calcium, as well as other minerals including copper, iron, and manganese.

Calcium is found in many seeds. For e.g., 1 tablespoon (9 g) of poppy seeds contains 13% of the RDI, while the same serving of sesame seeds contains 9%.

2. Cheese:

The bulk of cheeses are rich in calcium. Parmesan cheese has the most, at 331 mg per ounce (28 g), or 33 % of the RDI.

Softer cheeses contain fewer — 1 ounce of brie contains just 52 mg, or 5% of the RDI. Many other varieties are in the center, supplying around 20% of the recommended daily intake.
Additionally, our bodies absorb calcium from dairy products more readily than calcium from plant sources.
Some varieties of cheese, such as cottage cheese, are rich in protein. Furthermore, mature, hard cheeses have a low lactose content, making them easier to digest for lactose intolerant people.

Dairy goods can also have health benefits According to a new report, it could lower the risk of heart failure.

Another study linked daily cheese consumption to a reduced danger of digestive syndrome, a health measure that increases the hazard of cardiac disease, myocardial infarction, and type 2 diabetes mellitus.

Though, keep in mind that full-fat cheese contains a lot of fat and calories. Most cheeses are also high in salt, which can cause allergic reactions in certain individuals.

3. Yogurt:

Yogurt is a great calcium source. Most yogurts contain live probiotic bacteria, which have a range of health benefits. Plain yogurt contains 30 % of the RDI for calcium, phosphate, potassium, and vitamins B2 and B12 in one cup (245 g).

Low-fat yogurt can be also higher in calcium, with one cup (245 g) producing 45 % of the RDI.

Although Greek yogurt is an excellent source of protein, it contains less calcium than normal yogurt. According to one study, eating yogurt increases the overall consistency of one's food and improved metabolic health. Yogurt eaters were less likely to develop metabolic disorders

like type 2 diabetes and cardio-vascular disease. Yogurt is one of the strongest calcium sources, supplying 30% of the RDI in only one cup (245 g). It's also rich in protein and other vital nutritional elements.

4. Sardines and Canned Salmon:

Because of their edible bones, sardines and canned salmon are rich in calcium. This oily fish is high in protein and omega-3 fatty acids, which are both beneficial to your cardio-vascular system, nervous system, and skin. Smaller fish like sardines have low levels of mercury, despite the fact that it can be found in seafood.

5. Beans and Lentils:

Fiber, calcium, and micronutrients are available in beans and lentils. Steel, zinc, folate, magnesium, and potassium are all abundant in them. Calcium is found in some varieties as well. Winged beans, on the other hand, are at the top of the scale, with 244 mg of calcium (or 24 % of the RDI) in a single cup (172 g) of cooked wing beans. White beans are also a good source, supplying 13 % of the RDI in one cup (179 g) of cooked white beans. Some bean and lentil varieties have fewer, varying from about 4–6% of the RDI per cup. Beans, it turns out, are one of the reasons that plant-based diets are so good for you. According to research, beans will help lower “bad” LDL cholesterol parameters and decrease the health hazard of type 2

diabetes. Beans are a high-nutrient food. In one cup cooked wing beans provide 24 % of required amount for calcium, while other varieties provide 4–13 % in the same serving size.

6. Almonds:

Almonds provide the highest calcium content of any nut. Almonds have 3 g of fiber per ounce (28 g) and are rich in good fats and protein. They also contain high amounts of Mg, Mn, and vitamin E. Nuts can help to lower blood pressure, body fat, and other metabolic disease risk factors. Almonds are rich in good fats, protein, Mg, Mn, and other nutrients. One ounce, or 22 nuts, contains 8% of the recommended daily intake for Ca.

7. Whey Protein

Milk contains protein which is the liquid remaining after milk has been curdled and strained, which has been widely investigated for its nutritional benefits. It's a decent source of protein which has a lot of readily digestible amino acids. Whey-rich diets have been related to weight loss and greater blood sugar regulation in many trials. It is also high in calcium. Whey is also rich in calcium, with 200 mg in a 28-g scoop of whey protein powder concentrate, or 20% of the daily need. If pregnant mother wants to try whey protein, there are plenty of choices available online. Whey protein is also a very good protein source.

8. Leafy Green Vegetables:

Green vegetables are highly nutritious, and many forms are especially rich in calcium. Collard greens, lettuce, and kale are some of the greens that are enriched in this mineral. One cup (190 g) of cooked collard greens, for example, contains 266 mg, or around a quarter of the daily requirement. It's worth noting that certain varieties contain a number of oxalates, which are environmental compounds that fix to calcium and make it inaccessible to the physique. All of them is spinach. Although it's high in calcium, it's not as easily absorbed as calcium found in low-oxalate greens like kale and collard greens. Calcium is found in cool, leafy greens. Cooked collard greens offer 25% of your daily needs in one cup (190 g). However, certain leafy greens contain oxalates, which block the body from absorbing calcium.

9. Rhubarb:

In small doses, rhubarb is high in fiber, vitamin K, calcium, and other vitamins and minerals. It comprises prebiotic fiber, which will help the gut bacteria grow. Rhubarb, like spinach, is rich in oxalates, which stops most of the calcium from being consumed. In fact, one study showed that only about a quarter of the calcium in rhubarb can be consumed by the body. The calcium content of rhubarb, on the other hand, is very high. And if you just consume 25% of the nutrients in cooked rhubarb, you'll still get 87 mg per cup (240 g). Rhubarb is rich in fiber, vitamin K, and other vitamins and minerals. And if the calcium isn't fully consumed, the figures are high enough to guarantee that you get enough.

10. Fortified Foods:

Fortified foods are another type of calcium. Some cereals produce up to 1,000 mg of iron in every meal, and that's before milk is added. Remember that, however, that our body in unable to consume any of the calcium at once, so spread it out over the day. Calcium may also be added to flour and cornmeal. Calcium may be applied to grain-based foods. Check the label to see how much mineral fortified food there is.

11. Amaranth:

Amaranth is a nutrient-dense pseudo cereal. It's rich in minerals like manganese, magnesium, phosphorus, and copper, and is a decent source of folate. Cooked amaranth grain contains 116 mg of calcium per cup 246 g or 12 % of the required quantity. Amaranth leaves have more reference dietary intake — 28 % per cooked cup (132 g). Vitamins A and C are also abundant in the leaves. Amaranth seeds and leaves are rich in nutrients. Curry cooked amaranth grain contains 12 % of the RDI for calcium per cup (246 g), while the leaves supply 28 % per cup (246 g) (132 g).

12. Edamame and Tofu:

Edamame are young soybeans that are often sold in their pods. Edamame holds 10% of the RDI for calcium in one cup (155 g). It's both rich in protein and contains all of the regular folate needs in a small portion. It has been prepared with calcium also contains a lot of it: half a cup (126 g) contains 86 % of the RDI for calcium.

Calcium is found in tofu and edamame. Half a cup (126 g) of calcium-fortified tofu contains 86 % of the RDI, while one cup (155 g) of edamame contains 10%.

13. Fortified Drinks:

One can get calcium from fortified non-dairy drinks if you don't drink milk. 30 % of the RDI is contained in a cup (237 ml) of fortified soy milk. Furthermore, with 7 g of protein, it is the most nutritionally comparable non-dairy milk to cow's milk. Even higher amounts of fortification can be applied to other forms of nut and seed-based milks.

Orange extract can be reinvigorated to supply up to 50% of the recommended daily consumption (RDI) per cup (237 ml). Calcium should be added to non-dairy milks and orange juice.

14. Figs:

Antioxidants and fiber abound in dried figs. In comparison, they contain more calcium than other dried fruits. In fact, one ounce (28 g) of dried figs supplies 5% of the RDI for calcium. Furthermore, figs are a strong source of potassium and vitamin K. Dehydrated figs have a higher calcium content than most dried fruits. This mineral is contained in a single ounce (28 g) which supplies 5% of your everyday needs.

15. Milk:

One of the best and cheapest calcium sources is milk. Depending on whether it's whole or nonfat milk, one cup (237 ml) of cow's milk contains 276–352 mg. Dairy calcium is also well absorbed (40, 41). In addition, milk is high in protein, vitamin A, and vitamin D. Goat's milk, with 327 mg of calcium per cup (237 ml), is another excellent source of calcium.

Milk is a great source of calcium that is easily absorbed. This mineral is found in one cup (237 ml) of milk, which provides 27–35 % of the RDI. Calcium is an essential mineral the tone may be deficient in.

Although dairy products contain the uppermost levels of this mineral, there are many other strong sources, many of which are produced from plants. The foods mentioned in this article can easily satisfy your calcium requirements.

Calcium-enriched foods for vegans and people who do not eat dairy: [53]

The nutrients mentioned below are high in calcium and do not comprise any animal products.

Pic 2: Sunflower seeds

1. Chia seeds:

Plant-based calcium sources include chia seeds and soy milk. The calcium content of chia seeds is 179 mg per ounce (or 2 tablespoons).

Chia also contains boron, a mineral that aids in the metabolism of calcium, phosphorous, and magnesium in the body, promoting bone and muscle health. Chia seeds may be applied to smoothies or stirred with yogurt for a crunch lift.

2. Soy milk:

Soy milk also contains more vitamin D than lactose-free whole milk and has less saturated fats.

3. Almonds:

Almonds contain calcium. Although the fat of almond is mainly mono-unsaturated and nutritious, it is high in calories, so a person can limit themselves to a quarter cup per meal.

4. Dehydrated figs:

Figs are high in fiber and antioxidants and make a tasty, sweet treat. Crush them into a smooth jelly or serve them as a midday snack.

5. Tofu:

Tofu is also a good source of calcium. Calcium content, on the other hand, ranges from 275 to 861 mg per half cup, depending on firmness and brand. Read the labels carefully and choose tofu that holds calcium chloride, which is used as a coagulant by manufacturers, to get the calcium benefits.

6. White beans:

White beans are high in iron. They can be combined with a favourite soup or salad, served as an optional dish, or used to make hummus.

7. Sunflower seeds:

Magnesium, which helps to regulate nerve and muscle health by controlling calcium's effects in the body, is also abundant in these plants.

Pic 2: Sunflower seeds

Sunflower seed kernels are also rich in vitamin E and copper. These elements, when taken together, can enhance bone strength and endurance while also avoiding bone loss.

Sunflower seeds, on the other hand, will contain a lot of added salt, which depletes calcium levels in the body. Choose raw, unsalted seeds for the greatest health benefits.

8. Broccoli rabe:

Broccoli rabe, broccoli's acrimonious relative, has 100 mg of Ca per serving. The strong taste of this hearty vegetable is frequently toned down and complimented in many recipes.

9. Edamame:

Edamame is a high-quality protein that is available fresh or frozen, shelled or in pods, and contains all nine basic amino acids.

10. Kale:

Kale is part of the same family as broccoli and other cruciferous vegetables. The leafy green's antioxidants can help to avoid or in the postponement of cellular impairment. Kale has a low-calorie content, with just 35 calories per 100 g. Kale can be cut and added to salads, or it can be sautéed or steamed as a side dish.

11. Sesame seeds:

A pregnant mother’s diet can be fortified with 88 mg of calcium by consuming only 1 tablespoon of sesame seeds. For a nuttier taste, toast the seeds and scatter them over a salad or bake them in bread.

Sesame seeds are also rich in zinc and copper, all of which are essential for bone health. Supplementing with sesame seeds supports to alleviate certain effects of joint osteoarthritis. Of leg.

12. Broccoli:

The calcium content of one cup of stored broccoli is 87 mg. According to the National Cancer Center in the United States, a diet high in broccoli can be related to a lower risk of cancer.

Broccoli compounds have been shown in rodent experiments to help reduce cancers of the bladder, breast, bowel, liver, and stomach. Human trials, on the other hand, have yielded in conclusive findings.

13. Sweet potatoes:

The calcium content of a large, sweet potato is 68 mg. These vegetables also contain potassium and vitamins A and C. Vitamin A is an essential antioxidant that may aid with eye defense, cancer prevention, and ageing tolerance. Sweet potatoes don't contain high fat and calories. In certain areas of the region, they are used as a complementary dish.

Pic 3: Sweet potatoes

14. Mustard and collard greens:

Uncooked or fresh mustard greens are also high in health-promoting nutrients, with one cup providing 64 mg of calcium.

15. Okra:

Okra contains essential nutrients such as nutrition, carbohydrate, iron, and zinc. Much people like the vegetable in various forms, such as fried, grilled, marinated, or fermented.

16. Oranges and orange juice:

According to the National Institutes of Health, A single glass of calcium-administered orange juice contains 300 mg of calcium, while one full orange contains 74 mg. Butternut crush has 84 mg of calcium per mug served. Per day, men should take 90 mg of vitamin D, while women should take 75 mg.

18. Arugula:

Arugula contains calcium. With just 5 calories per cup, arugula is high in water and low in calories. Through consuming 3 to 4 cups of calcium per day, a person's calcium consumption may be increased. Arugula also contains erucin, which has anti-carcinogenic properties.

Calcium is a vital inorganic nutrient and can easily be accessed by cooking. Moreover, in terms of having proper calcium diet take advices of the obstetricians [53]**.**

Importance of folic acid during pregnancy:

Folate is a B vitamin that can be provided in a number of supplements and diets that have been enriched with it. It's a type of folate that has been synthesized. Our body uses folic acid to make new cells and generate DNA. It's important for natural development and growth in our life.

Folic acid is especially essential before and during pregnancy. It is vital for a developing baby's proper organ growth.

According to study, consuming folic acid before getting pregnant can help avoid spina bifida, encephalocele (rarely), and anencephaly [54].

Pic 5: Orange

What are the health benefits of taking folic acid during pregnancy:

Per year, nearly 3,000 babies in the United States are born with neural tube defects. By 28 days after pregnancy, the neural tube may have grown into the spinal cord and brain. Neural tube defects arise when the neural tube does not shut correctly. Anencephaly is a disease in which the brain struggles to function normally. Anencephaly infants do not have a hope of survival. Multiple surgeries, paralysis, and long-term impairment can be needed for babies born with spina bifida or encephalocele.

According to a study of research conducted in 2015, maternal folic acid intake lowers the risk of congenital heart defects. In the United States, these abnormalities occur in 8 out of every 1,000 births per year [55].

Congenital heart defects occur when the heart or blood vessels do not form properly until birth, according to the American Heart Association. They can have an influence on the heart's internal walls, heart valves, or arteries and veins. Folic acid supplementation during breastfeeding, according to Reliable Source, can help avoid cleft lip and palate. During the first 6 to 10 weeks of conception, portions of the mouth and lip do not merge correctly, resulting in these birth defects. The disorder is typically treated by one or more operations [55].

Amount of folic acid during pregnancy to be taken:

Pregnant woman can intake no less than 400 (µg) of folic acid on a regular basis. 600 microg of folic acid are present in certain prenatal vitamins [56]

It's likely that taking folic acid after finding out pregnancy isn't enough. The majority of women are unaware that they are pregnant for at least six weeks after conception., neural tube defects typically manifest within the first month of birth often before someone knows she is pregnant

The CDC advises that women who intend to become pregnant or who are of childbearing age take 400 mcg of folic acid every day to ensure they have enough folic acid in their bodies to avoid neural tube defects. If a pregnant mother has already given birth to a child with a

congenital spinal cord tube defect, she may expect higher folic acid doses in the months leading up to and through the next pregnancy [56].

Some health conditions also need higher folic acid doses:

- have kidney disease and are on dialysis
- have sickle cell disease
- have liver disease [56]

Folic acid from food:

Many crops, such as leafy greens, beets, and broccoli, contain natural folate. In the United States, folic acid is added to certain foods. There are some of them:

- orange juice
- pasta
- cereals
- rice

Many fortified breakfast cereals have 100 % of the folic acid that one needs. Even then, if you monitor the levels of folate and folic acid in everything you consume, it can be impossible to know just how many someone is receiving [56].

There's no way to tell if one will get enough folic acid from food alone, so taking a supplement is necessary.

It's likely that if pregnant mother gets morning sickness early in the pregnancy, it'll be tough to get pregnant. To guarantee that you get enough folic acid before and after birth, doctors will usually recommend taking a folic acid supplement or an antenatal vitamin that contains

folic acid. There is no way to ensure that any birth defects can be prevented. Having enough folic acid before and during having baby will help to lower the risk of:

- cleft palate
- cleft lip
- Birth tube defects
- Congenital heart defects [56].

If a woman is considering a baby, a prenatal vitamin should be part of the everyday routine. Prenatal vitamins come in a number of types, including pills, tablets, and chewable. Prenatal vitamins should be taken with meals to prevent stomach discomfort.

Please contact a doctor before consuming a prenatal vitamin, since taking so many vitamins can be detrimental to your unborn child.

A woman should also have folic acid-fortified foods in the diet. Never put off getting serious with folic acid before finding out of pregnancy. It could be too late by then. Consult the doctor to decide how much folic acid is needed.

Necessity of folic acid in reproductive age :

Our bodies work very hard during breastfeeding certainly, but they can't grow a child on their own. One of the most essential nutrients for an infant's growth is folic acid. With the aid of folic acid, protein, the building block of our cells, is degraded, used, and produced. It's also involved in DNA processing and red blood cell growth. Folic acid aids in the proper closing of the fetal neural tube, which is the antecedent to the baby's nervous system and spinal cord, during the first few weeks after birth. It also aids the proper development of the fetus' heart

and circulatory system, lowering the risk of birth defects in your newborn. Since folic acid is water soluble, it is not retained by the body. Instead, it's passed by the poop. To avoid a folic acid deficiency while pregnant, women must consume enough folic acid on a daily basis. Since the majority of congenital abnormalities occur in the primary days of birth, it's essential to have adequate folic acid without any delay.

Life-saving effects of folic acid intake:

A lot of research has found that folic acid has a lot of health benefits for pregnant women and their infants, particularly if taken in the months leading up to birth. That involves decreasing the likelihood of:

- Miscarriage: study has shown that folic acid deficiency can make it impossible for certain women to get pregnant or remain pregnant.
- Spinal tube deformities associated with spina bifida and anencephaly approximately 70%.
- Child born cardio-vascular defects
- Pregnancy induced diabetes mellitus
- Early parturition
- Congenital anomalies for infant [56].

Amount of folic acid requirement during pregnancy:

Pregnant women should take 400 micrograms of folic acid each day, according to the American College of Obstetricians and Gynecologists (ACOG), the Centers for Disease

Control and Prevention (CDC), and the United States Preventive Services Task Force (USPSTF).

It's important not to overdo it while a woman is pregnant and drink so much folate and folic acid. Autistic children are more likely to be born to mothers who have very high folate levels at the time of birth, according to a 2016 report. Breastfeeding vitamin B12 deficiency has also been attributed to an elevated risk of autism [56].

Origins of folic acid: [57]

Folic acid can be present in at least 400 microg of all prenatal vitamins. Consider it a nutritional back-up during your pregnancy; it'll come in handy, especially if a pregnant woman is too sick to eat. As a consequence, make it a priority to take every day. A vitamin or folic acid supplement, on the other hand, cannot replace a nutritious diet. During pregnancy, it's particularly important to consume lots of folate-rich foods because they're also high in fiber, Ca, vitamin A, and vitamin C, to name a few. The followings are the better folate-rich foods to use in your diet:

- Brussels sprouts.
- peas
- Avocado
- Legumes
- Asparagus
- Beetroots
- Orange
- Green vegetables
- chickpeas and kidney beans.
- liver (but avoid this during pregnancy)

2.5 Role of iron, calcium, folic acid during pregnancy:

Effects of iron deficiency in women with pregnancy: [58]

One can feel exhausted and drained if you have iron deficiency anaemia. Extreme anaemia may also cause pregnancy complications. It may, for example, compromise the mother's resistant system, making infections frequently. It also increases the chances of a child being born too light (small for birth weight).

In stable pregnant women who consume a well-balanced diet, severe anaemia is rare. Anemia, on the other hand, will lead to severe health issues in women who are unable to consume a balanced diet.

When does the use of iron supplements make sense:

Iron supplements are often taken by pregnant women and their bodies need more iron at this period. Iron supplements are often used for pregnant women with low blood iron levels to avoid anaemia. In the other hand, mild anaemia has no impact on the boy.

Only if anaemia is severe and lasts a long time should you be concerned. Anemia caused by iron deficiency is normally treated with high-dose iron supplements.

Pregnant or lactating women need 20 to 30 mg of iron a day, according to the German health authority. Vegans can have a particularly hard time getting enough iron from their food only. Standard blood checks, on the other hand, may reveal iron deficiency issues [59].

Iron supplements are beneficial for women with average iron levels:

The use of iron supplementation in breastfeeding has been studied in more than 60 trials. The studies enlisted the participation of over 40,000 women. The results show that having 30 mg of iron a day as a protective quantity has no significant health advantages for women or their children if their iron levels are normal. Although iron supplements have been shown to minimize the risk of anaemia, they have had little effect on the number of preterm births, small birth weight babies below 2,500 g, or infections in expectant women [59].

Why Iron Needs:

Following that, a few fundamentals: Iron is used by the body to make hemoglobin, a substance found in red blood cells that transports oxygen across the body. During birth, your body supplies blood and oxygen to your newborn, so your need for iron increases to keep up

with the increased blood supply. In reality, you need about twice as much iron when you're pregnant—27 mg per day—than when you're not [60].

Why iron is essential in pregnancy:

Pregnancy raises the blood flow, therefore, the iron comes in. Iron is metabolized by the body to create red blood cells. Increased blood flow means that you will require more red blood cells and more iron to produce those blood cells.

If anyone doesn't have enough iron in the body, you may cause anemia. Anemia is the most common disease of the blood of pregnant women.

Anemia during pregnancy will place you and your child at a greater risk of multiple complications, including preterm birth and low birth weight.

Function of Calcium in our body:

All craves this essential mineral on a daily basis. In addition to making up your teeth and muscles, calcium retains our blood and tissues flowing and makes our nerves relay signals from our nervous system to the whole body.

Calcium Requires In pregnancy:

Calcium is not produced by the body, so it must be obtained by diet or supplementation. During pregnancy we should get minimum 1,000 mg of calcium each day. If someone is under the age of 18, you can take minimum 1,300 mg of calcium a day [51].

Calcium is one of the main nutrients that you need during pregnancy—along with other vitamins and minerals, the body supplies it to your baby to help build essential components

such as the skeleton. Needs differ in age, and too much and too little calcium may cause problems.

Calcium and its Human Body Role:

Calcium is needed for muscle spasm and relaxation, ovulation process , healthy bone and tooth formation, blood coagulation, nerve reflexes propagation, heartbeat regulation, and cell fluid equilibrium.

Calcium intake during pregnancy has the ability to mitigate adverse gestational effects, in particular by reducing the likelihood of developing hypertensive disorders during pregnancy, which are linked with a large number of maternal deaths and a significant risk of preterm delivery, the leading cause of early pregnancy.

Folic acid is a source of B9 vitamin. Folate is essential for the production of erythrocytes as well as the growth of the baby's spinal cord. The highest food levels of folic acid are processed cornflakes.

Advantages of folic acid:

Pregnant or planning to become pregnant women should consume at least 400 g (0.4 mg) of folic acid a day for at least three months before pregnancy. According to research, this lowers the risk of severe neural tube defects in children.

Neural Tube Defects: [61]

The brain and spinal cord develop incorrectly due to neural tube defects, which are congenital deformities. The most eminent neural tube defect is:

- spinal bifida: where the spinal cord and spinal column are not fully closed

- Anencephaly: a substantial not properly developed of the brain
- Encephalocele: where brain tissue bulges to the skin from the opening of the skull.

Both abnormalities occur within the first 28 days of a woman's pregnancy, well before she realizes she's pregnant. That's why getting enough folic acid is crucial for all women of reproductive age, not just those who are attempting to conceive. Since half of all pregnancies are unplanned, any woman who is thinking about getting pregnant should make sure she gets enough folic acid.

It's indistinct why folic acid is so effective at preventing neural tube defects. On the other hand, experts know that this is critical for DNA processing. As a consequence, folic acid is essential for cell growth and development, as well as tissue formation.

2.6 Factors affecting the level of iron, calcium, folic acid during pregnancy:

Factors impacting the iron level: [62]

Calcium is found in milk, butter, cheese, sardines, dried fish, tofu, broccoli, almonds, figs, turnip greens, and rhubarb, and is the main known substance that inhibits all non-heme and heme iron absorption. Oxalates hinder the absorption of non-heme iron. Disease’s symptoms can even restrict the absorption of iron; this may be due to lack of stomach acid, lack of intestinal factor (IF), celiac disease, Crohn's disease (inflammatory disorders), autoimmune diseases and hormonal imbalances. Girls, children, and the elderly are at highest risk.

Coffee and caffeine can inhibit the absorption of iron. Several studies have shown that coffee and other caffeine beverages can reduce the absorption of iron. One research showed that consuming a cup of coffee with a hamburger meal decreased iron absorption by 39% [63]. What's more, the hotter the tea or coffee, the less iron is consumed.

Some foods or beverages, such as tea, chocolate, whole grains, legumes, milk, or dairy products, contain substances that can reduce the amount of non-heme iron consumed at a meal. Calcium can reduce the amount of heme-iron absorbed during a mealtime.

Factors influencing calcium levels: [64]

Calcium citrate supplements are more quickly absorbed than calcium carbonate. They can be used on an empty stomach and are thus more readily ingested by people who take heartburn-reducing medications. However, because calcium citrate is just 21 % calcium, you can need to take more tablets to satisfy your normal requirements.

During breastfeeding, hemodilution induces a drop in serum albumin and hemoglobin while the albumin stays low before birth. This decrease in albumin allows the overall serum calcium to decline to levels usually associated with symptomatic hypocalcemia.

Some food ingredients: phytic acid and oxalic acid, normally present in some herbals, bind to calcium and can prevent its absorption. Foods containing elevated amounts of oxalic acid contain lettuce, collard greens, sweet potatoes, rhubarb, and beans.

Our bodies do not consume calcium well from foods that are rich in oxalates (oxalic acid) such as spinach. Other foods containing oxalates include rhubarb, beet greens and certain beans.

Hormone condition hypoparathyroidism can also cause calcium deficiency. Other causes of hypocalcemia include malnutrition and malabsorption. Malnutrition is when you don't get enough nutrients, while malabsorption is when the body can't consume the vitamins and minerals you need from the food you eat.

Factors that affect folic acid during pregnancy: [54]

• Diseases in which folic acid is not sufficiently received in the digestive system; (such as Celiac disease or Crohn disease)

• Eating overcooked fruit and vegetables.

• Hemolytic anemia

• Other drugs (such as phenytoin, sulfasalazine, or trimethoprim sulfamethoxazole).

2.7 Outcomes of iron, calcium, folic acid deficiency during pregnancy:

Outcome of Iron deficiency during pregnancy: [12]

Severe anemia during pregnancy increases your risk of -

- premature birth,
- inferior neonatal health
- low birth weight baby
- postpartum depression,
- infant death immediately before or after birth,
- prenatal development limit, as well as obesity and
- elevated blood pressure in offspring later in life.

Hemoglobin levels above 11 g per deciliter at the start and end of pregnancy are considered normal. A slight decrease to 10.5 g per deciliter between three and six months of pregnancy is considered common.

Outcomes of Calcium deficiency during pregnancy: [65]

Potential harmful effects of calcium intake deficit during pregnancy can be affected-

- bony absorption
- hypertensive disorders may occur
- have an impact on fetal development

During breastfeeding, calcium concentration and excretion in the urine are higher than during labor or birth, resulting in high blood pressure and pre-eclampsia. (Pre-eclampsia is a life-threatening disease in which the mother's blood pressure and cholesterol levels in the urine are abnormally high.)

Outcomes of folic acid deficiency during pregnancy: [54]

Pregnant women ought to get adequate folic acid. Vitamin is fundamental for the progress and growth of the spinal cord and the brain of the fetus. Folic acid deficiency can cause serious birth deformities such as spinal tube defects. Low dietary and circulating folate concentrations are associated with elevated risks during pregnancy-

- Early delivery,
- Small birth weight baby and
- fetal developmental delay

- NTD (Neural Tube Defect)

2.8 The aim / objective of the present work:

Anemia, folic acid deficiency and hypocalcemia are also worldwide municipal health issues impacting both developed and emerging countries with significant health implications, in addition to public and commercial growth. Bangladesh is a developing world, where anemia, folic acid deficiency and hypocalcemia exist at all stages of the development cycle, but these health issues are more common in pregnant mothers and young children. Data from this study were obtained from one of the most famous government hospitals in the Dhaka Medical College Hospital. The goal and purpose of this research was to approximate and assess the prevalence, forms and causes of anemia, folic acid deficiency and hypocalcemia in pregnant women and to determine its relationship with maternal and fetal outcomes as well as the steps to be taken to avoid and treat anemia, folic acid deficiency and hypocalcemia among pregnant women with low socio-economic status in Bangladesh.

2.9 Suitability of using Sysmex XN-2000 for the present investigation:

In all samples, haematological limits of hemoglobin (Hb), haematocrit (HCT), mean cell volume (MCV), and red cell dissemination diameter in measurement of variation (RDW-CV) were calculated; trimester stages of each pregnancy were reported using Sysmex XN-2000-a perfect pair for easy and prolonged study. The XN-2000 framework is a synthesis of two modules of analysis that can be fitted with. It is turned into an excellent approach for simple and extended research in its Rerun & Reflex setup. Since both modules process rack samples at the same time, they are capable of handling any sample without stuttering. Also, with odd samples, the modules mesh together perfectly, and no one can waste time. In the event of a serum calcium level test, A blood sample will be taken from your arm by your doctor. An instrument is inserted into an arm vein, and a slight volume of blood is drawn into a tube. Drawing blood can take no more than five minutes. It feels like a small squeeze as the needle hits the shoulder. Red blood cells can also be checked for folic acid. This technique could be

a better alternative to a serum test for determining the level of folic acid in the body. The amount of folic acid in red blood cells is the same as it was four months earlier when the cell was formed.

Chapter 3

MATERIALS AND METHODS

3.1 Sample (Blood) collection:

50 pregnant women's blood samples were taken and placed in EDTA tubes between December 2019 and February 2020 from the Dhaka Medical College Hospital of Dhaka during the visits of the pregnant women to the Obstetrics & Gynaecology Department by using Sysmex XN-2000. The haematological limits of Hemoglobin (Hb), Haematocrit (HCT), Mean Cell Volume (MCV) and Red Cell allocation Width in coefficient variation (RDW-CV) were found in very of the tests, and the trimester phases of every pregnancy were recorded.

In the event of a serum calcium level test, the healthcare professional drew blood from your shoulder. An instrument will be implanted into an arm vein, and a small amount of blood will be drawn and stored in a bottle. Blood can be drawn in less than five minutes. When the needle hits your shoulder, you can feel a small touch.

The amount of folic acid in red blood cells was also calculated. This test could be a safer way to identify the amount of folic acid contained in the body than the serum test. The amount of folic acid in red blood cells reflects the level at the time the cell was formed, which may be up to four months ago.

The Data of sample collection is compiled in detail in the table 3 (a), 3(b), 3(c), 4(a), 4(b), 4(c), 5(a), 5(b).

3.2 Sample preparation:

The XN-2000-a seamless pair for simple and protracted research. The XN-2000 framework is a hybrid of two research components that can be fitted for a particular therapeutic program. It is turned into an excellent approach for simple and extended research in its Rerun & Reflex setup. Since both modules process rack samples at the same time, they can handle any sample without slowing down. The components are working together well. And nobody has to waste any valuable time, even with irregular samples.

Integrated reflex checking ensures that anyone does not needs to pick and reload samples manually. The impulse tester automatically feeds the samples to the left-hand segment and conducts extended measurements. If there are no odd samples, the machine speeds up by running on regular samples as an alternative.

Having two modules up and working ensures that there is more protection for everyday routines, since there is still an automated back-up system at the hands. To expand the reach of your laboratories, you can network your XN-2000 with other XNs to create numerous-position installs. This helps you to pair advanced " and central laboratory units and expand your service offering. And together the remote services, anyone can determine support quality standards, guarantee service response times, and ensure optimum device uptime.

Fresh human entire blood samples should be used in the evaluation report, anticoagulated with K2EDTA (or K3EDTA) and obtained within 4–8 hours of blood collection while kept at room temperature [66]. Hematological parameters remain constant for longer as samples are refrigerated. To ensure that all types of tubes taking to laboratory are reported for the authentication report, careful attention is needed. Micro tubes should be checked once they are used (for example, for pediatric patients and capillary sampling). The limited sample volume of these containers will impair sample management by the HA. Further assurance that samples with a broad spectrum of fundamental pathology are included in the analysis, with findings covering the whole analytical range, such as samples with low platelet and/or WBC counts, high cell counts, irregular cells (blasts), and established nosiness tasters including cryoglobulins, high bilirubin, and high triglycerides.

Pic 5: XN-2000 - a picture-perfect pair for rudimentary and long-drawn-out testing

Calcium in the blood can be measured using two different tests. Both free and bound sources of calcium are tested in the overall calcium assay. Only the free, metabolically active source of calcium is tested in the ionized calcium process. Any day, the body loses calcium, which is injected into the kidneys from the blood and excreted in the urine and sweat.

3.3 Analysis of blood by Sysmex XN-2000 testing system:

The XN-2000 offers an innovative solution which swaps the standard principal and gridlock schemes used previously.

• Most of the characteristics of the XN-1000 plus doubling the timely capability

• Automated capability adjustment between the two parts

• Solitary, redundant IPU architecture with combined record.

With the XN-Series, one now has the consistency and power to best balance the capacity, scientific criteria, and computer requirements, irrespective of the amount and quantity of samples one collects every day. Today, hematology is really distinct. The XN-Series deviates the technique hematology is conducted in the new scientific test center. This latest compiled dais has the following offer:

• Tested and revolutionary innovations that offer the most robust CBC and disparity obtainable.

• Progressive tests of hematopoiesis:

- Leukopoiesis— Even at the lowest WBC counts and differentials, automated immature granulocytes and weak WBC confidence can be found.
- Erythropoiesis— Immature Reticulocyte Fraction (IRF)., RBCs with nucleolus, and reticulocyte hemoglobin (RET-He)
- Thrombopoiesis [67].

• Ground-breaking methods to substance organization: – RU-20 and CELLPACK® DSTTM concentrated reagent device to eliminate chemical variations – narrower chemical bottles to dramatically decrease store space – new RFID (Radio Frequency Identification) dye cartridges for improved comfort and trust during chemical variations.

• Intelligent Automation reliability besides performance gains, including the potential to achieve self-validation by more than 85 per cent, using Sysmex WAMTM.

• Advanced Top Management to maximize the number of experiments that can be conducted on an only hematological sample.

• Meaningfully minor tracks to better maximize highly desirable laboratory space.

3.4 Quality control:

For intra-instrument quality control, regular (or more frequent) sampling of quality control samples is needed (internal quality control) [68]. The producer normally provides quality control samples, which are separated into 2^{nd} and 3^{rd} stages (low, medium, high). Some roadblocks are there to overcome. For starters, these samples are often tampered with in order to prolong their shelf life; as a result, they can show inversely than normal patient stock.

Secondly, since the producer's goal requirements are often wide-ranging, small differences in the analyzer's actions may be ignored. After a run-in period with several experiments, it is often suggested that the goal range be adjusted. The advantage of consuming these superiority regulator samples is that they can be used to assess the over time of the instrument's precision using the Levey–Jennings graph; though, it should be noted that the quality of the control samples that deteriorate towards the end of the shelf life should be taken into consideration [69]. Using the so-called moving average as an alternate technique is appealing. This statistical approach is based on the number that the statistical parameters of the CBC in an excessive population are constant over time, and therefore variations in the average value that constitute an analytical problem are expressed in the change in the average value. Although this approach has proved to be very durable and cost-effective, quality control samples must also be used. An inter-instrument consistency audit should be performed if a laboratory uses many HA and/or different analytical methods for the same parameter. Both methods will provide the equal result for each sample. If differing interventions result in unexpected differences in recorded results, this may contribute to misinterpretation and perhaps ineffective therapeutic intervention [69]. An inter-instrument quality control comparison is expected to ensure the harmonization of reported outcomes between different analyzers and procedures. This is usually achieved by comparing the effects of patient samples on these different systems. Different HAs should be matched at least once a week, using at least three or four samples [69] .It is mandatory to take part in the external standard assessment (EQA) Programme. To ensure a fair comparison, EQA samples should be treated the same as regular patient samples. EQA also employs manipulated samples that are intended to resemble pathological models. Samples are tampered with to extend their shelf life and reduce their vulnerability to transportation-related issues. As a result, a straightforward comparison of medical experiences is impossible. Workshops should

practice the EQA data to relate the findings to (inter)national records or comparison results in order to improve accuracy and harmonize their HA with the Consensus Community. In the nonappearance of a comparative measure, the outcomes can be compared to the HA group using the same statistical approach, since the consensus beliefs may be continuously biased by the most influential group method's inaccuracy [69].

Furthermore, since the EQA accord value and the exact value (calibrator) are not always the same, EQA content cannot be used for calibration. Regulatory bodies in certain countries are modifying EQA outcomes to assess the efficacy of contributing laboratories. This has an adverse impact on laboratory self-development, and it is recommended that this practice be stopped [69].

Chapter 4

RESULTS & DISCUSSION

The level of different micronutrients-Hb, iron, calcium, and folic acid from the blood sample of pregnant women of different trimesters were investigated and those results are presented in table 3, 4, 5 and briefly discussed. Our reported values are presented in g/dl, µg/dl, µg/L, and mg/dL.

Serum hemoglobin:

Hemoglobin or haem +-o-+ globulin, abridged Hb or Hgb, is an iron-holding oxygen transporting metalloprotein in the red blood cells of nearly most of the vertebrates and the tissues of some invertebrates. Blood hemoglobin transports oxygen from the lungs or gills to the whole body.

The serum hemoglobin test determines how much hemoglobin is free-floating in the blood serum. The substance left over after red blood cells and clotting factors have been separated from your blood plasma is known as serum. Our erythrocytes contain hemoglobin, which is an oxygen-carrying molecule.

Serum Hemoglobin level in Anemia:

- Mild 10-11 mg/dl
- Moderate 7-10 mg/dl
- Severe <7 mg/dl
- Very Severe <4 mg/dl
- Anemia is characterized as a haemoglobin (Hb) concentration of less than 11 g/dl during pregnancy [2].

Serum Iron:

Iron is a required micronutrient for the proper growth of red blood cells as well as a stable immune system (c). Iron deficiency is the world's most common and widespread nutritional deficiency, affecting the poorest people, particularly women, and accounting for roughly half

of all cases of anaemia. Anemia is characterized as a low concentration of hemoglobin in the blood. Iron deficiency is a common cause of anaemia [70].

The amount of circulating iron bound to transferrin and serum ferritin is measured by serum iron, a medical laboratory examination. This laboratory test is ordered by doctors because they are worried about an iron deficiency, which can lead to anaemia and other complications.

Normal Iron Range:

Serum iron is measured in microg of iron per blood deciliter (µg/dL). The subsequent are measured to be normal ranges for the serum iron test: iron: 60 to 140 µg/dL or 10.74 to 30.43 µmol/L. Total Iron Binding Capacity (TIBC): 240 to 450 µg/dL, or 42.96 to 80.55 µmol/L. Transferrin saturation: 25% to 35% [71]. The normal level of serum iron for women is 60 µg/dL to 140 µg/dL. Max iron binding capacity is 250 µg/dL to 450 µg/dL [72].

According to World Health organization (WHO, 2013), Anemia is a disorder in which the amount of red blood cells or their oxygen carrying capacity is inadequate to satisfy the physiological needs of the person, which, as a result, varies in age, sex, mood, smoking and pregnancy.

The prescribed dietary allowance (RDA) for iron is higher during pregnancy to help a woman's body provide for fetal growth and development. Iron deficiency (ID) also precedes the diagnosis of Iron Deficiency Anemia (IDA), since a loss of iron will go undetected before one's quality of life suffers. Women that are pregnant or of reproductive age are particularly vulnerable to the spread of ID and IDA [73]. Iron deficiency anaemia (IDA) is a condition

that affects people in both developing and developed countries. An individual with normal anaemia symptoms and consistently poor clinical markers of stored iron is diagnosed with this disorder [74]. The reticule-endothelial system, as well as iron-rich diets, iron-fortified foods, and iron supplements, are all essential for retaining and distributing adequate quantities of iron in the body [75]. Iron supplementation, which comes in a variety of forms, is widely used, especially in pregnant women who have IDA [76].

Iron Requirements in Pregnancy: [77]

During Pregnancy approximately 1,500 mg iron is required for:

- Rises in mothers' hemoglobin approximately 400-500mg
- The fetus and placenta require 300-400 mg
- Substitution of loss everyday by urine, stool and epidermis which is 250mg
- Substitution of lost blood at parturition near about 200mg
- Lactation/ Breast Feeding (1mg a day)
- Elemental iron 30 mg to 60 mg

Iron Deficiency Anemia:

- Iron deficiency type 1 affects about 95% of pregnant women who have anaemia [78].
- A pregnant woman is said to be anemic if her hemoglobin is less than 11 g/dl [2].
- Pregnancy anemia is the most prevalent medical condition in pregnancy.
- Anemia is the primary or only cause of 20–40 per cent of maternal deaths [79].
- 18-20 pregnant women are anemia in developed countries compared to 40-75 per cent in emerging countries [80].
- Iron deficiency anemia is blamed for the high feto-maternal death rate worldwide.

- Anemia is the most common illness condition, affecting over 1.5 billion people globally, according to the World Health Organization (WHO).
- Iron deficiency anaemia (IDA), on the other hand, accounts for 50% of all anaemia cases [81].

Classification of Anemia: [82]

A. Physiological Anemia

B. Pathological Anemia

- Iron shortage
- Folic acid deficit
- Vitamin B12 lacking

1. Hemolytic anemia
    - Familial—congenital jaundice, sickle cell anemia, etc.
    - Acquired—malaria, severe infection, etc.

2. Bone marrow inadequacy
    - Radiation, medications, or a serious infection may cause hypoplasia or aplasia.
3. Hemoglobinopathies
    - Sickle cell disorder is characterized by an abnormal arrangement of one of the globin chains of the haemoglobin molecule's globin chains of the haemoglobin molecule's globin chains of the haemoglobin molecule's globin chains of the haemoglobin molecule's globin chains of the haemoglobin molecule'
4. Hemorrhagic Anemia
    - Acute—following bleeding in early months of pregnancy or APH

- Chronic—hookworm infestation, bleeding piles, etc.

Physiological Anemia of Pregnancy:

- During birth, maternal plasma volume steadily rises by 50%, an increase of approximately 1,200 ml per term [83].
- Much of the raise takes place before the 32nd to the 34th week of gestation, although there is very no improvement thereafter (Letsky, 1987).
- The average rise in red blood cells is 25 per cent, about 300 ml, and happens later in pregnancy. This relative hemodilution results in a drop in the concentration of hemoglobin, thereby providing an image of iron deficiency anemia [40].
- However, these modifications have been shown to be a biochemical modification in conception required for the growth of the embryo.

A total of 50 blood trials of women with pregnancy were drawn and the results are given in the table below:

Table 3(a): Sample and Data Collection of Pregnant women for Hb and Serum Iron level

(Chart showing mild iron deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Hemoglobin (Reference value: Women 12-15.5 g/dl) *Mild=10-11 *Moderate=7-10 *Severe <7 *Very Severe <4	Serum Iron level (Reference value: Women 60-140 µg/dl)
1	Rezina begum	23	1st	10.2	40-50
2	Sharmin akhter	29	1st	11.0	40-50
3	Rehana mollick	21	1st	10.9	40-50
4	Dolly khanom	23	2nd	10.3	40-50
5	Nargis akhter	20	1st	10.8	40-50

6	Nazma Begum	27	1st	10.6	40-50
7	Nargis islam	25	1st	11.0	40-50
8	Rina akter	28	1st	10.9	40-50
9	Bilkis akhter	33	1st	10.8	40-50
10	Sheuly Begum	29	2nd	10.4	40-50
11	Ayesha begum	25	2nd	10.1	40-50
12	Nargis banu	24	2nd	11.0	40-50
13	Rehana sultana	22	3rd	10.6	40-50
14	Fatema jannat	28	3rd	10.1	40-50
15	Sharifa begum	29	1st	10.2	40-50
16	Nasrin doly	21	1st	10.3	40-50
17	Naznin akter	23	2nd	10.7	40-50
18	Shamima banu	25	2nd	10.8	40-50
19	Runa bagum	24	1st	11.0	40-50
20	Mina hosen	27	1st	10.7	40-50
21	Baby akhter	25	1st	10.9	40-50
22	Rita bagum	25	1st	10.3	40-50
23	Nahida begum	31	3rd	10.6	40-50
24	Rumi islam	20	3rd	11.0	40-50
25	Shammi akhter	29	3rd	10.8	40-50
26	Popy sultana	26	3rd	10.9	40-50
27	Kafi banu	20	3rd	11.0	40-50

28	Rokeya akhter	22	3rd	10.8	40-50
29	Afrin Sultana	22	3rd	10.9	40-50
30	Asma akhter	28	3rd	11.0	40-50
31	Jannatul ferdous	36	3rd	10.7	40-50
32	Mouly mondal	39	3rd	10.9	40-50

Table 3(b): Sample and Data Collection of Pregnant women for Hb and Serum Iron level

(Chart showing moderate iron deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Hemoglobin (Reference value: Women 12-15.5 g/dl) *Mild=10-11 *Moderate=7-10 *Severe <7 *Very Severe <4	Serum Iron level (Reference value: Women 60-140 µg/dl)
1	Safura begum	19	1st	7.6	30-40
2	Bilkis banu	25	2nd	9.8	30-40
3	Shaly bagum	24	1st	8.2	30-40
4	Ranu moitri	25	1st	7.8	30-40
5	Rani mondal	30	2nd	9.6	30-40
6	Shanti rani	28	2nd	7.8	30-40
7	Prianka mondal	28	2nd	8.2	30-40
8	Ismot Ara	36	2nd	9.9	30-40
9	Nazma akhter	31	2nd	8.1	30-40
10	Rehana jannat	23	1st	8.8	30-40
11	Joba banik	25	1st	9.8	30-40
12	Panti begum	33	1st	8.7	30-40
13	Jotika rani	26	3rd	8.7	30-40

Table 3(c): Sample and Data Collection of Pregnant women for Hb and Serum Iron level

(Chart showing severe iron deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Hemoglobin (Reference value: Women 12-15.5 g/dl) *Mild=10-11 *Moderate=7-10 *Severe <7 *Very Severe <4	Serum Iron level (Reference value: Women 60-140 µg/dl)
1	Nasrin akhter	32	1st	6.7	<30
2	Kamrunnahar	22	3rd	6.2	<30
3	Jahanara begum	19	1st	6.5	<30
4	Shamsun nahar	20	2nd	5.8	<30
5	Shilpi sultana	33	1st	6.4	<30

Causes of mild to severe Iron Deficiency Anemia (IDA): [5]

- Decreased dietary iron intake.
- Reduced or poor iron absorption.
- Excess increase of iron demand during pregnancy.

Effects of Anemia on The Mother: [12]

- Decreased resistance to infection caused by impaired cell-mediated immunity.
- Reduced ability to withstand postpartum hemorrhage or bleeding.
- Strain of even an uncomplicated labor may cause cardiac failure
- Predisposition to PIH and preterm labor due to associated malnutrition.
- Reduced enjoyment of pregnancy and motherhood owing to fatigue.

- Potential or possible threat to life.

Effects to Fetus/ Baby:
[12]

- Intrauterine hypoxia and growth retardation.
- Prematurity.
- LBW.
- Anemia a few months after birth due to poor stores.
- Augmented danger of perinatal sickness and death rate.

IDA is common during pregnancy and after childbirth, but it may cause serious maternal and fetal complications including preterm labor, low birth weight, and postpartum depression. Some studies also show an increased risk of infant deaths immediately before or after birth.

Anemia is characterized as Hb less than 11 g/dL or hematocrit less than 33% of the CDC during the third trimester of pregnancy, and its occurrence varies between populations and geographic regions.

Management of mild to severe Iron Deficiency Anemia (IDA): [84]

- Accurate history of food intake
- Proper history of food habits
- Accurate history of medicine intake (if any)
- Proper history of obstetric and social life
- Early detection of falling hemoglobin level
- Dietary advice with iron enriched food and fruits
- Supplementary iron therapy

- Avoidance of frequent childbirths
- Adequate treatments to eradicate illnesses which may cause anemia.

Pic 6: Pregnant woman in 1st Trimester

Curative Management of mild to severe Iron Deficiency Anemia (IDA): [84]

- Women having hemoglobin level of 7.5 mg/dl and those associated with obstetrical medical complications must be hospitalized.
- Following therapeutic measures are to be instituted:
- Diet
- Antibiotic therapy.
- Blood transfusion.
- Iron therapy which may be oral/ parental.
- Oral iron: daily dose 120- 180 g is given.

Management of Iron Deficiency Anemia (IDA) during Labor: [84]

1st stage:

Special

precautions

- Comfortable position on bed
- Light analgesia
- Oxygenation to increase oxygenation of maternal blood and prevent fetal hypoxia
- Strict asepsis.

2nd stage:

Usually no problem.

- IV Methergine 0.2mg or 20 units oxytocin in

500ml RL IV and 10units of IM given.

Pic 7: Pregnant woman in 2nd Trimester

3rd stage:

Intensive observation.

- blood loss must be replaced by fresh pack cell and

amount must not exceed loss amount to avoid overloading

Puerperium: [84]

- Bed rest
- Sign of infection detected and treated
- Pre delivery iron therapy must be continued until patient restores.
- Diet
- Patient and family members must be counseled for help at home regarding baby care and household chores.

It is shown from the result that, Total 32 (64%) pregnant women's Hb level was in between 10-11 mg/dl and Serum Iron level Women 40-50 µg/dl, which refers to mild iron deficiency anemia. **[Table 3(a)]**

Total 13(26%) pregnant women's Hb level was in between 07-10 mg/dl and Serum Iron level Women 30-40 µg/dl, which refers to moderate iron deficiency anemia. **[Table 3(b)]**

Total 05 (10%) pregnant women's Hb level was in between <7 mg/dl and Serum Iron level Women <30 µg/dl, which refers to severe iron deficiency anemia. **[Table 3(c)]**

Total 32 (64%) pregnant women who has mild iron deficiency anemia during pregnancy and Total 13(26%) pregnant women who has moderate iron deficiency anemia, addition to the prenatal vitamins, one can consider taking an iron and/or folic acid supplement. The doctor can also advise the anaemic pregnant mother with mild to severe iron deficiency to increase her intake of iron and folic acid-rich foods.

Total 05 (10%) pregnant women who has severe iron deficiency anemia obstetrician suggest taking antibiotic therapy, blood transfusion and iron therapy which may be oral/ parental. This management has been similarly reported by Matthew W. Short, LTC, MC, USA, and Jason E. Domagalski, MAJ, MC, USA of Madigan Healthcare System, Tacoma, Washington in the article of "Iron Deficiency Anemia: Evaluation and Management" [84].

Pregnancy anemia is the extensively burning health disorder during pregnancy, so every mother who is pregnant must be tested for anemia and must be treated as soon as possible along with iron-rich foods and must also have family support and care throughout pregnancy.

Folic Acid:

Folic acid is not a natural form of the B vitamin folate. Folate is fundamental for the making of erythrocytes and the growth of the baby's spinal brain tube into the nervous system and spinal cord [61]. The highest nutrient levels of folate are processed cereal. Leafy vegetables and citrus fruits naturally contain folate.

Folic Acid Normal Range: [85]

- **Adults:** 2.0-20.0 µg/L (ng/ml)
- **Children:** 5-21 µg/L (ng/ml) (24)

Requirement in Pregnancy:

Folic acid- 400 µg (0.4 mg) [56]

Pregnant mothers should take prescription vitamins containing the endorsed 400 mg of vitamin B9 before and after infancy to prevent birth defects in their child's brain and spinal cord. A cup of reinforced rice is also consumed during breastfeeding [56].

Hazard of heart disease decreases with the intake of Folic acid [54]

- Reduced risk of pre-eclampsia (pregnancy convulsion).
- Cardio-vascular health hazards.
- Sudden cardiac arrest.
- Various types of carcinoma.
- Memory loss illness (Alzheimer's disease).

A total of 50 blood models of expecting women were taken and the results are given in the table below:

Table 4(a): Sample and Data Collection of Pregnant women for Serum Folic acid level (Mild Folate deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Serum Folic acid level (Reference value: Adult 2.0-20.0 µg/L)
1	Rezina begum	23	1st	3.0
2	Sharmin Akhter	29	1st	3.8
3	Rehana mollick	21	1st	3.8
4	Dolly khanom	23	2nd	3.1
5	Nargis Akhter	20	1st	3.7
6	Nazma Begum	27	1st	3.6
7	Nargis islam	25	1st	3.8
8	Rina akter	28	1st	3.8
9	Bilkis Akhter	33	1st	3.7
10	Sheuly Begum	29	2nd	3.3
11	Ayesha begum	25	2nd	3.1
12	Nargis banu	24	2nd	3.8

13	Rehana sultana	22	3rd	3.6
14	Fatema Jannat	28	3rd	2.9
15	Sharifa begum	29	1st	3.0
16	Nasrin doly	21	1st	3.2
17	Naznin akter	23	2nd	3.6
18	Shamima banu	25	2nd	3.7
19	Runa bagum	24	1st	3.8
20	Mina hosen	27	1st	3.7
21	Baby Akhter	25	1st	3.8
22	Rita bagum	25	1st	3.2
23	Nahida begum	31	3rd	3.6
24	Rumi islam	20	3rd	3.8
25	Shammi Akhter	29	3rd	3.7
26	Popy sultana	26	3rd	3.8
27	Kafi banu	20	3rd	3.9
28	Rokeya Akhter	22	3rd	3.7
29	Afrin Sultana	22	3rd	3.8
30	Asma Akhter	28	3rd	3.9
31	Jannatul ferdous	36	3rd	3.9
32	Mouly mondal	39	3rd	3.9

Table 4(b): Sample and Data Collection of Pregnant women for Serum Folic acid level (Moderate Folate deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Serum Folic acid level (Reference value: Adult 2.0-20.0 µg/L)
1	Safura begum	19	1st	2.1
2	Bilkis banu	25	2nd	2.9
3	Shaly bagum	24	1st	2.5
4	Ranu moitri	25	1st	2.2
5	Rani mondal	30	2nd	2.9
6	Shanti rani	28	2nd	2.2
7	Prianka mondal	28	2nd	2.5
8	Ismot Ara	36	2nd	2.9
9	Nazma Akhter	31	2nd	2.4
10	Rehana Jannat	23	1st	2.7
11	Joba banik	25	1st	2.9
12	Panti begum	33	1st	2.6
13	Jotika rani	26	3rd	2.7

Table 4(c): Sample and Data Collection of Pregnant women for Serum Folic acid level (Severe Folate deficiency anemia)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Serum Folic acid level (Reference value: Adult 2.0-20.0 µg/L)
1	Nasrin Akhter	32	1st	1.6
2	Kamrunnahar	22	3rd	1.6
3	Jahanara begum	19	1st	1.5
4	Shamsun nahar	20	2nd	1.0
5	Shilpi sultana	33	1st	1.4

Causes of Mild, Moderate, Severe Folic Acid deficiency:

The baby's neural spinal tube might not dissolve properly without adequate folic acid in the body and she may grow health issues called neural tube faults. They include: [61]

- Spina bifida: not properly fused spinal cord or vertebrae formation
- Anencephaly: not proper growth of essential components of the nervous system.

Infants with anencephaly do not normally live long, and children with spina bifida can have long-term issues. In 50 percent of cases, getting adequate folic acid will shield the child from neural tube defects, according to the religious point of view. If you've already had a baby with a neural tube defect, getting enough folic acid will reduce the chances of raising another child with one by as much as 70%, according to the CDC [86]. One should increase your folic acid intake to 4000 g (equivalent to 4 mg) a day if you have already had a child with a neural tube defect (91). You should get medical guidance on how many to take. [87].

- Folic acid deficiency anemia occurs as a consequence of insufficient folic acid in our body [88].
- Folic acid is a B vitamin that aids in the formation of new cells in the body, including erythrocytes.
- Folic acid deficiency can cause placental abruption, congenital cardiac septal defects, and neural tube defect of the newborn [88].

Outcomes of Mild, Moderate, Severe Folic acid deficiency: [87]

- Miscarriage (95)
- Poor growth in the womb (95)
- Cleft lip and palate (95)
- Preterm birth (95)
- Small for birth weight (95)

Management of Mild, Moderate, Severe Folic acid deficiency [87]

Start taking Folic Acid:

In the primary 3rd and 4th week of pregnancy, birth malformations may occur (91). Folate is also essential during the early stages of a baby's development, when the brain and spinal cord are still growing.

Since speaking with a psychiatrist, anyone who wishes to conceive is advised to take a fertility supplement that contains folic acid. According to one study, expecting mother who took folic acid for minimum a year before getting pregnant cut their chances of having an early delivery by 50% or more [87].

According to the Centers for Disease Control and Prevention (CDC), one can take folic acid daily for as a minimum a month before getting pregnant and each day after giving birth. The CDC also advises, however, that folic acid be taken every day by all women of childbearing age. So, pregnant mother would be okay to even start taking it sooner [87].

If someone has chosen her own prenatal vitamin, must consult the OB to make sure it contains the endorsed doses of the whole thing she needs, including folic acid, until she gets pregnant. Not all prenatal supplements are the same, and others may contain less or more of the minerals and vitamins than one needs [87].

How Much Folic Acid Should be Taken: [87]

For most of the women of reproduction age, the prescribed dosage is 400 µg of folate per day. It is recommended quantity if one takes a multivitamin per day. Pregnant mother should take vitamins of folic acid if she doesn't want to take a multivitamin for any reason.

In terms of breastfeeding, here's following is the amount of folate prescribed daily:

- For the first three months of pregnancy: 400 µg
- When attempting to get pregnant: 400 µg
- For the first trimester of gestation: 400 µg
- For 2nd and 3rd trimesters of pregnancy: 600 µg
- During Lactation: 500 µg

Good Food Sources of Folic Acid: [87]

In the diet, the following foods will help you get more folic acid:

- Egg noodles
- Cereals
- Beans
- Cornflakes
- Beef liver
- Lentils
- Spinach
- Mature seeds

It is shown from the result that, Total 32 (64%) pregnant women's Serum Folic acid level was in between 3.0-4.0 µg/L, which refers to Mild Folate deficiency anemia. **[Table 4(a)]**

Total 13 (26%) pregnant women's Serum Folic acid level was in between 2.0-3.0 µg/L which refers to Moderate Folate deficiency anemia. **[Table 4(b)]**

Total 05 (10%) pregnant women's Serum Folic acid level was in between 1.0-2.0 µg/L, which refers to Severe Folate deficiency anemia. **[Table 4(c)]**

Total 32 (64%) pregnant women who has mild folate deficiency anemia during pregnancy and Total 13(26%) pregnant women who has moderate folate deficiency anemia, need to start taking folic acid addition to the vitamins which are taken before pregnancy. The doctor may also suggest that the mild to moderate iron deficiency anemic pregnant mother add more foods high in folic acid to the diet. Total 05 (10%) pregnant women who has severe iron deficiency anemia obstetrician suggest taking (400-600) µg folic acid every day during pregnancy. This management has been similarly reported by "The Centre for Disease Control (CDC)", which advises that one continue to take folic acid each day for as a minimum a

month before you get pregnant and daily during your pregnancy. "The Centre for Disease Control (CDC)" also advises, however, that folic acid should be taken every day by all women of gestational age. So, expecting mother is okay to even start taking the folic acid as soon as she gets pregnant to avoid severe folate deficiency anemia [56].

Serum Calcium:

Hypocalcemia can cause multiple problems for the mother and fetus during pregnancy and hypertensive conditions are associated with it and can raise the risk of various complications such as pre-eclampsia and fetal development disorders [89]. The average woman loses 3-5% of her bone mass during pregnancy and breastfeeding. She's going to lose even more if she gets too little calcium from her diet as well as the average woman loses 3-5% of her bone mass during pregnancy and breastfeeding (21). She's going to lose even more if she gets too little calcium from her diet [90].

Calcium is needed for a broad- spectrum of biological processes, including bone and tooth structural support, signal transduction, muscle relaxation, enzyme control, and blood clotting and more dietary calcium is also prescribed, after adjusting for body size, to support growth in babies and infants, to improve osteoporosis in the aged, and to meet the physiological needs of maternal and lactating mothers [91].

Calcium is one of the most important minerals in the body. Calcium is essential for strong bones and teeth. Calcium is also essential for the proper functioning of your nerves, muscles, and heart, and your bones process 99 percent of the calcium in your body. The level of calcium in your blood is determined by a calcium blood test [92].

Pic 8: Pregnant woman in 2nd Trimester

Different forms of calcium in our blood:

There are many common sources of calcium. Calcium ionized, calcium bound to other anions (so-called minerals), and calcium in-bound to proteins like albumin are all examples [93].

Normal range of Serum calcium:

The body uses hormones to control blood calcium levels in order to retain a normal calcium intake in addition to our blood supply, the natural regulation of calcium is close to the way a thermostat function [93].

Calcium is preserved from 8.5 to 10.5 mg/dl (2.2 to 2.7 mmol/L) within a very restricted range.

Standard values and reference ranges can differ by as much as 0.5 mg/dl between laboratories [64]

Normal range of ionized calcium in adults and children: [64]

- In grownups, 4.64 to 5.28 mg/dL is normal limit
- In offspring's, an ionized calcium of 4.8 to 5.52 mg/dL is normal.

Calcium requirements during Pregnancy: [64]

Calcium can't be produced from our body, so pregnant mother has to get it from diet or supplements. She has to try consuming no less than 1,000 mg of calcium a day when someone is pregnant. She needs no less than 1,300 mg of calcium each day whether she is 18 or less than 18 years.

Lab	Normal Limit (Conventional Unit)	Normal Limit (SI Unit)
Serum Calcium	8.6-10.3 mg/dl	2.2-2.6 mmol/L
Ionized Calcium	4.4-5.3 mg/dl	1.1-1.3 mmol/L

Figure 2: Level of Different forms of Calcium [93]

A total of 50 blood collections of pregnant mothers were composed and the results are given in the table below:

Table 5(a): Sample and Data Collection of Pregnant women for Serum Calcium level

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Serum Calcium level (Reference value: Women 8.5-10.5 mg/dL)
1	Rezina begum	23	1st	9.0
2	Sharmin akhter	29	1st	9.5
3	Rehana mollick	21	1st	9.5
4	Dolly khanom	23	2nd	9.2
5	Bilkis banu	25	2nd	8.9
6	Nargis akhter	20	1st	9.8
7	Shaly bagum	24	1st	8.4
8	Nazma Begum	27	1st	9.4
9	Nargis islam	25	1st	9.5
10	Rina akter	28	1st	9.5
11	Bilkis akhter	33	1st	9.8
12	Rani mondal	30	2nd	8.9
13	Sheuly Begum	29	2nd	9.3
14	Shanti rani	28	2nd	8.2
15	Prianka mondal	28	2nd	8.5
16	Ayesha begum	25	2nd	8.7
17	Nargis banu	24	2nd	10.2
18	Rehana sultana	22	3rd	9.0
19	Fatema jannat	28	3rd	8.4
20	Ismot Ara	36	2nd	8.0
21	Sharifa begum	29	1st	9.2
22	Nasrin doly	21	1st	10.1
23	Naznin akter	23	2nd	9.8
24	Shamima banu	25	2nd	9.7
25	Runa bagum	24	1st	9.8
26	Mina hosen	27	1st	9.6
27	Baby akhter	25	1st	9.7
28	Rita bagum	25	1st	9.2

29	Nahida begum	31	3rd	9.8
30	Rumi islam	20	3rd	9.9
31	Shammi akhter	29	3rd	9.8
32	Popy sultana	26	3rd	9.5
33	Kafi banu	20	3rd	9.6
34	Rokeya akhter	22	3rd	9.6
35	Afrin Sultana	22	3rd	9.5
36	Asma akhter	28	3rd	9.2
37	Jannatul ferdous	36	3rd	9.0
38	Mouly mondal	39	3rd	8.8

Table 5(b): Sample and Data Collection of Pregnant women for Serum Calcium level (Hypocalcemia or Calcium deficiency)

S/N	Patient Name	Age (years)	Pregnancy Trimester (weeks)	Serum Calcium level (Reference value: Women 8.5-10.5 mg/dL)
1	Safura begum	19	1st	8.0
2	Ranu moitri	25	1st	7.8
3	Nasrin akhter	32	1st	7.2
4	Kamrunnahar	22	3rd	7.0
5	Nazma akhter	31	2nd	7.8
6	Rehana jannat	23	1st	7.9
7	Jahanara begum	19	1st	6.5
8	Shamsun nahar	20	2nd	6.1
9	Joba banik	25	1st	7.8
10	Panti begum	33	1st	7.7
11	Shilpi sultana	33	1st	6.5
12	Jotika rani	26	3rd	7.5

Hypocalcemia or Calcium deficiency: [24].

Hypocalcemia is characterized as a whole of serum calcium concentration of 8.8 mg/dL (2.20 mmol/L) or a serum ionized calcium concentration of 4.7 mg/dL in the occurrence of normal plasma protein density (< 1.17 mmol/L).

Outcomes of Calcium deficiency during pregnancy: [24].

Hypocalcemia can cause multiple problems for the mother and fetus during pregnancy. Hypertensive conditions are associated with it and may raise the likelihood of multiple problems such as -

- Fetal growth disorders
- Maternal mortality in developing regions
- pre-eclampsia

By increasing uterine smooth muscle contractility, calcium deficiency can lead to preterm birth, but its indirect effect is best known by pre-eclampsia .Hemodilution allows serum albumin and hemoglobin to decline during breastfeeding, while albumin remains low until birth and this reduction in albumin causes the calcium in the overall serum to decrease to levels usually associated with symptomatic hypocalcemia.

- The possible negative effects of calcium deficiency during pregnancy can influence the metabolism of the bone, cause hypertensive disorders, or affect fetal development.
- During labor, calcium intake and calcium evacuation with urine are greater than before conception or following childbirth.
- High blood pressure induces pre-eclampsia (Pre-eclampsia is a maternal condition with elevated blood pressure and protein in the urine that is life-threatening).

Pre-eclampsia is the major consequence of Hypocalcemia or Calcium deficiency: [24]

Pre-eclampsia is a danger of pregnancy noticeable by elevated blood pressure and signs of danger to another system of the heart, most commonly the liver and kidneys. Pre-eclampsia typically starts in women whose blood pressure is normal after 20 weeks of pregnancy.

Risk Factors: Calcium deficiency, Kidney disease, Vitamin D deficiency [94]

Pre-eclampsia Signs and Symptoms: [95]

- Change with impulsive reactions.
- Less micturition or not at all.
- Drowsiness.
- Extreme head nuisances.
- Excessive vomiting and sickness.
- Weight increases over because of a large increase in bodily fluid.
- Abdominal discomfort, especially in the right hypochondriac region.
- Eye-sight deformities like blinking lights, floaters, or fuzzy vision.

Pre-eclampsia: Lab abnormalities: [96]

In pre-eclampsia lab abnormalities are found in the following measures:

- Proteinuria- presence of protein in urine
- Protein/creatinine ratio more than 0.3.
- Low platelets, coagulopathy ratio.
- Platelets count below than 100,000/mm3.
- Increased PT or APTT.
- Serum uric acid greater than 5.6 mg/dL.

- Serum creatinine more than 1.2 mg/dL.
- Depleted fibrinogen.

Pic 9: Pregnant woman in 3rd Trimester

Management:

According to a new World Health Organization (WHO) recommendation, pregnant women in Bangladesh who consume 1.5 to 2.0 g of essential calcium per day from 20 weeks of pregnancy to the last day of pregnancy have a 14 percent lower risk of pre-eclampsia [27]. Clinical guidelines: In Bangladesh, Ca should be added to critical medicine lists [97]. Global clinical recommendations should be revised in addition to the provision of Ca in antenatal care to incorporate an informative aspect in antenatal care as to signs of pre-eclampsia, to implement dietary guidance, and to improve the correct timing of the supplement [98]. In remote areas, the same aspects may be addressed by a nationwide outreach initiative and the outreach can be preempted by the recruiting and preparation and sensitization of an

acceptable group of community health employees as to the functions and relevance of Ca [99].

Supplements of calcium citrate are more readily absorbed than the supplements of carbonate calcium and the people who take acid-reducing heartburn drugs should take them on an empty stomach and they are more readily absorbed but since calcium citrate is just 21 % calcium, to get your daily requirement, you may need to take more pills [100].

It is shown from the result that, Total 38 (76%) pregnant women's Calcium level were in between 8.5-10.5 mg/dL which refers to normal calcium level. **[Table 5(a)]**

Total 12 (24%) pregnant women's Calcium level were below the range of 8.5-10.5 mg/dL, which refers to Hypocalcemia or Calcium deficiency. **[Table 5(b)]**

Total 38 (76%) pregnant women who has to normal calcium level, but still need to start taking calcium complement or supplement in addition to the antenatal vitamins. The obstetricians may also advice that the pregnant mother having normal calcium level add more foods high in calcium to the diet to maintain the pregnancy properly and to avoid pre-eclampsia. Total 12 (24%) pregnant women who has hypocalcemia, obstetrician advises to take calcium supplement as calcium can't be produced from our body, so pregnant mother has to get it from diet or supplements. She has to try consuming minimum 1,000 mg of calcium each day when you're pregnant. Pregnant mother needs no less than 1,300 mg of calcium daily whether she is 18 or below 18. This similar management also has been reported in "Serum Calcium" article by David A. Goldstein and in clinical review article of "Hypocalcemia in Pregnancy" by A. Almaghamsi, M. H. Almalki and B. M. Buhary, Oman Medical Journal, [64] [24].

Chapter 5
CONCLUSION

.All the collected statistics and surveys and related literature indicate that iron deficiency anemia, folate deficiency and calcium deficiency during pregnancy is a community health hazard that distresses both emerging and advanced states, with serious human health, communal, and financial consequences.

It has now become apparent that early recognition and proper diagnosis and management will play a crucial role in resolving the overall iron, folic acid, and Ca deficiency of pregnant mothers in emerging countries such as Bangladesh. But because of our indifference and lack of knowledge, we do not feel much pride in gathering more and more data and sampling and disseminating awareness to avoid and handle.

In this research work, 50 pregnant women's blood samples were drawn between December 2019 and February 2020 and inserted in EDTA tubes from the Dhaka Medical College Hospital of Dhaka during the visits of the pregnant women to the Obstetrics & Gynaecology Department by using Sysmex XN-2000, the bulk of the 50 pregnant woman blood samples tested were slightly anemic cases, with 64% being mildly anemic, 26% being moderately anemic, and 10% being seriously anemic. Iron deficiency anemia was seen in 22% of the patients, while 88 % had mixed anemia, suggesting normocytic- normochromic anemia. Anemia was more prevalent (73%) in pregnant women in their second trimester. Total 32 (64%) pregnant women who has mild iron deficiency anemia during pregnancy and total 13(26%) pregnant women who has moderate iron deficiency anemia, addition to the prenatal vitamins, they can consider taking an iron and/or folic acid supplement. The doctor can also advise the anaemic pregnant mother with mild to severe iron deficiency to increase her intake of iron and folic acid-rich foods. Total 05 (10%) pregnant women who has severe iron deficiency anemia obstetrician suggest taking antibiotic therapy, blood transfusion and iron therapy which may be oral/ parental. This management has been similarly reported by Matthew W. Short, LTC, MC, USA, and Jason E. Domagalski, MAJ, MC, USA of Madigan Healthcare System, Tacoma, Washington in the article of “Iron Deficiency Anemia: Evaluation and Management” [84].

Total 05 (10%) pregnant women’s Serum Folic acid level was in between 1.0-2.0 µg/L, which refers to Severe Folate deficiency anemia. Total 32 (64%) pregnant women’s Serum Folic acid level was in between 3.0-4.0 µg/L, which refers to Mild Folate deficiency anemia,

total 13 (26%) pregnant women's Serum Folic acid level was in between 2.0-3.0 µg/L which refers to Moderate Folate deficiency anemia, total 05 (10%) pregnant women's Serum Folic acid level was in between 1.0-2.0 µg/L, which refers to Severe Folate deficiency anemia. Total 32 (64%) pregnant women who has mild folate deficiency anemia during pregnancy and total 13(26%) pregnant women who has moderate folate deficiency anemia, need to start taking folic acid addition to the vitamins which are taken before pregnancy. The doctor may also suggest that the mild to moderate iron deficiency anemic pregnant mother add more foods high in folic acid to the diet. Total 05 (10%) pregnant women who has severe folate deficiency anemia obstetrician suggest taking (400-600) µg folic acid every day during pregnancy. This management has been similarly reported by "The Centre for Disease Control (CDC)", which advises that one continue to take folic acid each day for as a minimum a month before you get pregnant and daily during your pregnancy. "The Centre for Disease Control (CDC)" also advises, however, that folic acid should be taken every day by all women of gestational age. So, expecting mother is okay to even start taking the folic acid as soon as she gets pregnant to avoid severe folate deficiency anemia.

Total 38 (76%) pregnant women who has to normal calcium level, but still need to start taking calcium complement or supplement in addition to the antenatal vitamins. The obstetricians may also advice that the pregnant mother having normal calcium level add more foods high in calcium to the diet to maintain the pregnancy properly and to avoid pre-eclampsia. Total 12 (24%) pregnant women who has hypocalcemia, obstetrician advises to take calcium supplement as calcium can't be produced from our body, so pregnant mother has to get it from diet or supplements. She has to try consuming minimum 1,000 mg of calcium each day when you're pregnant. Pregnant mother needs no less than 1,300 mg of calcium daily whether she is 18 or below 18. This similar management also has been reported in "Serum Calcium" article by David A. Goldstein and in clinical review article of "Hypocalcemia in Pregnancy" by A. Almaghamsi, M. H. Almalki and B. M. Buhary, Oman Medical Journal, [64] [24].

According to statistics, nearly half of Bangladeshi pregnant mothers have present haematological values that reflect anaemia, iron deficiency, folic acid deficiency, and Calcium deficiency: effects on pregnancy outcome. Anemia during pregnancy is a nation-wide health issue both in developed countries and in Bangladesh, which is a significant cause

of co-morbidities and increasing death. Bangladesh is among the world's highest prevalence of stunting and micronutrient deficiency [101].

The Results of this present study indicates that half of Bangladesh's population is undernourished. and iron deficiency, folic acid deficiency and calcium deficiency during pregnancy lead to potential threats to the mothers such as miscarriage, pre-eclampsia, hemorrhage and also brings out negative out comes to the infants such as prematurity, low birth weight, growth retardation, cleft lip, cleft palate, neural tube defects and stillbirth. Hence, our current slogan should be to increase awareness and consciousness for lowering the incidences and prevalence of iron, folic acid, calcium deficiency during pregnancy as well as proper diagnosis, and appropriate management at right time for iron, folic acid, calcium deficiency during pregnancy can fill the nutritional gap and can control the major causes of mortality, morbidity, and poor maternal and fetal outcomes of pregnancy in Bangladesh.

Chapter 6
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