ASSESSING KNOWLEDGE AND PREVENTION STRATEGIES FOR ANEMIA AMONG PREGNANT WOMEN

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CERTIFICATE

This is to certify that the research work presented in this thesis has been carried out independently by Ms. HETVI SHAH in pursuit of a Master's degree in Foods and Nutrition

(PUBLIC HEALTH NUTRITION)

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ABSTRACT

There is an increase in the prevalence of anemia from 51.3% in NHFS 4 to 62.6% in NFHS 5 report, among pregnant women in the state of Gujarat. The prevalence of anemia among women in reproductive age group (15-49 years) also increased from 54.9% to 65.0% in the NFHS 4 and NFHS 5 reports, respectively. The high prevalence of anemia in this group makes it crucial to address this issue seriously at the grass root level. Anemia in pregnant women a major public health issue, often caused by socio-cultural factors, including the lack of essential nutrients like iron and folate in their diet and other poor dietary habits, poverty, infections like malaria and tuberculosis, and lack of knowledge regarding anemia, its causes, and prevention strategies. However with the paucity of data related to knowledge of anemia and its prevention strategies among pregnant women and therefore this study aims to evaluate the knowledge of anemia among pregnant women in their second or third trimesters.

Thus, with this rationale, this study was planned with the following objectives.

Broad Objective

To assess the knowledge of anemia among pregnant women.

Specific Objectives

To assess the knowledge of anemia among pregnant women.

To assess dietary intake and pattern among the pregnant women.

To understand the extent to which pregnant women have access and adhere to anemia prevention strategies.

To assess determinants that influence knowledge and prevention strategies of anemia.

22 Anganwadi centres were randomly selected from each of the 4 zones of Urban Vadodara.

From each zone approximately 106 pregnant women were selected. A semi-structured questionnaire was used to collect information on socio-demographic data, anthropometry, knowledge of anemia and adherence to prevention strategies, etc.

The study findings show that a vast majority of participants were homemakers or unemployed (91.06%). This could affect their financial independence as well as their ability to access better healthcare facilities. Majority of the participants (88.24%) reported having been pregnant 1-2 times, while a smaller fraction (11.6%) had experienced multiple (3-5) pregnancies.

A striking majority (81.65%) reported not knowing what anemia is. About 57.69% of those who knew what anemia is recognized it as iron deficiency or low hemoglobin. When they were asked about the causes of anemia, 92.70% of them had no idea what led to the development of anemia. A smaller faction of participants (6.12%) knew that low intake of iron rich foods can be one of the many causes.

About 97.41% of participants received IFA tablets, 96.38% of those reported actual consumption. The discrepancy suggests that some women may not adhere to supplementation despite the availability. A significant percentage of participants, 52.89%, adhered to IFA consumption because they thought it could prevent anemia, while about 24.39% of the participants consumed the supplements thinking it will help them stay healthy, while 20.29% of them did not even know the reason for the consumption of supplements.

Most women failed to meet the EAR for energy (99.29%), iron (98.12%), and folate (97.88%). Protein intake was insufficient in both the second (94.65%) and third trimesters (96.15%). Vitamin C intake was comparatively better, yet 68.71% remained below the recommended level. Dietary diversity when assessed, 65.18% of the respondents met the criteria of consuming ≥ 5 food groups while, 34.82% of the respondents consumed <5 food groups.

The majority of participants (98.59%) attended ANC visits during pregnancy, while 1.41% did not attend ANC visits. About 40.33% of those in second trimester had less than 3 ANC visits and 59.76% had more than or equal to 3 ANC visits. About 46.15% of those in third trimester had less than 8 ANC visits, and 53.85% had more than or equal to 8 ANC visits. An overwhelming 99.76% of respondents reported not having heard of fortified foods. The fact that 1 respondent (0.24%) mentioned being aware of THR being a fortified food product, underscores the knowledge gap in the community regarding food fortification.

INTRODUCTION

Anemia happens to be the most persistent global health challenge, affecting individuals among all the age groups, socioeconomic backgrounds, and geographic locations. It is not only a medical condition that has reduced hemoglobin levels in the body but a mix of various implications for human health, productivity, and overall well-being.

It is estimated that, 40% of children (6-59 months), 37% of pregnant women, and 30% of women in reproductive age group (15-49 years) are affected by anemia, globally. Anemia led to a loss of approximately 50 million years of healthy life due to disability in the year 2019. Diet deficient in Iron, genetic conditions like thalassemia and sickle cell anemia, and infections such as malaria, are said to be the primary causes.

Anemia is a condition wherein, the number of red blood cells (RBCs) or hemoglobin concentration in the RBCs is lower than normal. This makes it difficult to carry oxygen and supply to all the organs in the body. Thus, making fatigue, shortness of breath, and reduced capacity to do physical activities some of its symptoms. Tiredness, dizziness or feeling lightheaded, cold hands and feet, headache, and shortness of breath, especially upon exertion are some common symptoms of anemia. Pale mucous membranes commonly in the mouth and nose, pale skin under the fingernails, rapid breathing and heart rate, dizziness when standing up, and bruising easily are some of the symptoms that appear when there is severe anemia [Who, Anemia factsheet, 2025].

Anemia can differ in severity from mild to moderate to severe with varying levels of treatment, respectively. It can be hereditary or developed during the life course due to various reasons. Different types of anemia include anemia of chronic diseases, autoimmune hemolytic anemia, macrocytic anemia and megaloblastic anemia, normocytic anemia, pernicious anemia, aplastic anemia, hemolytic anemia, microcytic anemia, sideroblastic anemia, diamond-blackfan anemia, fanconi anemia, sickle cell anemia, and thalassemia. Most of the time, anemia appears with mild symptoms and can be treated effectively in a short time period [Cleveland clinic, Anemia, 2024].

Microcytic anemia occurs when red blood cells become smaller and paler than usual because of the lack of hemoglobin and iron. It may be acquired with iron deficiency being the primary cause. Impaired erythroid differentiation is when low hemoglobin levels slow down the development of red blood cells.

Macrocytic or Megaloblastic anemia is the abnormally large formation of red blood cells due to Vitamin B12 or Folate deficiency. Though the cells are larger than normal, they do not function properly. It is more common in older adults and the occurrence is expected to rise with the aging population.

When the body cannot absorb Vitamin B12 due to destruction of gastric parietal cells, a specific type of megaloblastic anemia called pernicious anemia occurs. A demand of intrinsic factor (a protein for B12 absorption) is created due to its deficiency and the immune system produces antibodies against the intrinsic factor. Thus, preventing B12 absorption, eventually leading to autoimmune gastritis. Pernicious anemia is more common in individuals over 60-70 years [Hafiza. et.al., 2024].

There is about 20 to 30% increase in the amount of blood during pregnancy. Women with multiple pregnancies, not consuming enough iron, short birth spacing, heavy menstrual blood flow, and often vomiting due to morning sickness are most likely to develop anemia during pregnancy.

If the mother has anemia during pregnancy, it can affect the growth of the fetus, especially during the first trimester of pregnancy. If mother is left untreated for anemia, the baby is at higher risk of developing anemia post birth which can further lead to developmental delays. Anemia during pregnancy can also pose a risk of preterm delivery or delivering low birth weight baby [Cleveland clinic, Anemia during pregnancy, 2022].

Anemia can cause varying negative consequences to both the mother and the fetus such as fatigue, impaired immune function, increased risk of cardiac diseases due to low hemoglobin, and even death in cases of hemorrhage during labor. It can also cause miscarriages, stillbirths, preterm labor, and low birth weight resulting from insufficient supply of oxygen to the fetus. It can also contribute to the development of neural tube defects, preeclampsia, and fetal malformations. In developing countries like Ethiopia, 12%

of low birthweight, 18% of perinatal mortality, and 19% of preterm births are an outcome of anemia [Beshir. et.al., 2020].

When the normal hemoglobin levels in the blood fall below 14-18 g/dl (for males) or 12-16 g/dl (for females), anemia diagnosis is confirmed. It can usually be caused by poor nutrition, difficulty in absorbing nutrients, infections, chronic diseases, gynecological conditions, or inherited blood disorders. Iron deficiency, folate deficiency, and vitamins A & B12 deficiency being the most common cause of anemia, since these nutrients play a major role in hemoglobin production and red blood cell formation.

Iron plays multiple important biochemical roles in the body, including oxygen binding in hemoglobin and acting as a key component in enzymes like cytochromes. About 0.5-2 mg of iron is lost daily in healthy adults, due to blood loss and shedding of iron-containing cells from the skin, hair, and digestive and urinary tracts. Although, iron is essential for metabolism, elevated levels can be toxic to the cells and tissues. There are two sources of dietary iron - haem iron (found in animal-origin foods) and non-haem iron (found in plant-origin foods).

Our diet contains a major part of non-haem iron (90-95%) while haem iron makes up only 5-10% of total dietary iron. Haem iron is easily absorbed by the body, with about 20-30% being readily absorbed by the body, as compared to non-haem iron with just 1-10% being readily absorbed. Iron absorption majorly takes place in the duodenum (the opening of the small intestine, located just after the stomach).

Some foods enhance the absorption of iron such as Vitamin C (ascorbic acid), while others may also inhibit the absorption. Vitamin C converts iron into a simpler form that is easier for the body to absorb, on the other hand, phytates and polyphenols can block/inhibit iron absorption. However, the presence of Vitamin C can counteract the inhibiting compounds and help the body absorb more iron. The body is not capable of getting rid of the excessive iron hence, iron absorption is regulated based on the body's needs especially, for red blood cell production and overall iron stores.[Sharp. et.al., 2007]

Other factors include blood loss from conditions like parasitic infections, childbirth or menstruation, poor nutrient absorption, low iron levels at birth, and nutrient interactions

that affect iron availability [Who, Anemia factsheet, 2025, Cleveland clinic, Anemia, 2024].

A 2003 study mentions malaria as one of the leading causes of illness and death, with an estimate of 400 million cases and 1 million child deaths in developing countries, every year. Malarial anemia, a severe condition caused by Plasmodium falciparum is most commonly occurring among children and pregnant women. The major complication of both acute malaria and asymptomatic plasmodium infections is severe anemia. It scales up the death rates in the areas that are more prone to malarial infection. It also causes some pregnancy complication and pregnant women delivering low birth weight babies.

Though malaria has a significant contribution in increasing anemia cases, the role of micronutrient deficiencies in worsening the condition cannot be overlooked. A lot of malaria-endemic areas are also found to have higher rates of micronutrient malnutrition which further creates a complex interaction with severe health complications.

Research shows that people affected with malaria also tend to have low levels of essential micronutrients like Vitamins A & E, zinc, and dietary carotenoids, as compared to healthy individuals. These micronutrients play a major role in immune function and interestingly these micronutrients are also needed by the malaria parasite, making them important for both the human immune response and the parasite's survival [Veronique. et.al., 2002].

In India, among children aged 6–59 months, anemia prevalence was significantly high at 71.5% in 2005–06 (NFHS 3), showing an improvement as it dropped to 59.5% in 2015–16 (NFHS 4). However, by 2019–21 (NFHS 5), the prevalence increased again to 68.3%, indicating a resurgence in anemia cases among children in rural areas. In urban areas, anemia affected 63.0% of children during NFHS 3, decreased to 56.0% during NFHS 4, but climbed again to 64.2% in NFHS 5, reflecting a fluctuating trend in urban childhood anemia.

Women in reproductive age group (aged 15–49 years, non-pregnant women) in rural areas, the prevalence of anemia was 54.4% during NFHS 4, which further increased to 58.7% during NFHS 5, highlighting a rising trend despite awareness and intervention efforts. In urban areas, 51.0% of women were anemic during NFHS 4, and this figure increased to

54.1% during NFHS 5, showing that urban women were also experiencing a growing burden of anemia over time.

Among Pregnant women in rural areas, anemia prevalence was 52.2% during NFHS 4, increasing further to 54.3% during NFHS 5, suggesting a worsening trend despite prenatal health programs. In urban areas, anemia among pregnant women was recorded at 45.8% during NFHS 4, and the prevalence remained almost steady at 45.7% during NFHS 5, indicating a minimal change over the years.

Among men aged 15–49 years, in rural areas, anemia prevalence was 25.3% during NFHS 4, which further increased to 27.4% during NFHS 5, showing a rising concern for anemia even in the male population. In urban areas, anemia was lower compared to rural regions, with a prevalence of 18.5% during NFHS 4, which rose to 20.4% during NFHS 5, indicating a gradual but steady increase in urban male anemia rates [Givens. et.al., 2024].

The national (India) prevalence of anemia among women of reproductive age (WRA) increased from 53% in NFHS-4 to 57% in NFHS-5. In Aspirational Districts, the prevalence rose from 58.7% in NFHS-4 to 61.1% in NFHS-5. Between 2015 and 2021, over 60% of Aspirational Districts saw a rise in anemia cases, and 29 out of 112 districts experienced an increase of at least 10 percentage points.

The prevalence of anemia varies significantly between districts, with Simdega and Udalguri recording the highest rates in NFHS-4 and NFHS-5, at 78.2% and 81.5%, respectively. The districts of Barpeta and Udalguri (Assam) saw the biggest increases, with anemia rates rising by 29.4% and 26.7%, respectively [Let. et.al., 2024].

In Gujarat, among children aged 6-59 months, anemia prevalence was 62.6% during NFHS 4, which drastically increased to 79.7% during NFHS 5. Prevalence of anemia among women in reproductive age group (15-49 years, non-pregnant) increased from 55.1% in NFHS 4 to 65.1% in NFHS 5. While the prevalence among pregnant women increased from 51.3% in NFHS 4 to 62.6% in NFHS 5.

Pregnant women who consume IFA tablets show more than 50% prevalence of anemia in two-thirds of the districts of Gujarat, suggesting that there can be a possibility of a type of anemia other than iron deficiency among women in Gujarat.

In Vadodara, among children aged 6-59 months, anemia prevalence was 54.3% during NFHS 4, which drastically increased to 86.4% during NFHS 5. Prevalence of anemia among women in reproductive age group (15-49 years, non-pregnant) increased from 49.3% in NFHS 4 to 72.6% in NFHS 5. While the prevalence among pregnant women increased from 48.2% in NFHS 4 to 65.9% in NFHS 5 [NFHS4 & NFHS5].

A study conducted in Georgia suggested that, most pregnant women that were interviewed (84.6%) interpreted anemia as lack of blood, while only 15.4%, with higher education knew the medical definition of anemia. A majority (88.5%) respondents reported that insufficient, unbalanced, and low-quality nutrition, sharing blood with the fetus, increased energy consumption, emotional stress, and long exposure to the sun were the main causes of iron deficiency anemia (IDA).

About 88.5% of respondents suggested that women should include more of fruits, vegetables, meat, milk, and dairy products in their diet. About 92.3% women had no idea that iron deficiency was the cause of anemia and 84.6% women had some knowledge about iron folic acid supplementation [Verulava. et.al., 2024].

Given the multifactorial nature of anemia, prevention strategies must be comprehensive and multi-pronged. Nutrition-based interventions, including iron supplementation, dietary diversification, and food fortification, play a critical role in reducing anemia prevalence. Public health initiatives such as mass deworming, malaria control, and maternal health programs contribute significantly to anemia prevention. Additionally, awareness campaigns and community education can empower individuals to adopt healthier dietary practices. Policymakers and healthcare providers must collaborate to integrate anemia prevention into national health agendas.

Optimal adherence to cost-effective anemia prevention strategies like Iron and folic acid supplementation (IFAS) to control the deficiencies of iron and folate during pregnancy, thus preventing anemia. IFAS consumption during pregnancy is known to reduce the risk of maternal anemia by 70% and iron deficiency by 57%. WHO has recommended, all women receive and consume a standard dosage of 30-60mg elemental iron and 400 micrograms of folic acid daily starting as early as possible during pregnancy [Beshir. et.al., 2020].

Despite global health initiatives promoting iron and folic acid supplementation, adherence to these preventive strategies remains suboptimal in many regions. Less than half of the pregnant women, 44.9% (184 participants), had good knowledge about anemia, while nearly half, 52.7% (216 participants), followed its prevention strategies properly. Women in the age groups of 15–19, 20–24, and 25–29 years, those living in rural areas, having at least a secondary education, experiencing vaginal bleeding, being in the third trimester of pregnancy, and having a medium or high dietary diversity score were more likely to be knowledgeable about anemia.

Similarly, adherence to anemia prevention strategies was significantly linked to factors such as being aged 15–19 years, having a secondary or higher education, being pregnant for the first time (primigravida), having a family size of two to four members, being in the second or third trimester of pregnancy, having a high dietary diversity score, and possessing good knowledge of anemia. Overall, the study revealed that maternal knowledge of anemia and adherence to prevention strategies were relatively low, highlighting the need for better awareness and intervention programs.[Balcha. et.al., 2023].

Another study measured changes in knowledge, attitude, practices, adherence to iron supplements, and anemia status after a follow-up period for both groups. The results showed significant improvements in all these areas within the intervention group. Among participants with moderate anemia, the percentage dropped from 38.66% to 7.25%, while cases of mild anemia declined from 61.33% to 21.74%.

Additionally, the average hemoglobin level increased significantly from 9.8 ± 1.3 g/dL at the beginning to 10.8 ± 0.5 g/dL by the end. Similarly, the serum ferritin level, which indicates iron storage, improved from 12.5 ± 8.7 μg/dL to 19.0 ± 7.6 μg/dL. A difference-in-difference analysis showed that the intervention group had an increase of 0.78 g/dL in hemoglobin and 4.72 μg/dL in ferritin levels, demonstrating that family-centered health education played a key role in improving anemia-related outcomes.[Singh. et.al., 2024].

In another study conducted in India, at the start of the study, the average hemoglobin level in 146 women was 10.9 ± 1.7 g/dL. Out of these, 70.5% (103 women) were diagnosed with anemia, including 59.2% (61 women) with mild anemia, 37.9% (39 women) with moderate anemia, and 2.9% (3 women) with severe anemia. After receiving iron and folic acid (IFA)

supplements along with anti-helminthic treatment, the average hemoglobin levels of those who were followed up increased from 11.1 ± 1.7 g/dL to 11.7 ± 1.4 g/dL. A statistically significant increase of 0.6 ± 0.5 g/dL in hemoglobin levels was observed between the start and end of the supplementation period ($p<0.001$), confirming the effectiveness of the treatment.

The study also compared hemoglobin levels before and after supplementation across different age groups. At the beginning, the percentage of participants with normal hemoglobin levels was 31.4% (11 out of 35 women) in the 7–10 years age group, 29.45% (15 out of 51 women) in the 11–14 years age group, and 38.5% (5 out of 13 women) in the 15–19 years age group. After weekly IFA supplementation, the proportion of participants with normal hemoglobin levels improved to 48.6% (17 out of 35 women) in the 7–10 years group (increase of 17.2%), 47.1% (24 out of 51 women) in the 11–14 years group (increase of 17.7%), and 46.2% (6 out of 13 women) in the 15–19 years group (increase of 7.7%). This data highlights the positive impact of regular IFA supplementation in improving anemia status across different age groups.[Kataria. et.al., 2024].

In a study conducted by Indian Council of Medical Research (ICMR), only 13% (132 girls) were consistent in taking iron and folic acid tablets (IFAT), as shown in Figure 1. While 72% (704 girls) were aware of IFAT, only 49% had regularly taken the tablets in the past six months. Furthermore, just 17% of the girls had consumed at least one IFA tablet in the previous month. Overall, more students were aware of the tablets and had received them than those who actually consumed them in the last month.

Among the 63% (617 girls) who had taken IFA tablets at least once in the last six months, 92% (570 girls) received them from their teachers and took them in their presence. However, among the 37% (355 girls) who missed taking the tablets during the same period, 86% (305 girls) reported that they were not given the tablets by their teachers. This highlights the significant role of school distribution in ensuring adherence to IFAT.[Maheshwari. et.al., 2024].

In India, nearly half of all pregnant women suffer from anemia, affecting more than 7.5 million women. Despite its high prevalence, few studies have explored the link between multiple micronutrient deficiencies and anemia during pregnancy, especially in low-

resource settings. To fill this gap, 200 pregnant women from the Maternal and Newborn Health (MNH) registry in Eastern Maharashtra, India, were enrolled in a study. Blood samples were collected in early pregnancy (less than 15 weeks) and again in the third trimester (beyond 27 weeks) to assess anemia levels using different testing methods.

At the start of pregnancy, hemoglobin levels averaged 10.9 ± 1.5 g/dL based on finger-prick blood tests, with 51.1% of women classified as anemic. When tested using venous blood samples, hemoglobin levels were slightly higher at 11.3 ± 1.3 g/dL, with 37.5% of women diagnosed with anemia. Among those with anemia, 56% had iron deficiency, suggesting that their condition could improve with iron supplementation. The study found that 40% of women had iron deficiency, 30% had vitamin B12 deficiency, and none had folate deficiency. By the third trimester, hemoglobin levels declined to 10.1 ± 1.35 g/dL, and anemia prevalence increased to 70.7%, despite 99.4% of women receiving iron-folic acid (IFA) supplements and 83.9% reporting that they had taken the supplements the previous day.

The study identified several factors linked to anemia, including gestational age, inflammation levels, height, BMI, and IFA consumption during the third trimester. While IFA supplementation appeared to improve micronutrient levels, anemia continued to be a significant issue, highlighting the need for stronger healthcare interventions. The findings emphasize that iron deficiency and anemia do not always affect the same individuals, meaning that preventing anemia during pregnancy requires both clinical and community-based strategies to address various underlying causes.[Locks. et.al, 2024].

A hospital-based cross-sectional study was conducted with 360 pregnant women attending the Antenatal Clinic of a District Hospital, in Aurangabad, Maharashtra between October and December 2023. Based on a previous study in India that reported 53% anemia prevalence among pregnant women. Data was collected through a structured interview, and hemoglobin levels were measured using Sahli's hemoglobinometer.

The study found that 52.76% of the pregnant women were anemic. Anemia was more common in women with multiple pregnancies (multigravida) ($p<0.001$) and was significantly linked to pregnancy risks. Most of the women were aware of the importance

of iron and folic acid (IFA) tablets, and the majority had their hemoglobin levels checked in the first trimester [Nija. et.al., 2024].

This study is part of an innovation pilot project where counseling played a key role in encouraging pregnant women and adolescent girls to use the project's services. The study was conducted between June 2020 and March 2021 in Bhanvad Taluka, DevBhoomi Dwarka, Gujarat, under the Anemia Project by ICDS.

A total of 60 pregnant women and 304 adolescent girls were selected through random sampling. Researchers used a semi-structured questionnaire in the local language to collect data, ensuring that every participant provided verbal informed consent. The involvement of counselors, including ASHA workers and healthcare staff, played an important role in making the project more effective.

The results showed a 9.34% overall reduction in anemia among participants. The decline was more noticeable among pregnant women (18.33%) compared to adolescent girls (7.56%). The study concluded that nutrition education and counseling had a positive impact, encouraging women to consume more iron-rich and vitamin C-rich foods, which help in preventing anemia [Sanghvi. et.al., 2024].

A Knowledge, Attitude, and Practice (KAP) survey was conducted among obstetricians and gynecologists (ObGyns) across India. A validated 20-question survey was used to evaluate their understanding, perspective, and approach to managing anemia during pregnancy. The findings were presented as percentages.

A total of 1,974 ObGyns participated in the survey. About 88.7% screened for anemia during the first trimester, while 53.7% conducted Complete Blood Count (CBC) tests along with RBC indices. Most ObGyns checked hemoglobin levels three times during pregnancy. However, 50% did not routinely screen for thalassemia or recommend regular deworming.

Regarding treatment, 92.4% believed that iron supplementation was necessary even if Hb levels were above 11 g/dL. A low-dose iron therapy approach was preferred by most, with 59.9% prescribing 100 mg oral iron daily. When patients did not respond to iron therapy, nearly half of the ObGyns preferred switching iron salts rather than moving to injectable

iron. 52% checked serum ferritin levels before starting IV iron therapy, and 43.5% conducted Hb testing within two weeks of IV iron administration.

For severe anemia (Hb < 5 g/dL at 34 weeks of pregnancy), 82.2% of ObGyns preferred blood transfusion. However, only 40.5% knew the exact cut-off for postpartum anemia diagnosis. Most were aware that iron supplementation should continue for 3–6 months postpartum, and over 90% recommended IV iron therapy for severe postpartum anemia.

The survey provided insights into the knowledge and practices of ObGyns regarding anemia in pregnancy and highlighted gaps in screening, prevention, and treatment approaches. These findings emphasize the need for better awareness and standardized practices to improve anemia management during pregnancy [Kumar. et.al., 2022].

Anemia remains a significant global health challenge, affecting millions worldwide and impacting overall well-being and economic productivity. Understanding its causes, risk factors, and consequences is essential for devising effective prevention strategies. A holistic approach, encompassing nutritional, medical, and policy-driven interventions, is crucial to mitigating the burden of anemia.

Despite existing prevention strategies, challenges persist in addressing anemia effectively. Limited access to healthcare services, socio-cultural barriers, and inconsistencies in policy implementation hinder progress. There is a growing need for innovative approaches and personalized treatment plans. Future research should focus on bridging these gaps to develop sustainable solutions for anemia prevention and management.

BROAD OBJECTIVE:

To assess the knowledge of anemia among pregnant women.

SPECIFIC OBJECTIVES:

To assess the knowledge of anemia among pregnant women.

To assess dietary intake and pattern among the pregnant women.

To understand the extent to which pregnant women have access and adhere to anemia prevention strategies.

To assess determinants that influence knowledge and prevention strategies of anemia.

REVIEW OF LITERATURE

Global data

Beshir. et.al. (2020) conducted at the ANC clinic of Tikur Anbessa Specialized Hospital (TASH), the largest teaching referral hospital in the capital city of Ethiopia. All pregnant women, who had attended at least two ANC visits of the current pregnancy at TASH, had been previously supplemented with 60 mg iron with 0.4 mg folic acid tablets for a month before the interview, and were willing to participate in the study were enrolled. The sampling was done using a systematic random sampling technique, and a total of 257 participants were included in the study.

250 of the 257 participants that were enrolled were eligible for the analysis, making the response rate 97.02%, and 7 participants were excluded because the data obtained was incomplete. The mean age was calculated to be 27.85 ± 5.1 years; 99.2% of the participants were married; 142 (56.8%) were Orthodox Christians; 77 (30%) were Muslims; 108 (43.2%) had primary education; and 144 (57.6%) were housewives. A majority (79.2%) were in their third trimester, and only 56% of them started ANC visits in their first trimester; about 37.2% were primiparous, and 38.8% were multiparous.

Only 145 of the total participants had their total blood count done. Of those 145, only 4.8% were found to be anemic. Of the total participants, 219 (87.6%) had heard of anemia during pregnancy, and only half, 126 (50.4%), of the participants had knowledge about anemia and about 195 (78.2%) adequate knowledge on IFAS. The reason for taking IFAS for the majority of the participants, 232 (92.8%), was the health service providers advice, while the reasons for not taking the supplement were forgetfulness, 76 (30.4%); and the fear of side effects, 60 (24.0%). Pregnant women who started their ANC visits during their first trimester were more adherent to IFAS by 1.874 times as compared to those starting their ANC visits in their second or third trimester. Women with an education level of graduation

and above and secondary education were 4.236 and 4.086 times more likely to adhere to IFAS, respectively, in comparison to those who could not read and write.

Appiah. et.al. (2020) conducted on pregnant women who had lived in the Juaboso district of Ghana for at least 3 months and were registered and attending ANC visits. After the area was split up into four sub-districts, a multistage sampling technique was used to identify the ANC centers with registered pregnant women. A proportionate sample size of 598 participants was assigned depending on the number of women who were registered in each center. Two ANC centers from each stratum were selected randomly, and participants were chosen at random from the list of registered pregnant women.

The mean age of the participants was 24.4 years, with most of them falling between 20 and 29 years of age. 18.2% of pregnant women had no formal education; 43.7% had primary education. 78.6% were legally married, 67.9% had non-formal employment, and 44.7% were in the second trimester. 13.5% had high knowledge of anemia 58.4% had fair knowledge, and 28.1% had low knowledge. 39.1% of those who completed the survey adhered to anemia prevention strategies, while the majority were partially adhering. Those with basic, secondary, or tertiary education were more likely to have high knowledge compared to those with no formal education. Additionally, women engaged in nonformal or formal employment had higher knowledge of anemia compared to the unemployed.

Balcha. et.al. (2023) carried out this study in the Pawi district of Northwest Ethiopia, aims to examine the level of maternal knowledge of anemia and its prevention strategies. The study was conducted among 410 pregnant women attending antenatal care at 3 public health facilities. Participants were selected using systematic random sampling with a sampling interval of 2, and the starting point at each facility was randomly chosen using the lottery method. The study results revealed that the mean age of the participants was 25 years. About 52% of the participants lived in urban areas, 99% were married, and 63.7% followed the Orthodox Christian faith. Approximately 44.4% of women had primary education; 63.7% were housewives. Their partners were mainly farmers (48.3%), and

31.3% had primary education. More than half (52%) had 2-4 family members, 70.0% were multigravida, 16.1% had a history of abortion, and 55.6% were in their second trimester.

Knowledge of anemia was good in 44.9% of women, while 52.7% adhered to anemia prevention strategies. Factors that were significantly associated with knowledge of anemia included age, rural residence, higher education, vaginal bleeding, and pregnancy trimester. Adherence to anemia prevention was linked to young maternal age, education level, smaller family size, primigravida status, and knowledge of anemia. The study found that knowledge of anemia and its prevention was low among pregnant women. Socio-demographic, obstetric, and nutritional factors influenced awareness. Providing anemia-related education, promoting iron-rich diets, and raising awareness about the effects of consuming coffee, tea, or milk with meals are essential for improving maternal health outcomes.

Verulava. et.al, (2024) conducted this phenomenological qualitative study to explore the experiences of pregnant women regarding iron deficiency anemia (IDA) with the help of in-depth interviews. The research aimed to gather the perceptions and interpretations of the participants and identify key themes and patterns. The study includes 9 obstetricians-gynecologists and 26 pregnant women who were selected through purposive sampling from 3 maternity hospitals in Tbilisi. The study also highlights that socioeconomic factors, poor diet, and multigravidity can contribute to IDA during pregnancy.

While 77.8% of gynecologists brought to attention that pregnant women had basic knowledge of nutrition, 88.9% of them highlighted poor adherence of pregnant women to medical advice due to financial constraints. Anemia is perceived as normal by most of the pregnant women (84.6%), including many who are unaware of the risks. Doctors recommend educating the mothers about anemia to improve their awareness of the disorder and distributing free iron supplements as an anemia prevention strategy. While 46.2% of participants had a regular intake of iron supplements, some also avoided medications altogether, preferring a diet-based prevention. The study underscores the need for improving education, financial support, and healthcare policies to reduce the prevalence of iron deficiency anemia.

Qiao. et.al, (2024) conducted this study covering 108,351 women across 8 provinces and 15 districts in China, between the years 2016 and 2020. The data was collected on antenatal care using parameters such as hemoglobin (Hb) levels and maternal health. The study explores the differences in anemia rates throughout eastern, central, and western China by following the standard pregnancy stages (first trimester—up to 12 weeks; second trimester—13–27 weeks; and third trimester—28 weeks and beyond). The study finds that about 43.59% of the participating pregnant women experienced anemia at some point during their pregnancy, while 3.95% of them had anemia throughout their pregnancy. The occurrence of anemia was more prevalent in the rural areas, among women with less education, women with multiple pregnancies, and those who carried multiple fetuses.

There was a comparatively lower risk of anemia among the ethnic minorities and the residents of the northern regions. While the women from the southern regions were more vulnerable to anemia during pregnancy, perhaps due to thalassemia (a genetic condition commonly occurring in that region) and less usage of iron supplements as compared to the northern regions. While the women in the rural areas had lower compliance with iron supplements, doctors were more inclined to recommend supplements to the pregnant women in the urban areas. Thus, the study urges a need for increased awareness, improved anemia prevention strategies, and better prenatal care for women in rural areas and especially high-risk pregnant women, eventually reducing complications during pregnancy.

Knowles. et.al.,(2024) examines the national survey data, literature, and government policies between 2010 and 2022, this review study analyzes the prevalence of anemia, its causes, and prevention strategies. More than 268 documents from national representative data of 15 UNICEF country offices were reviewed to perceive the trends in anemia prevalence and effectiveness of the policies. Anemia emerges to be a severe public health problem in multiple countries, notably among pregnant women (PW), lactating women (LW), and preschool children (PSC).

With 42% of pregnant women and 46% of lactating women affected by anemia, Tajikistan had the highest prevalence. Other Central Asian and Eastern European countries also

recorded moderate to severe anemia levels. With more than 55% of women being deficient in iron, iron deficiency anemia was more likely to occur even with ongoing supplementation programs. Iron supplementation is the most common anemia prevention strategy for pregnant women throughout the globe, but with some countries failing to follow WHO guidelines, implementation is inconsistent.

Social and economic factors are the most common contributors to anemia prevalence; women with low socio-economic status and less education have high chances of being affected by anemia due to poor diet and healthcare access. Other factors like hygiene and sanitation, household conditions, and cooking fuels also influence anemia prevalence. Many countries tried implementing wheat flour fortification as a prevention strategy, but with weak enforcement and only Turkmenistan achieving 90% coverage it remains ineffective.

A lack of screening for anemia on a regular basis leads to missed diagnosis and delay in the treatment given; many national health programs do not prioritize testing for iron deficiency. Healthcare workers like ASHAs and Anganwadi workers play an important role in iron folic acid (IFA) distribution. But their lack of awareness of misconceptions about iron supplements (iron supplements may cause larger babies and more difficult delivery) contributes to the ineffectiveness of the supplements.

Varying methods of collecting data across countries may affect the accuracy and comparability of anemia prevalence data. To reduce the prevalence, the government must make bold moves to encourage screening, strengthen implementation of iron supplement programs, enhance food fortification strategies, and especially promote education on anemia and its prevention.

Hasan. et.al., (2022) in this study analyzed anemia trends in women of reproductive age (15–49 years) using Demographic and Health Surveys (DHS) data from 15 countries between 1995 and 2018. The global target for anemia reduction aims to decrease anemia prevalencea in women by 50% from 2012 to 2025, but most countries are not on track to meet this goal. Between 2000 and 2018, anemia prevalence declined in 9 of the 15

countries, with Malawi (-2.5%), Uganda (-2.0%), and Ethiopia (-1.4%) showing the greatest reductions.

Anemia prevalence increased in six countries, with Burundi (10.9%), Jordan (2.3%), and Togo (2.1%) experiencing the highest increases. Projections for 2025 indicate that anemia will remain a severe public health issue, with Burundi (66.8%), Togo (60.4%), and India (50.3%) expected to have the highest burdens. Wealth disparities influence anemia rates, as the poorest women in some countries showed improvements (e.g., Malawi, India, and Uganda) while others, like Burundi, saw increases (12.4%).

Rural women generally had higher anemia rates, with Burundi (70.9%) projected to have the highest rural prevalence by 2025, while urban anemia increased in Albania (4.6%). Only Armenia (53%) had a probability higher than 50% of meeting the global anemia reduction target, with Ethiopia also showing progress among urban women (55%). Education plays a key role, as anemia rates were lower among women with secondary or higher education compared to those with little or no schooling.

Anemia prevalence varied widely across subgroups, with younger women (15–19 years) and those in poorer households facing the highest risks. Iron deficiency remains a leading cause of anemia, with over 55% of women in some countries lacking sufficient iron, despite supplementation programs. Health interventions, such as iron fortification and supplementation, need better enforcement, as compliance remains low in many regions. Policy gaps and weak healthcare systems contribute to slow progress, as some countries lack clear anemia reduction strategies or fail to integrate anemia screening into routine maternal care. Social and cultural beliefs impact anemia prevention, as misconceptions about iron supplements and dietary habits discourage many women from taking necessary interventions. Urgent action is needed to improve nutrition education, access to supplements, and healthcare policies to effectively reduce anemia and improve maternal health worldwide.

National Data

India has launched multiple programs to reduce anemia, starting with the National Nutritional Anemia Control Program in 1970, followed by Weekly Iron and Folic Acid Supplementation (WIFS) in 2000, and the 12 by 12 initiative in 2007.

The National Iron+ Initiative Program (NIPI) was introduced to provide iron and folic acid (IFA) supplements to pregnant women, lactating mothers, and adolescent girls. Despite widespread distribution of IFA supplements, compliance remains low, with only 37% of pregnant women consuming them for over 100 days, despite 91% receiving them. Barriers to IFA intake include lack of awareness, misconceptions about side effects, and concerns that iron causes excessive blood or a larger baby, making labor difficult. Food insecurity and poor diets also contribute to anemia, as many women eat last in their families or consume whatever food is left over. Social support plays a key role, as husbands, mothers, and mothers-in-law influence whether a woman takes IFA supplements regularly. Social norms act as barriers to IFA uptake, as many women do not consider iron supplements essential during pregnancy due to cultural beliefs.

Policy challenges make it difficult to implement new research findings, as translating evidence into national programs takes time and requires strong government and stakeholder collaboration. More research is needed to understand how social norms influence anemia prevention strategies, and how changing attitudes at the community level can impact national policies. To effectively reduce anemia, India must focus on improving awareness, addressing misconceptions, strengthening food security, and ensuring better policy implementation at all levels.

Smitha. et.al. (2024) conducted a single-blind randomized controlled trial in Sakaka, Saudi Arabia, from January to May 2021 to assess the impact of a health education intervention on anemia management among pregnant women. The study involved 196 participants, equally divided into intervention and control groups, who met specific inclusion criteria. The study found no significant baseline differences between the groups in demographic or health characteristics, knowledge, food selection ability, or hemoglobin levels. After three months, the intervention group exhibited notable improvements in knowledge, food selection ability, and hemoglobin levels, with medium to large effect sizes.

Compliance with IFA supplementation was significantly higher in the intervention group, with 90.8% achieving high compliance compared to 66.4% in the control group. Participants in the intervention group consumed an average of 82.31 tablets, compared to 66.78 tablets in the control group. Factors influencing compliance included younger age, higher education levels, first-time pregnancy, regular antenatal follow-ups, greater knowledge, and better food selection ability. Among these, educational level emerged as the most significant predictor of adherence. The study underscores the efficacy of targeted educational interventions in improving anemia management among pregnant women.

Kuppusamy. et.al. (2023) in this study used data from the India National Family Health Survey-V (NFHS-5) conducted from 2019–2021, analyzing anemia in 27,317 pregnant women aged 15–49 years. The overall prevalence of anemia among pregnant women in India was 52.2%, with 24.4% having mild anemia, 26.3% moderate anemia, and 1.4% severe anemia. Anemia was most common among adolescent women (61.5%), those with no education (59.2%), women in the poorest wealth category (61.9%), and those from Scheduled Tribes (59.3%).

Eastern states had the highest anemia prevalence (62.1%), with Bihar (63.1%), Gujarat (62.5%), and West Bengal (62.3%) having the highest rates. Severe anemia was more frequent among rural women (1.7%) than urban women (0.8%), and among women with no education (2.9%) compared to those highly educated (0.4%). Women with no media exposure (2.4%), smoking, tobacco, or alcohol habits (3.9%), and a short interpregnancy interval (59.7%) had a higher risk of severe anemia. The study found that women from poor households, those with no formal education, and those in the eastern region had a higher risk of anemia.

The odds of having anemia were 1.41 times higher in uneducated women, 1.69 times higher in the poorest wealth group, and 1.35 times higher in women from eastern India. Women with no education had nearly 5 times higher odds (aOR = 4.79) of severe anemia, and those in the poorest wealth category had 2.41 times higher risk. Women who smoked, consumed tobacco, or alcohol had 1.39 times higher odds of anemia and 2.32 times higher odds of severe anemia compared to non-users. The findings highlight the urgent need for better

education, improved nutrition, economic support, and healthcare interventions to reduce anemia among high-risk pregnant women in India.

Surendhar. et.al. (2024) conducted this retrospective study at Government Medical College and Hospital, Nagapattinam, analyzing 110 pregnant women diagnosed with anemia over six months (Dec 2023–May 2024). The majority of patients (42.72%) were aged 24–28 years, while only 4.54% were 18 years old, showing a higher prevalence of anemia in young adults. Moderate anemia (7.0–9.9 g/dL) was the most common, affecting 64.54% of patients, followed by mild anemia (29%) and severe anemia (6.36%). More than half (55.45%) of the anemic pregnant women were first-time mothers (primi gravida), while 44.45% were multigravida, and 17.28% had a history of abortion.

The literacy rate was low, with 71.8% of women being illiterate, which may contribute to a lack of awareness about anemia prevention and nutrition. The most common comorbidities were hypothyroidism (23.6%), pregnancy-induced hypertension (20.8%), and gestational diabetes mellitus (18%). About 69.1% of patients received packed red blood cell (PRBC) transfusions, highlighting the severity of anemia in several cases. Other anemia treatments included folic acid (29 patients), iron sucrose (28 patients), L-arginine (15 patients), and amino acids (12 patients). Cefotaxime (16.3%) was the most commonly prescribed antibiotic, followed by azithromycin (12 patients) and amoxicillin (5 patients). Some patients received combination antibiotic therapies like cefoperazone + sulbactam, piperacillin + tazobactam, and ciprofloxacin for infection control.

Nair. et.al. (2023) analyzed iron levels and anemia in pregnant and postpartum women using data from two Indian study cohorts of the Maternal and Perinatal Health Research collaboration (MaatHRI), covering 1,132 antenatal and 837 postnatal women. Moderate anemia was the most common, affecting 32% of pregnant women and 31% of postpartum women, while severe anemia was found in 3% and 4%, respectively. Ferritin levels were lower in pregnancy but increased postpartum, possibly due to inflammation after childbirth.

Women with no anemia still had signs of iron deficiency, with 17% having low ferritin in pregnancy and 27% postpartum, indicating hidden iron deficiency.

Hemoglobin variants were found in 22% of women, with HbE being the most common, followed by β-thalassemia trait and sickle cell trait. Vitamin B12 deficiency increased with anemia severity, especially in postpartum women, affecting 4.5% of anemic women. Women from lower-income groups had a higher risk of anemia, with 62% of postpartum women being below the poverty line compared to 47% of pregnant women. Ferritin levels were not strongly linked to hemoglobin levels; suggesting that standard iron markers may not fully capture anemia causes in pregnancy.

Iron deficiency was strongly associated with anemia severity, with severe anemia increasing the risk of low ferritin nearly 14-fold in pregnancy and threefold postpartum. The study found no major differences in iron deficiency between normal and abnormal hemoglobin types, except for higher iron overload risk in some abnormal types. These findings emphasize the need for better anemia screening, nutritional support, and personalized iron supplementation to improve maternal health outcomes.

Siddiqui. et.al. (2017) analyzed data from the National Family Health Survey-3 (NFHS-3) conducted in 2005-2006. The study includes 5,911 pregnant women (PW), 21,973 lactating women (LW), and 97,418 NP-NL women. The overall prevalence of anemia was highest among LW (62.9%), followed by PW (58.7%) and NP-NL women (37.8%), with older PW having a higher risk of moderate and severe anemia. Moderate anemia was the most common type, affecting 30.6% of PW, 17.2% of lactating women, and 13.5% of NP-NL women, while severe anemia was more prevalent in PW (2.2%) than in LW (1.7%) and NP-NL women (1.8%). PW in rural areas have a significantly higher prevalence of severe anemia (2.4%) than those in urban areas (1.7%).

Women from Scheduled Castes and Scheduled Tribes (SC/ST) had a higher burden of anemia, particularly in severe cases, compared to Other Backward Classes (OBC) and general caste groups. Lower education levels were strongly linked to higher anemia rates, with 63.8% of pregnant women with no education being anemic, compared to 53.4% of

those with secondary or higher education. Women from the poorest households had a much higher prevalence of anemia, with 67.2% of PW in the poorest category being anemic, compared to 48.4% in the richest category. Employment did not offer a protective effect, as working pregnant women had a higher prevalence of anemia (63.7%) than non-working women (57.1%).

Khanna. et.al., (2023) conducted this community-based intervention study in Village Sanghol, Punjab, India, from October 2018 to October 2019, focusing on women aged 15–49 years to assess anemia and nutritional status. A total of 443 women participated in the study; at the start, 153 women had their biochemical analysis done and 141 women at the end of the study. The intervention phase included nutrition education and awareness programs using multi-channel communication strategies like face-to-face training, community discussions, and educational materials. Ferritin was used as the main indicator for anemia detection, rather than hemoglobin, as it provides a better measure of iron stores.

At baseline, 45.75% of women were anemic, with low ferritin levels, indicating iron deficiency anemia as a major concern. A significant 15% reduction in anemia was observed after the intervention ($p = 0.027$), showing the positive impact of nutrition education and improved dietary habits. Microcytic anemia (low MCV levels) decreased by 10%, while macrocytic anemia (high MCV levels) increased by 5%, although these changes were not statistically significant. The majority of participants (47.63%) had secondary-level education, while 51.24% had a monthly income of less than ₹5000, highlighting economic challenges affecting nutrition.

Nearly 56% of the participants lived in joint families, and 68.40% were unemployed, further emphasizing the need for financial and social support in improving nutrition. The mean hemoglobin level (11.24 g/dL) remained below normal, reinforcing the need for long-term interventions to tackle anemia. Significant improvements were seen in ferritin levels ($p < 0.001$), while other biomarkers like RBC, folate, and vitamin B12 showed minor but positive changes. This study showed a 15% reduction in anemia through community-based interventions, surpassing the national target of 3% per year, proving that behavioral changes and targeted nutrition programs can significantly improve women's health.

Raksha. et.al., (2016) conducted this study on 200 primigravida pregnant women who went to an antenatal clinic in Mangalore for more than four months, emphasizing their knowledge and practices related to anemia and its prevention. The majority of participants (111 women) were aged 19–25 years, while 69 were aged 25–30 years, and 20 were above 30 years. About 50% of the women (102) came from the lower socioeconomic group, with only 6 women belonging to the upper middle class, highlighting economic challenges in accessing nutrition and healthcare facilities. 64% of women were aware of iron-rich food sources, while only 30% were including them in their diets daily, highlighting a gap between being aware and putting the knowledge to practice.

About 50% of women were familiar with the importance of high-protein diets in correcting anemia, but none knew about inhibitors of iron absorption, such as tea, coffee, and calcium. Awareness of maternal complications of anemia (e.g., postpartum hemorrhage, cardiac failure, recurrent infections) was low at 25%, and only 31% knew about fetal risks like intrauterine growth restriction (IUGR) and preterm labor. Deworming awareness was extremely low, with only 22 out of 200 women knowing about its role in anemia prevention. Iron supplement compliance was high, with only 5 women not taking their medication, showing good adherence due to free supply and healthcare staff reinforcement. 60% of women received anemia-related knowledge from healthcare professionals, while 22% learned from family and friends, and 18% from books and television.

Kumar. et.al., (2022) conducted **t**his survey-based study was among 1,974 obstetricians and gynecologists across India to assess their knowledge, attitudes, and practices regarding anemia management in pregnancy. Only 10% of doctors performed hemoglobin (Hb) estimation in the second trimester, while 99% did so in the third trimester, indicating gaps in screening practices. Complete blood count (CBC) and general blood picture (GBP) were performed by 83% of doctors, while 17% relied solely on Hb estimation, which is not sufficient for diagnosing anemia. Only 9.5% of doctors performed Hb estimation twice during pregnancy, despite guidelines recommending regular monitoring for anemia detection. Thalassemia screening was not routinely practiced by 71.9% of doctors, even

though India lies in the thalassemia belt, where 9,000 children are born with thalassemia each year. Deworming before starting iron supplementation was not suggested by 49.9% of doctors, which led to reduced iron absorption and inefficiency of treatment. In the first trimester, 43% of doctors did not prescribe oral iron, opting instead for dietary modifications only, due to concerns about teratogenicity (harm to the fetus).

Iron injections were used only by 11% of doctors for the treatment of moderate anemia in the first trimester. A majority of doctors avoided injectable iron due to the fear of fetal risks. For patients not tolerating oral iron, 52.9% of doctors switched to injectable iron, while 47.1% preferred changing the type of oral iron salt instead of injections. Less than half (48%) of doctors assessed serum ferritin levels before starting injectable iron therapy, even though it is a recommended practice. There was no uniformity in Hb estimation after intravenous iron therapy, with only some testing after 2 weeks while others waited for 4 weeks or more, leading to inconsistency in treatment monitoring. A small percentage (2%) of doctors still prescribed intramuscular iron dextran, despite newer, more effective, and less painful options being available. Many doctors lacked awareness of comprehensive anemia workup, as only 29% performed proper anemia screening, including serum ferritin tests.

Sedlander. et.al., (2018) with this study aims to develop a social norms-based intervention to improve iron and folic acid (IFA) supplement use and reduce anemia among women of reproductive age in Odisha, India. Researchers will use qualitative and observational methods, including focus groups, interviews, and perceptual mapping, to understand barriers and facilitators to IFA consumption. Social norms play a key role in IFA uptake, as many women follow community beliefs, family influence, and cultural perceptions regarding anemia prevention. The study will also explore health system barriers, such as limited awareness, inadequate access to IFA supplements, and inconsistent healthcare messaging. Observational data will be collected from clinics, pharmacies, and food markets to assess how IFA supplements are stocked, promoted, and distributed.

A rapid participatory ethnographic approach (PEER interviews) will involve local community members interviewing their peers to gain real-life insights into anemia-related

beliefs and behaviors. Pilot testing of the intervention will be conducted, and findings will be refined through community feedback and expert analysis before final implementation. The study emphasizes collaboration between universities, healthcare professionals, and community stakeholders to ensure effective intervention strategies. While the study provides valuable evidence-based recommendations, its findings are specific to Odisha, which may limit generalizability to other regions. The ultimate goal is to shift social norms, improve IFA compliance, and create long-term behavioral changes, leading to better maternal health outcomes and anemia reduction in India.

Dutta. et.al., (2023) reviewed several studies and found only 35.2% of anemic mothers knew about iron requirements during pregnancy, and many believed dietary restrictions or family influence prevented them from taking IFA tablets. Younger women (21–30 years) are at higher risk of anemia, especially those from low-income backgrounds, poor education levels, and low body mass index (BMI). Common misconceptions, such as iron supplements causing large babies or making labor difficult, discourage many pregnant women from taking IFA tablets. Education plays a crucial role in reducing anemia, as higher-educated women have lower anemia rates, and a 1% increase in education can lead to a 1.12% decrease in anemia prevalence. Income also affects anemia risk, with studies showing that 85.6% of anemic women in Punjab had monthly incomes below ₹10,000, indicating financial constraints on nutrition. Environmental factors, such as poor sanitation, cooking fuels, tobacco smoke exposure, and seasonal changes, also contribute to higher anemia rates in India.

Social norms and cultural beliefs strongly influence IFA compliance, as many women follow family traditions that discourage supplement use, fearing complications in childbirth. Husbands, mothers-in-law, and social networks play a significant role in supporting or discouraging pregnant women from taking IFA supplements. Healthcare workers like Accredited Social Health Activists (ASHAs), Anganwadi workers (AWWs), and ANMs are key providers of IFA supplements, but distribution gaps still exist. Government programs such as the National Iron Plus Initiative (NIPI) and state-level interventions help distribute IFA supplements, but compliance remains a challenge due to

supply chain issues and misinformation. Antenatal care (ANC) and postnatal care (PNC) are essential for anemia prevention, but many women in rural areas do not receive adequate maternal healthcare services. To effectively reduce anemia, India needs better education, improved healthcare access, targeted social interventions, and stronger implementation of existing government programs.

State Data

Goswami. et.al., (2023) conducted this community-based cross-sectional study in Surendranagar district, Gujarat, focusing on 270 pregnant women who had completed their first trimester to assess anemia prevalence and iron-folic acid (IFA) supplementation practices. The majority of participants (49.26%) were aged 22–24 years, and 20% were illiterate, while most had at least primary education. Nearly 50% of the women were homemakers, and 60% were multigravida, meaning they had been pregnant before. Only 71.11% had their hemoglobin levels checked after pregnancy confirmation, and of those, 46% were aware of their Hb levels. Anemia prevalence among those who knew their Hb levels was 63%, categorized into mild (17.74%), moderate (41.94%), and severe (3.23%) anemia.

Most women (95%) were aware of IFA supplements, with health workers (ASHA, 47%) being the primary source of information, followed by nurses (30%) and doctors (19%). 76% of women were taking IFA supplements, but reasons for not taking them included forgetfulness (37%), side effects (21%), and believing they were unnecessary (21%). 64% of women knew the correct schedule for IFA intake, and 62% understood that lemon enhances iron absorption, while 50% knew that tea reduces absorption. Husbands played a role in adherence, with 60% of women stating that their husbands were aware of IFA benefits, and 53% of husbands reminding them to take the tablets. Most women (70%) took their IFA supplements in the afternoon, and 68% consumed them with water, while 30% took them with lemon water. More than half of the women experienced side effects, including stomach upset (49%), constipation (20%), and teeth discoloration (18%), but

20% had no side effects. About 90% of women believed pregnancy could cause iron deficiency and agreed that IFA supplements help both mother and baby, with over three-fourths believing IFA is beneficial even after childbirth.

Zala. et.al., (2025) conducted this community-based cross-sectional study in government schools of Anand district, Gujarat, among 1,704 adolescent girls aged 10–19 years to assess anemia prevalence and associated risk factors. The mean age of participants was 12.35 years, and 92% belonged to the Hindu religion, while 61.7% lived in joint families. Based on BMI categories, 49.5% of girls were undernourished, while only 1.9% were overweight, and 0.5% were obese, indicating poor nutritional status. The mean hemoglobin level was 9.21 g/dL. Among the participants, 21.1% had reached menarche, but only 13.8% had regular menstrual cycles, suggesting possible nutritional deficiencies affecting reproductive health. Most girls (67.8%) belonged to the lower-income group, highlighting economic barriers to proper nutrition and healthcare access.

Food consumption patterns, lifestyle habits, and socioeconomic status were analyzed, but no significant association with anemia prevalence was found in the study. Common risk factors for anemia, such as dietary deficiencies, low BMI, and poor hygiene practices, were assessed, but none showed statistically significant associations at $P < 0.05$. Hemoglobin levels ranged from 4.6–13.9 g/dL, indicating a wide variation in anemia severity among adolescent girls in the study. The lack of a significant association between anemia and socioeconomic factors suggests that anemia prevention requires more than just economic improvements and should focus on education, diet quality, and healthcare awareness.

Nimbalkar. et.al., (2020) conducted this interventional study at Nootan Medical College, Visnagar, Gujarat, among 100 lactating mothers between August and October 2019 to assess and enhance their knowledge of anemia and its prevention. Baseline knowledge about anemia causes was low (41%), but after the training, it significantly increased to 73%. Only 26% of mothers recognized the symptoms of anemia initially. The awareness rose to 56% after education, showing the positive impact of health interventions. Knowledge about dietary iron sources was critically low (5%) before training but increased

significantly to 42% after the session. Awareness of factors that inhibit iron absorption (like tea, coffee, and calcium) improved from 31% to 80%, highlighting the importance of educating mothers on proper dietary practices. Only 22% of mothers knew about iron absorption enhancers, such as vitamin C, but after education, 41% became aware of their importance. Before training, just 24% of participants knew about anemia treatments, but this knowledge significantly improved to 67% after the session.

Dr. Jani. et.al., (2022) conducted this cross-sectional study among 1,000 young women aged 15–24 years in North Gujarat (2019–2020) to assess their knowledge, attitude, and practices (KAP) regarding anemia and iron-folic acid (IFA) supplementation. A 59% of participants were aged between 15 and 19 years, and 63.9% lived in urban areas, while 36.1% were from rural areas. Even though 79% of the participants recognized anemia as a deficiency of hemoglobin or red blood cells, only 40–60% of the respondents were aware of the symptoms, causes, and effects of anemia. Commonly identified causes of anemia included lack of dietary iron (45.6%), heavy menstrual bleeding (45.9%), and sickness/infections (35%). More than half (56.5%) associated anemia with weakness and fatigue, but knowledge about iron absorption enhancers and inhibitors was very low. Only 32.6% of participants supported taking IFA tablets, while 47.5% preferred micronutrient powder, showing resistance toward tablet intake.

The biggest barriers to IFA compliance were taste and smell (44.5%), abdominal pain (30.7%), and nausea (17.3%), along with family disapproval (7.5%). Most young women (54.8%) believed iron-rich food is important, but only 24.5% had consumed such food in the past two days, indicating a gap between knowledge and practice. Family was the primary source of anemia-related knowledge (42.5%), followed by healthcare workers (31.5%), schools (52.9%), and media (13.9%). More than two-thirds (67.6%) consumed tea daily, but only 43.1% knew the correct timing to avoid interference with iron absorption. 61% of respondents had not taken IFA tablets for a long time, and only 34.89% received IFA under the WIFS (Weekly Iron Folic Acid Supplementation) program. Hemoglobin testing was low, with 66% not undergoing testing for more than a year, showing poor anemia screening and awareness.

BROAD OBJECTIVE:

To assess the knowledge of anemia among pregnant women.

SPECIFIC OBJECTIVES:

To assess the knowledge of anemia among pregnant women.

To assess dietary intake and pattern among the pregnant women.

To understand the extent to which pregnant women have access and adhere to anemia prevention strategies.

To assess determinants that influence knowledge and prevention strategies of anemia.

METHODS AND MATERIALS

Anemia is a major public health concern in India as well as across the world. It mainly affects the women in the reproductive age group (also including adolescent girls, menstruating girls and women, and pregnant and lactating women) and young children.

Study Design and Period

An Anganwadi-based cross-sectional study conducted between December 2024 and March 2025 in the Anganwadi centers of the Urban Vadodara region.

Source Population

Pregnant women registered in the Anganwadi centers of Urban Vadodara

Study Setting

Urban Vadodara is divided into 4 zones. 22 Anganwadi centers were randomly selected, and approximately 106 consenting women from each of the 4 zones were selected. A total of 424 pregnant women were enrolled for the study.

Sample Size Determination

Using the prevalence estimate of good knowledge of anemia (P), the sample size was calculated using the formula n=Z^2xPx(1-P)/d^2. Knowledge of anemia (P) was calculated by considering the following assumptions:

Knowledge of anemia was 50%
Z = critical value for normal distribution = 1.96
Confidence interval = 90%

Error rate = 10%

n= Z^2xPx(1-P)/d^2

n= (1.96)^2x0.50x(1-0.50)/(0.05)^2

n= 384.16

With 10% attrition, the total sample size sums up to 424

Therefore, N=424

Inclusion Criteria:

Women in the second or third trimester of pregnancy.

Exclusion criteria:

Women unwilling to participate in the study.

TOOLS AND TECHNIQUES

A semi-structured questionnaire was used to collect information on socio-demographic data, anthropometry, knowledge of anemia and adherence to prevention strategies, etc.

PRIMARY OUTCOME OF THE STUDY:

The knowledge of anemia and its prevention strategies among pregnant women

SECONDARY OUTCOME OF THE STUDY:

Adherence to prevention strategies of anemia.

STATISTICAL METHODS USED

The data was entered in an excel sheet and segregated properly. The calculation of the following statistical tests were done:

1. Mean and standard deviation
2. Percentages

EXPERIMENTAL DESIGN

Random selection of Anganwadi Centres from all 4 zones of Urban Vadodara.

Enrollment of Pregnant women in their second or third trimester.

Collection of data with the help of the semi-structured questionnaire.

Dependent variables

Knowledge of anemia and adherence to its prevention strategies are the dependent variables of the study.

Independent variables

Socio-demographic factors (maternal age, residency, religion, educational level and occupation of the mothers and husbands, and family size); obstetric characteristics of the mothers (gravidity and gestational age); and anthropometry (height and weight); and hemoglobin levels.

RESULTS AND DISCUSSION

Socio-demographic characteristics

The study included participants from various socio-demographic backgrounds. The mean age of the participants was 25.74 ±4.29 years. The distribution of maternal age highlights that a majority of participants (79.53%) were between 20 and 30 years of age, while a smaller proportion of participants (7.06%) were under the age of 20 years. This underscores a potential risk of teenage pregnancies. About 13.41% of the participants were over 30 years of age.

Education plays a vital role in an individual's life. The findings in table 4.1 reveal that (31.76%) participants had at least a middle school education and 32.94% of them had finished high school. A smaller portion (19.06%) had completed their graduation while 4.47% of them had no formal education. This suggests that there could be implications on the ability of the participant to understand and implement health recommendations.

The study findings show that a vast majority of participants were homemakers or unemployed (91.06%). This could affect their financial independence as well as their ability to access better healthcare facilities. Only 8.94% of the participants were employed, suggesting that most of the women were financially dependent on their spouses other family members who earn in the family. The study also indicated that 62.12% of the participants belonged to the families earning between 10,703-31,977 rupees per month. A smaller percentage (14.24%) belonged to higher income group earning above 53,360 rupees per month.

The assessment of the family structure of the participants revealed that joint families were more common (65.41%) than nuclear families (34.12%) followed by extended families (0.47%).

Figure 4.1: Frequency of Maternal Age in Years (N=425)

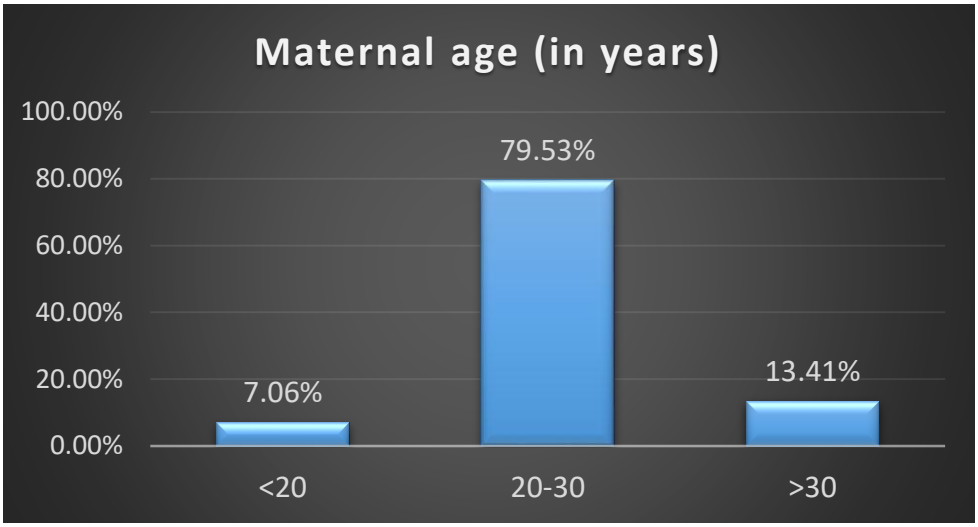


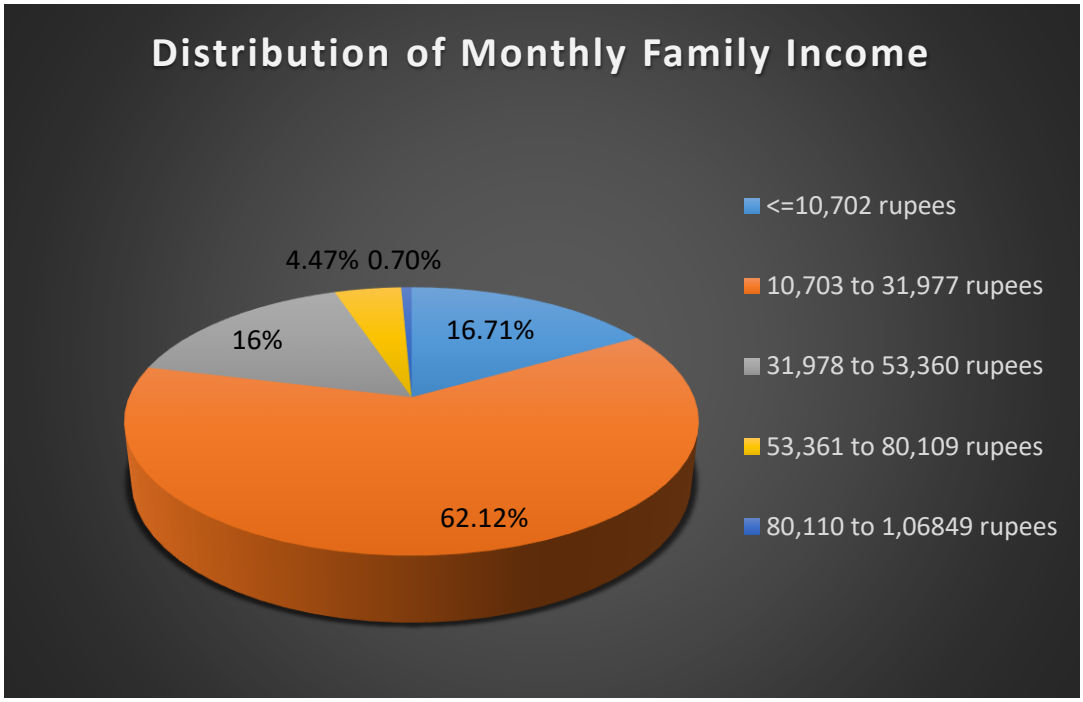
Table 4.1: Socio-demographic characteristics

Variable	Frequency (%)
Maternal educational level	
Illiterate	19 (4.47%)
Primary school	16 (3.76%)
Middle school	135 (31.76%)
Higher school	140 (32.94%)
Intermediate or diploma	64 (15.06%)
Graduate	45 (10.59%)
Profession or honors	6 (1.41%)
Maternal occupation	
Skilled workers and shop and market sales workers	4 (0.94%)
Skilled agricultural and fishery workers	0
Craft and related trade workers	2 (0.47%)
Plant and machine operators and assemblers	0
Elementary occupation	32 (7.53%)
Unemployed/homemaker	387 (91.06%)

Head of the family's education	
Illiterate	88 (20.71%)
Primary school	52 (12.24%)
Middle school	119 (28.00%)
Higher school	91 (21.41%)
Intermediate or diploma	57 (13.41%)
Graduate	17 (4.00%)
Profession or honors	1 (0.24%)
Head of the family's occupation	
Legislators, senior officers, and managers	0
Professionals	0
Technicians and associate professionals	3 (0.71%)
Clerks	0
Skilled workers and shop and market sales workers	5 (1.18%)
Skilled agricultural and fishery workers	1 (0.24%)
Craft and related trade workers	0
Plant and machine operators and assemblers	18 (4.24%)
Elementary occupation	329 (77.41%)
Unemployed	65 (15.29%)
Other sources of income	
Farmland	3 (0.70%)
Father-in-law's pension	2 (0.47%)
Milk vendor	1 (0.24%)
None	419 (98.59%)
Type of family	
Nuclear family	145 (34.12%)
Joint family	278 (65.41%)
Extended family	2 (0.47%)

Number of members in the family	
2-5	291 (68.47%)
6-9	121 (28.47%)
≥10	13 (3.06%)
Number of earning members in the family	
0-3	393 (92.47%)
4-7	31 (7.29%)
≥ 8	1 (0.24%)

Figure 4.2: Distribution of Monthly Family Income (N=425)



Obstetric characteristics

The study also examined the gravidity patterns (the number of pregnancies a woman has had). Majority of the participants (88.24%) reported having been pregnant 1-2 times, while a smaller fraction (11.6%) had experienced multiple (3-5) pregnancies. Table 4.2 (a) analyzes the gravidity pattern highlighting the mother's nutritional status. A majority of participants (57.18%) were in their second trimester while the remaining 42.82% participants were in the third trimester.

The assessment of pre-existing medical conditions among the participants was also carried out. Table 4.2 (b) shows that although a majority of them had no history of medical conditions, a smaller group had hypothyroidism (1.41%) which was followed by hypertension and anemia at 0.47% and diabetes, low blood pressure, and blood cancer at 0.24%. The presence of underlying medical conditions can influence hemoglobin levels and may interfere with the management of anemia during pregnancy.

A smaller group of participants (4.71%) also reported a history of vaginal bleeding. About 92.94% of the participants had a family history of Non-Communicable Diseases (NCDs), thyroid being the most prevalent (46.67%) among the female members of their families, followed by diabetes (20%) and hypertension (23.34%).

Anthropometry and Biophysical indicators

The table 4.3 (a) shows Anthropometry and Biophysical indicators. The mean values of the anthropometric measurements were; Height (in cm) - 152.992 (± 5.69), Weight (in Kg) - 55.76 (± 11.14. The mean values of the biophysical indicators are; Systolic blood pressure (in mmHg) 114.97 (± 8.64) and Diastolic blood pressure (mmHg) 78.69 (± 6.31) Figure 4.3 (a) shows the assessment of hemoglobin levels.

According to WHO cut offs for Hemoglobin, 20.94% participants were moderately anemic (7-9.9 g/dl), 34.12% were mildly anemic (10-10.9 g/dl), and 44.94% were not anemic (≥11 g/dl). According to WHO 2024 report, Figures 4.3 (b) and (c) show about 11.93% women in second trimester were moderately anemic (7-9.4 g/dl), 24.28% were mildly anemic (9.5-10.4 g/dl), and 63.79% were not anemic (≥10.5 g/dl). About 22.53% women in third trimester were moderately anemic (7-9.9 g/dl), 35.71% were mildly anemic (10-10.9%), and 41.76% were not anemic (≥11 g/dl).

Table 4.2(a): Obstetric Characteristics

Variable	Frequency (%)
Gravidity	
1-2	375 (88.24%)
3-5	50 (11.76%)
>5	0
Gestational age in trimester	
Second	243 (57.18%)
Third	182 (42.82%)
Number of children	
0	227 (53041%)
1	152 (35.76%)
2	34 (8.00%)
3	8 (1.89%)
4	4 (0.94%)

Table 4.2(b): Medical History of the Respondent

Variable	Frequency (%)
Medical history of the Participant	
Diabetes	1 (0.24%)
Hypothyroidism	6 (1.41%)
Hypertension	2 (0.47%)
Food allergies	0
Any other	
Low BP	1 (0.24%)
Anemia	2 (0.47%)
Blood cancer	1 (0.24%)
No medical condition	412 (96.94%)
Is there a family history of NCDs?	
Yes	30 (7.06%)
No	395 (92.94%)
Family history of NCDs	
Diabetes	6 (20%)
Hypertension	7 (23.34%)
Chronic obstructive pulmonary disease (COPD)	0
Dyslipidemia	2 (6.67%)
Cancer	1 (3.33%)

Others	
Thyroid	14 (46.67%)
Piles	1 (3.33%)
Kidney stones	1 (3.33%)
Paralysis	2 (6.67%)
History of Vaginal bleeding	
Yes	20 (4.71%)
No	405 (95.29%)

Table 4.3: Anthropometry and Biophysical indicators

Variable	Mean (SD)
Anthropometric measurements	
Height (in cm)	152.99 (± 55.76)
Weight (in Kg)	55.76 (± 11.14)
BMI (Kg/m^2)	23.81 (± 4.45)
Blood pressure	
Systolic blood pressure (mmHg)	114.97 (± 8.64)
Diastolic blood pressure (mmHg)	78.69 (± 6.31)

Figure 4.3 (a): Prevalence of Anemia among Pregnant Women (N=425)

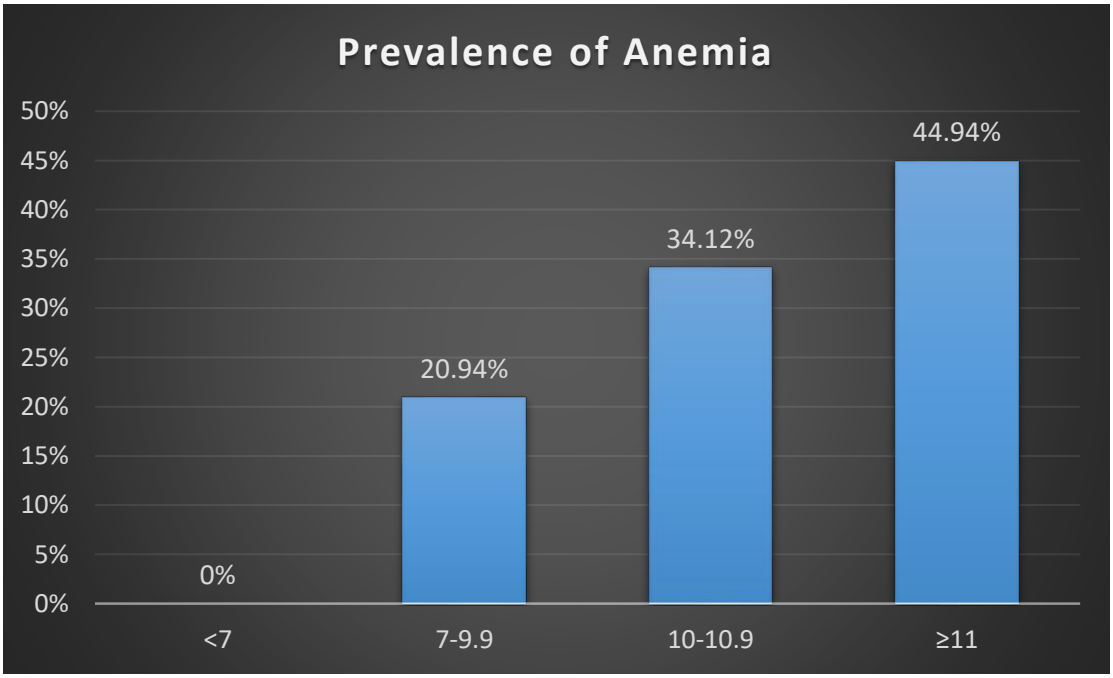
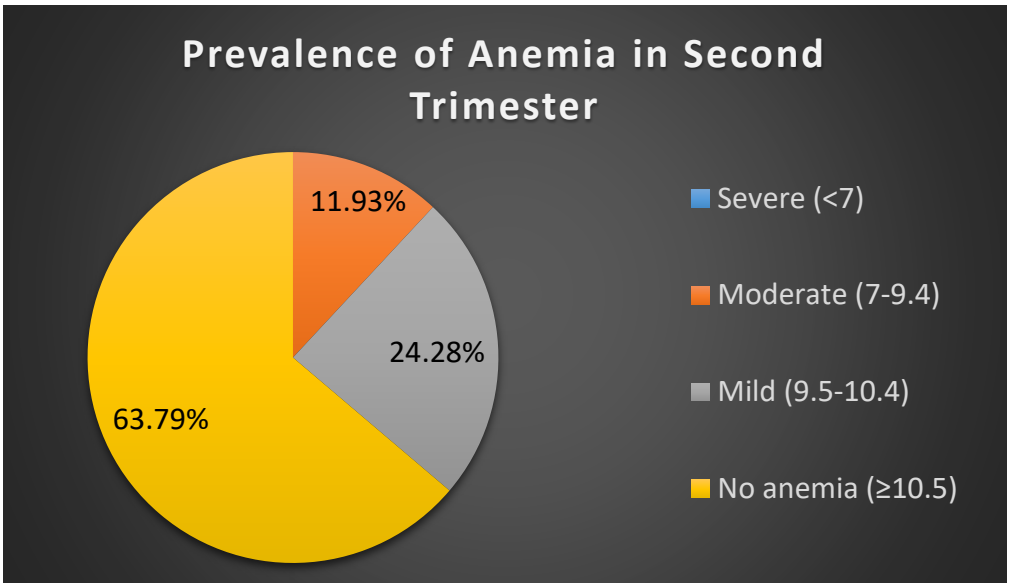
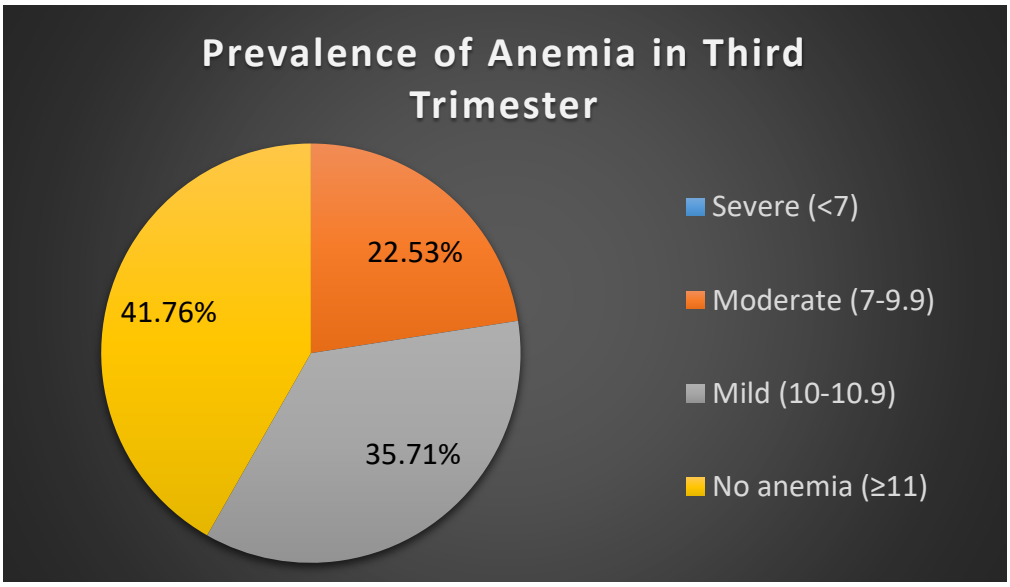


Figure 4.3 (b): Prevalence of Anemia among Pregnant Women in Second Trimester



WHO, Hemoglobin cut offs, 2024

Figure 4.3 (c): Prevalence of Anemia among Pregnant Women in Second Trimester



WHO, Hemoglobin cut offs, 2024

Knowledge of Anemia

The study assessed participants' knowledge and awareness regarding anemia and is displayed in table 4.4 (a). A striking majority (81.65%) reported not knowing what anemia is. About 57.69% of those who knew what anemia is recognized it as iron deficiency or low hemoglobin.

When they were asked about the causes of anemia, 92.70% of them had no idea what led to the development of anemia. A smaller faction of participants (6.12%) knew that low intake of iron rich foods can be one of the many causes. When symptoms of anemia were explored most (27.76%) recognized it as general body weakness and dizziness or fainting (19.05%) among other symptoms, leaving a majority of participants (69.88%) who did not know the symptoms at all.

In response to questions about the consequences of anemia, only 9.88% of them could recognize that it could expose their babies to anemia and developmental delays, 1.65% acknowledged that it could result in babies with low weight at birth, and 1.18% stated it could increase the blood loss during delivery. This emphasizes the knowledge gap even further.

Table 4.4 (b) shows that knowledge regarding anemia prevention strategies varied among the participants. A majority of participants (83.06%) were aware that anemia could be prevented. When asked about preventing anemia through diet, with their limited knowledge, they could only state that intake iron-rich foods (84%) and Vitamin C-rich foods (57.41%) could help. While 32.47% stated that usage of iron supplements could help in preventing, only 2.35% and 1.41% of them knew that WASH practices and using insecticide-treated bed nets, respectively, could be helpful in preventing anemia.

Table 4.4 (a): Knowledge of Anemia

Variable	Frequency (%)
Is there an increased need of iron during pregnancy?	
Yes	18 (18.35%)
No	347 (81.65%)
Do you know what anemia is?	
Yes	78 (18.35%)
No	347 (81.65%)
If yes, what is it?	
Iron deficiency/Low hemoglobin	45 (57.69%)
Don't know	7 (8.97%)
Any other	26 (33.34%)
Any other	
Less blood in the body	22 (84.62%)
Less intake of fruits and vegetables	2 (7.69%)
Blood disorder/deficiency of Vitamin B12	2 (7.69%)
What is cut off for hemoglobin during pregnancy?	
< 7 g/dl	2 (0.47%)
>9.9 g/dl	0
>=11 g/dl	232 (54.59%)
Any other	60 (14.12%)
Don't know	131 (30.82)
What are the symptoms of anemia? (MR)	
Shortness of breath/palpitations	12 (2.82%)
Fatigue	24 (5.65%)
General body weakness	118 (27.76%)
Poor appetite	24 (5.65%)
Dizziness or fainting	81 (19.05%)
Pallor of face	0
Brittle nails	8 (1.88%)
All listed above	2 (0.47%)
Don't know	297 (69.88%)

Figure 4.4: Causes of Anemia (N=425)

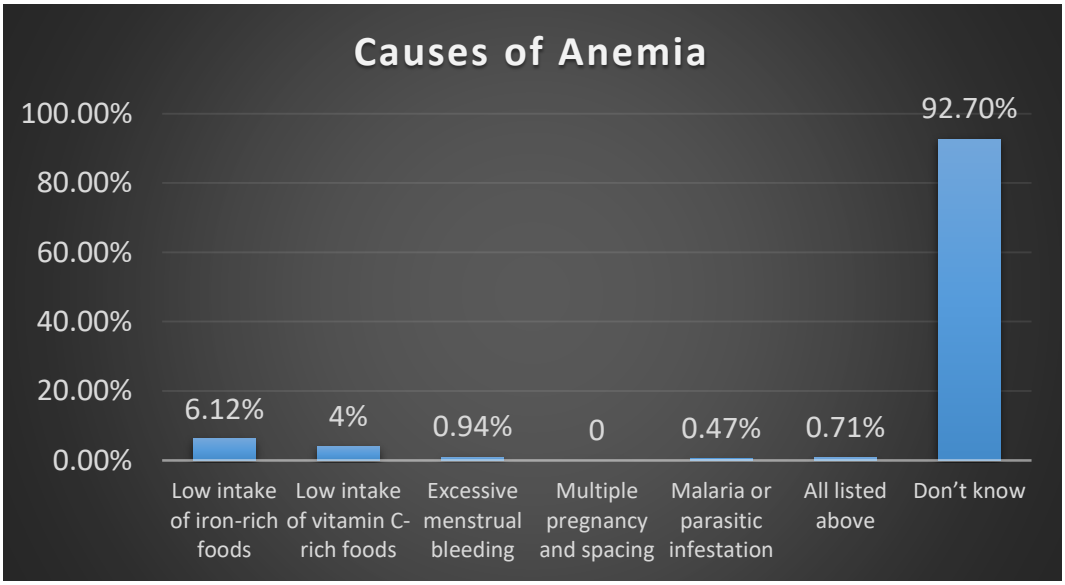


Table number 4.4(b): Knowledge of Anemia

Variable	Frequency (%)
What are the consequences of anemia? (MR)	
Anemia and developmental delays in the baby	42 (9.88%)
Preterm labor	2 (0.47%)
Increased blood loss during delivery	5 (1.18%)
Low-birth weight baby	7 (1.65%)
Decreased concentration (affects learning ability)	2 (0.47%)
Decreased ability to work (physical work capacity)	4 (0.94%)
Don't know	381 (89.65%)
How to prevent anemia?	
Yes	353 (83.06%)
No	72 (16.9%)
Prevention of anemia (MR)	
Fortified foods	0
Dietary diversity	349 (82.12%)
Using iron supplements	138 (32.47%)
Deworming tablets	0
WASH practices	10 (2.35%)
Using insecticide-treated bed nets	6 (1.41%)
All listed above	0
Don't know	72 (16.94%)
How can you prevent anemia through diet? (MR)	
Eating iron-rich foods (green leafy, meat, seafood, dried fruits, etc.)	357 (84%)
Vitamin C-rich foods (lemons, guavas, amlas, citrus fruits, etc.)	244 (57.41%)
Fortified foods	0
Including different food groups in the diet throughout the day	62 (14.59%)
All of the above	0
Don't know	56 (13.17%)

Adherence to Anemia Prevention Strategies

Iron-folic acid (IFA) supplementation is a critical component of anemia prevention during pregnancy. Table 4.5 (a) shows that the study found that 100% of the participants had heard of IFA supplements, indicating their awareness of the public health programs. Even with the widespread awareness of IFA supplementation, gaps were found in consumption. About 97.41% of participants received IFA tablets, 96.38% of those reported actual consumption. The discrepancy suggests that some women may not adhere to supplementation despite the availability.

A staggering majority of the participants (83.09%) procured their IFA supplements from government (40.99%) and private (57.85%) hospitals. The recommended frequency of IFA consumption is daily and 96.86% of the participants followed the recommendations religiously. A majority (77.05%) of the participants received IFA supplements from people other than ASHA, AWW, and ANM.

A significant percentage of participants, 52.89%, adhered to IFA consumption because they thought it could prevent anemia, while about 24.39% of the participants consumed the supplements thinking it will help them stay healthy, while 20.29% of them did not even know the reason for the consumption of supplements. A majority (44.71%) of participants had been taking IFA supplements for the past 2-3 months of their pregnancy. About 29.64% of them were taking the supplements for longer or shorter durations than mentioned in the questionnaire, followed by 20.24%, who were consuming the IFA supplements for only 1 month.

The major reason for not consuming IFA supplements turned out to be the side effects of the supplementation, as reported by approximately half the participants (53.33%), who were not consuming the supplements. A majority (91.06%) of participants adhered to supplementation regularly. The reasons that supported the regular intake of supplements by the participants turned out to be memory (96.38%), followed by family support (1.81%), reminding technique (1.29%), and lastly because they were available for free. The irregularity in consumption had forgetfulness as the major reason (50%). An assessment on side effects of the supplements was carried out, it highlighted that nausea and vomiting were major (91.89%) side effects reported by the participants.

A vast majority of participants were unaware as to whom to approach (78.82%) and where to go (77.88%), to procure the deworming tablets from. There was poor

consumption (4.71%) of deworming tablets and poor knowledge regarding its dosage frequency (0.94%). While the calcium supplements were procured at the government hospital by 40.27% of the participants and 58.65% procured it from the private hospitals.

Dietary Habits

Among the total participants, majority were vegetarians (51.29%), followed by non-vegetarians (43.53%), and a small proportion were identified as ovo-vegetarians (5.18%); indicating a mixed dietary pattern among the population. While majority (99.06%) didn't report any, a small percentage (0.94%) reported having food allergies.

The dietary pattern also revealed that majority (95.77%) of the participants had 2-4 meals in a day. A smaller proportion of participants (8.71%) reported of skipping meals. The majority (43.24%) of those participants reported of skipping lunch. Skipping meals once a week was the least cited frequency, accounting for 5.14%.

The majority of participants consumed tea (84.71%) while 4.94% reported having neither tea nor coffee. The timing for consumption of tea was majorly reported during or with meals (83.29%). A small proportion (17.18%) reported of having PICA (a craving or consumption of non-nutritive, non-edible - at times – substances). Sand was the most craved (80.82%) item among the population.

Table number 4.5(a): Adherence to Anemia Prevention Strategies

Variable	Frequency (%)
Are you aware of IFA supplements?	
Yes	425 (100.00%)
No	0
Do you get IFA supplements?	
Yes	414 (97.41%)
No	11 (2.59%)
Do you consume?	
Yes	399 (96.38%)
No	15 (3.62%)
Place of IFA tablet procurement (MR)	
PHC	39 (9.42%)
AWC	68 (16.42%)
Any other	344 (83.09%)
Any other	
Government hospital	141 (40.99%)
Private hospital	199 (57.85%)
CHC	4 (1.16%)
Who provides IFA tablet? (MR)	
AWW	19 (4.59%)
ASHA	57 (13.77%)
ANM	58 (14.00%)
Any other person	319 (77.05%)
Recommended frequency of IFA consumption (MR)	
Weekly	1 (0.24%)
Biweekly	0
Daily	411 (99.27%)
Don’t know	2 (0.48%)
Any other	0
Frequency of consumption by the respondent (MR)	
Daily	401 (96.86%)
Once a week	0
Once in 15 days	0
Any other	13 (3.14%)

Table 4.5(b): Adherence to Anemia Prevention Strategies

Variable	Frequency (%)
Duration of IFA consumption (MR)	
< 1 month	4 (0.94%)
1 month	86 (20.24%)
2 - 3 months	190 (44.71%)
100 days	0
Irregularly	0
Don't remember	0
Any other	126 (29.64%)
No consumption	19 (4.47%)
Reasons for consuming IFA tablets (MR)	
It prevents anemia	219 (52.89%)
Improves normal growth and delivery of the baby	56 (13.53%)
Helps them stay healthy	101 (24.39%)
Reduces dizziness and fatigue	27(6.52%)
Don't know	84 (20.29%)
Any other	2 (0.48%)
Do you consume IFA regularly?	
Yes	387 (91.06%)
No	38 (8.94%)
Reasons for consuming IFA regularly (MR)	
Family support	7 (1.81%)
Free of cost	2 (0.52%)
Reminding technique	5 (1.29%)
Reinforcement from the service provider (AWW/ASHA)	0
Reinforcement through advertisements/social media	0
Any other	373 (96.38%)

Reasons for not consuming IFA regularly (MR)	
Stops taking IFA tablets due to too many medications	10 (26.32%)
Job Commitment	0
Household Chores	0
Forgetfulness	19 (50%)
Any other	9 (23.68%)
Timing for IFA consumption	
Before meal	26 (6.16%)
With meal	0
Immediately after meal	203 (48.10%)
After half hour to one hour gap	183 (43.36%)
After 1-2 hours of meal	10 (2.37%)
Don’t know	0
Any other	0
Do you experience side effects after IFA consumption?	
Yes	37 (8.71%)
No	388 (91.29%)
Side effects	
Nausea/vomiting	34 (91.89%)
Constipation	3 (8.11%)
Diarrhea	0
Metallic taste	0
Flatulence	0
Black stool	0
Any other	0

Figure 4.5 Reasons for Not Consuming IFA Supplements (N=425)

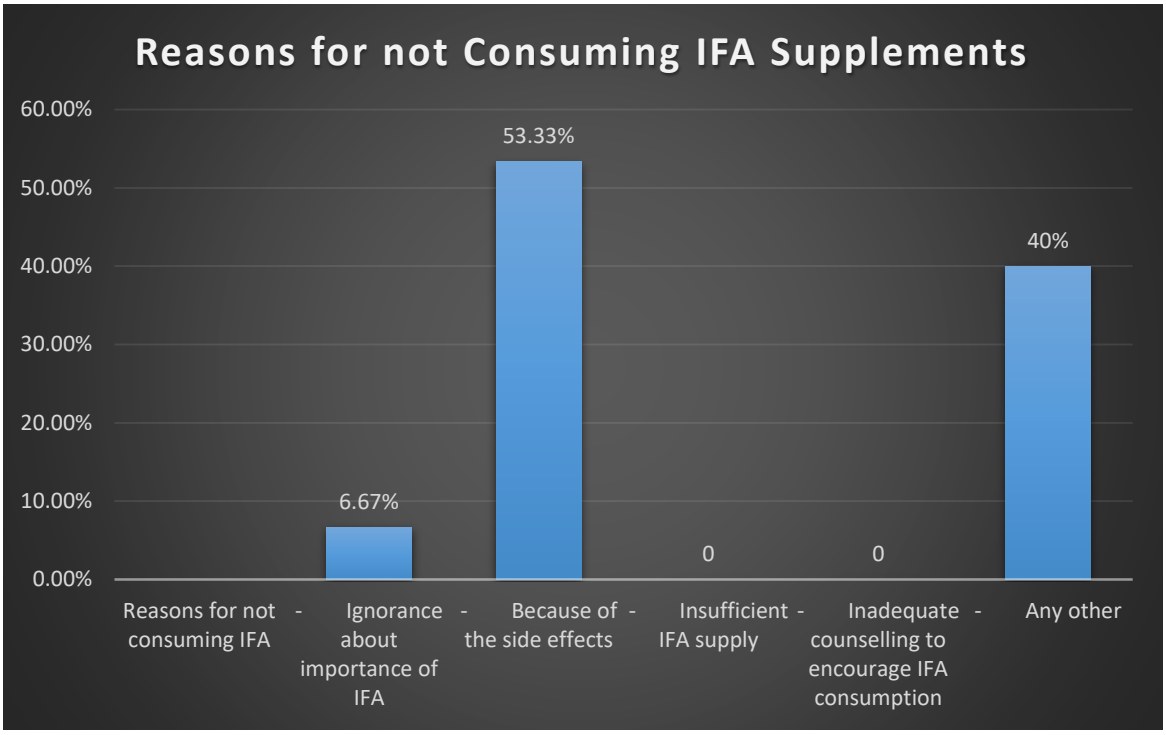


Table 4.5(c): Adherence to Anemia Prevention Strategies

Variable	Frequency (%)
History of parasitic infestation	
Yes	2 (0.47%)
No	423 (99.53%)
History of malaria	
Yes	8 (1.88%)
No	417 (98.12%)
History of other infections	
Yes	12 (2.82%)
No	413 (97.18%)
Place of Deworming tablet procurement (MR)	
PHC	13 (3.05%)
AWC	63 (14.82%)
Any other	26 (6.12%)
Don't know	331 (77.88%)

Who provides Deworming tablet?	
AWW	13 (3.06%)
ASHA	59 (13.88%)
ANM	5 (1.18%)
Any other	22 (5.18%)
Don’t know	335 (78.82%)
Do you consume Deworming tablet?	
Yes	20 (4.71%)
No	405 (95.29%)
Frequency of dosage	
Once a year	2 (0.47%)
Twice a year	4 (0.94%)
Any other	14 (3.29%)
Don’t know	405 (95.29%)
Place of Calcium tablet procurement (MR)	
PHC	40 (9.41%)
AWC	52 (12.24%)
Any other	370 (87.06%)
Any other	
Government hospital	149 (40.27%)
Private hospital	217 (58.65%)
CHC	4 (1.08%)
Who provides Calcium tablet? (MR)	
AWW	13 (3.06%)
ASHA	49 (11.53%)
ANM	57 (13.41%)
Any other person	344 (80.94%)

Table 4.6 (a): Dietary Habits

Variables	Frequency (%)
Dietary preferences	
Vegetarian	218 (51.29%)
Non-vegetarian	185 (43.53%)
Ovo-vegetarian	22 (5.18%)
Food allergies	
Yes	4 (0.94%)
No	421 (99.06%)
Which ones?	
Fish	2 (50%)
Tomato	1 (25%)
Brinjal	1 (25%)
Do you skip any meals?	
Yes	37 (8.71%)
No	388 (91.29%)
Tendency of skipping meals	
Breakfast	10 (27.03%)
Lunch	16 (43.24%)
Dinner	11 (29.73%)
Frequency of skipping meals	
3-4 times a week	8 (21.62%)
2-3 times a week	13 (35.13%)
Once a week	2 (5.41%)
3 times in 15 days	2 (5.41%)
Everyday	4 (10.81%)
Rarely	4 (10.81%)
Sometimes	4 (10.81%)

Consumption of tea/coffee in a day	
Tea	360 (84.71%)
No tea/coffee	21 (4.94%)
Do you have the urge to eat non-edible things (PICA)?	
Yes	73 (17.18%)
No	352 (82.82%)
If so, what do you crave?	
Sand	59 (80.82%)
Ice cubes	8 (10.96%)
Slate pens	4 (5.48%)
Black sand	2 (2.74%)

The food frequency questionnaire data in the table 4.6 (b) reveals that wheat flour was the most commonly consumed cereal, with nearly all participants (96.94%) consuming it daily. Rice flakes were consumed once a week by 48% of participants, and puffed rice was taken 2–4 times a week by 27.29%. Bajra (pearl millet) was consumed occasionally by 28.23% of participants.

The intake of legumes and pulses was mostly occasional or infrequent. Whole green gram (39.53%) and Bengal gram dal (31.53%) were consumed once in 11–15 days. Black gram dal (23.76%) was consumed once a month, and Bengal gram whole (27.05%) occasionally. Green gram dal (32.94%) was consumed once a week. Peanuts (51.76%), white sesame seeds (48.94%), processed dates (26.82%) were consumed occasionally.

Spinach (73.17%) and fenugreek leaves (95.29%) had relatively high seasonal consumption. Other GLVs like colocasia (56.94%), green amaranth (52.94%), and radish leaves (46.35%) were also consumed seasonally. Onion stalk (72.23%) and cluster beans (26.82%) were consumed seasonally and once a week, respectively.

About 12.23% participants consumed eggs once a week. Chicken (8.23%), meat (6.12%), and fish (4.7%) were consumed 2-3 times a week, once a week, or occasionally, respectively.

Vitamin C Intake

Spinach (73.17%) and green amaranth (52.94%) were consumed seasonally, supporting vitamin C intake to some extent. Cabbage had a weekly intake by 73.88% of the participants. Ripe tomatoes were consumed daily by 72.47%. Cauliflower (84.70%), fresh peas (78.58%), and onion stalk (72.23%) were consumed once a week and seasonal. Capsicum (34.35%) was consumed occasionally.

Mango (96.70%), Guava (78.58%), Orange (78.11%), Sweet lime (81.41%), Zizyphus jujube (Bor) (73.88%), and Indian gooseberry (54.82%) were all consumed seasonally.

Dietary diversity is an important indicator of micronutrient adequacy. When assessed, 65.18% of the respondents met the criteria of consuming ≥ 5 food groups while, 34.82% of the respondents consumed <5 food groups.

Based on the dietary data (24-hour diet recall) collected, the nutritional needs as per the EAR are as follows;

Energy - 1660+350, i.e. 2010 Kcals per day

Protein (2nd trimester) - 44.0+7.6, i.e. 51.6 g/day

Protein (3rd trimester) - 54.0+17.6, i.e. 71.6 g/day

Iron - 21 mg/day

Folate - 480 mcg/day

Vitamin C - 65 mg/day

The figure 4.8 highlights a significant prevalence of nutrient intake among pregnant women, with the majority consuming less than 100% of the recommended levels for key nutrients. The most alarming deficiencies are observed in folate, iron, and energy intake, with 97.88%, 98.12%, and 99.29% of women respectively falling short of the recommended EAR. Protein intake is also notably insufficient, with 94.65% and 96.15% not meeting daily requirements during the second and third trimesters, respectively. Although Vitamin C shows comparatively better intake, 68.71% still consume less than the recommended EAR. These findings indicate a widespread nutritional risk among the population studied.

Utilization of Maternal Health Services

The majority of participants (98.59%) attended ANC visits during pregnancy, while 1.41% did not attend ANC visits. About 40.33% of those in second trimester had less than 3 ANC visits and 59.76% had more than or equal to 3 ANC visits. About 46.15% of those in third trimester had less than 8 ANC visits, and 53.85% had more than or equal to 8 ANC visits.

The respondents utilized the ANC services from different places. About 52.75% went to private hospitals, 38.19% went to government hospitals, while the remaining 8.11% and 0.95% reported utilizing services from primary health centers (PHCs) and community health centers (CHCs), respectively.

When asked about the Mother and Child Protection (MCP) card, 76% reported having the card, 20.94% did not possess the card, and 3.06% had registered for the card but had not received it. Of those who possessed the MCP card, 77.09% had updated cards, while 22.91% did not have updated cards.

Table 4.6 (b): Dietary Habits

Food frequency (for iron intake)	
Cereals and Millets	
- Wheat flour	412 (96.94%) - daily
- Rice flakes	204 (48%) - once a week
- Bajra	120 (28.23%) - occasionally
- Puffed rice	116 (27.29%) - 2 to 4 times a week
Legumes and Pulses	
- Bengal gram whole	115 (27.05%) - occasionally
- Bengal gram dal	134 (31.53%) – once in 11-15 days
- Whole green gram	168 (39.53%) – once in 11-15 days
- Black gram dal	101 (23.76%) – once a month
- Green gram dal	140 (32.94%) – once a week
Green Leafy Vegetables	
- Green Amaranth leaves	225 (52.94%) - seasonally
- Fenugreek leaves	405 (95.29%) - seasonally
- Raddish leaves	197 (46.35%) – seasonally
- Colocasia	242 (56.94%) – seasonally
- Spinach	311 (73.17%) – seasonally
Other Vegetables	
- Cluster beans	114 (26.82%) – once a week
- Onion stalk	307 (72.23%) – seasonally
Dried fruits, Nuts, and Seeds	
- White sesame seeds	208 (48.94%) - occasionally
- Peanuts	220 (51.76%) – occasionally
- Dates (processed)	114 (26.82%) – occasionally
Meat Fish, and Poultry	
- Eggs	52 (12.23%) – once a week
- Chicken	35 (8.23%) – 2-3 times in a week
- Meat	26 (6.12%) – once a week
- Fish	20 (4.7%) - occasionally
Food frequency (for Vitamin C intake)	
Green Leafy Vegetables	

- Green amaranth leaves	225 (52.94%) – seasonally
- Cabbage	314 (73.88%) – once a week
- Spinach	311 (73.17%) – seasonally
Other Vegetables	
- Capsicum	146 (34.35%) – occasionally
- Cauliflower	306 (84.70%) – once a week
- Drumstick	169 (39.76%) – seasonally
- Onion stalk	307 (72.23%) – seasonally
- Fresh peas	334 (78.58%) – seasonally
- Ripe tomato	308 (72.47%) – daily
Fruits	
- Indian gooseberry	233 (54.82%) – seasonally
- Guava	334 (78.58%) – seasonally
- Zizyphus jujube (Bor)	314 (73.88%) – seasonally
- Sweet lime	346 (81.41%) – seasonally
- Orange	332 (78.11%) – seasonally
- Mango (kesar)	411 (96.70%) - seasonally
MDD score food groups	
- < 5	148 (34.82%)
- ≥ 5	277 (65.18%)

Figure 4.6 Consumption of Tea (N=425)

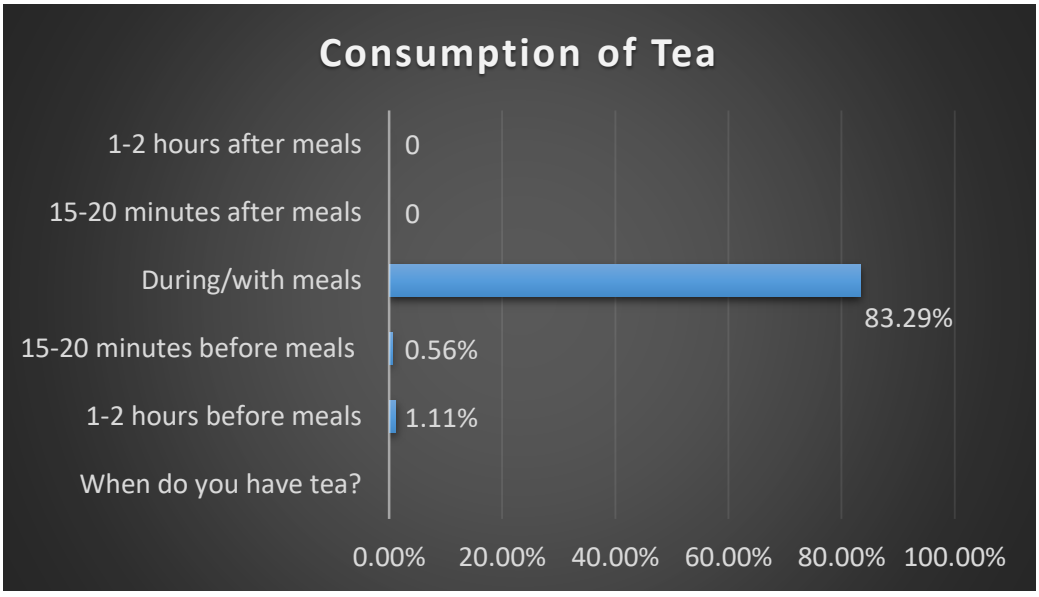


Figure 4.7: Total % Contribution of Macronutrients in 24 hour diet recall.

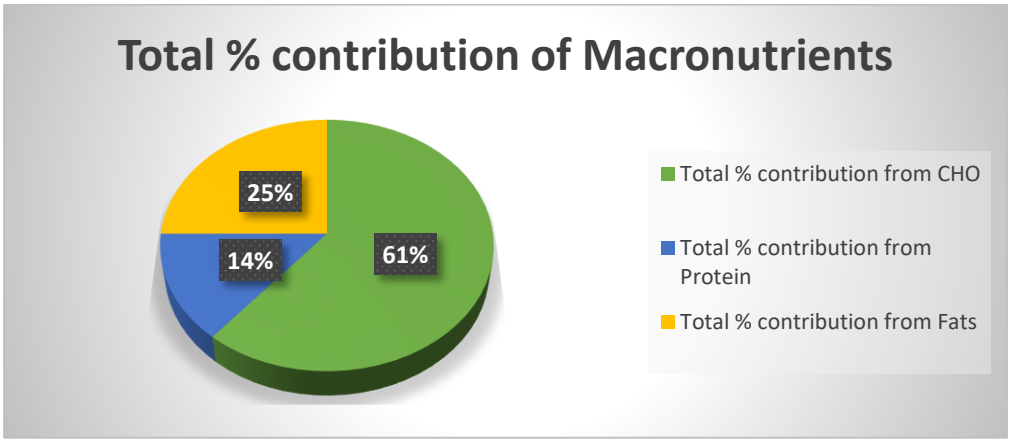


Figure 4.8: Pregnant Women Nutritionally at Risk

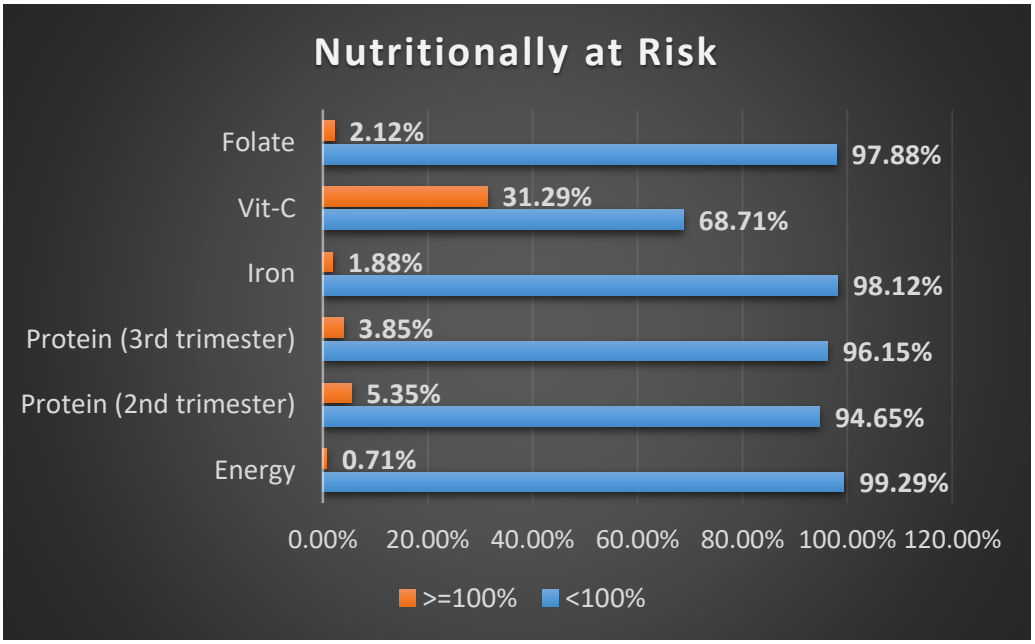


Table 4.7: Utilization of Maternal Health Services

Variables	Frequency (%)
Do you visit the health center for an antenatal care (ANC) checkup?	
Yes	419 (98.59%)
No	6 (1.41%)
Reasons for not going to ANC visits	
Health Centre is far away from home	0
Ignorance of the subject	0
Objection by the family members	0
Don't know	0
Any other	6 (100%)
Any other	
Will start going from next month	5 (83.33%)
No MCP card	1 (16.67%)
Place of ANC visit	
PHC/clinic	34 (8.11%)
Private hospitals	221 (52.75%)
Government hospitals	160 (38.19%)
Any other	4 (0.95%)
Do you have MCP card?	
Yes	323 (76%)
No	13 (3.06%)
Registered but received	89 (20.94%)
Is your MCP card up to date?	
Yes	249 (77.09%)
No	74 (22.91%)
AWW making home visits	
Yes	217 (51.06%)
No	208 (48.94%)

Frequency of visits	
2-3 times a month	55 (25.35%)
4-5 times throughout pregnancy	2 (0.92%)
As and when required	3 (1.38%)
Once a month	129 (59.45%)
Once in 15 days	13 (5.99%)
Once a week	12 (5.53%)
ASHA making home visits	
Yes	407 (95.76%)
No	18 (4.24%)
Frequency of visits	
Once a month	371 (91.15%)
Once in 2 to 6 months	0
Once a year	0
Any other	36 (8.85%)
Any other	
2-3 times in a month	26 (72.22%)
As and when required	4 (11.11%)
Once a week	4 (11.11%)
Only for vaccination	2 (5.56%)
Who gives dietary advice?	
AWW	32 (7.53%)
ASHA	240 (56.47%)
Both AWW and ASHA	122 (28.71%)
Any other	31 (7.29%)
What dietary advice was given to you?	
Green leafy vegetables and fruits	150 (35.30%)
THR	20 (4.71%)
Protein-rich foods	10 (2.35%)
Drink milk	5 (1.18%)
Healthy homemade food	120 (28.23%)
Avoid outside food	120 (28.23%)

Figure 4.9 (a): Distribution of Frequency of ANC Visits in Second Trimester

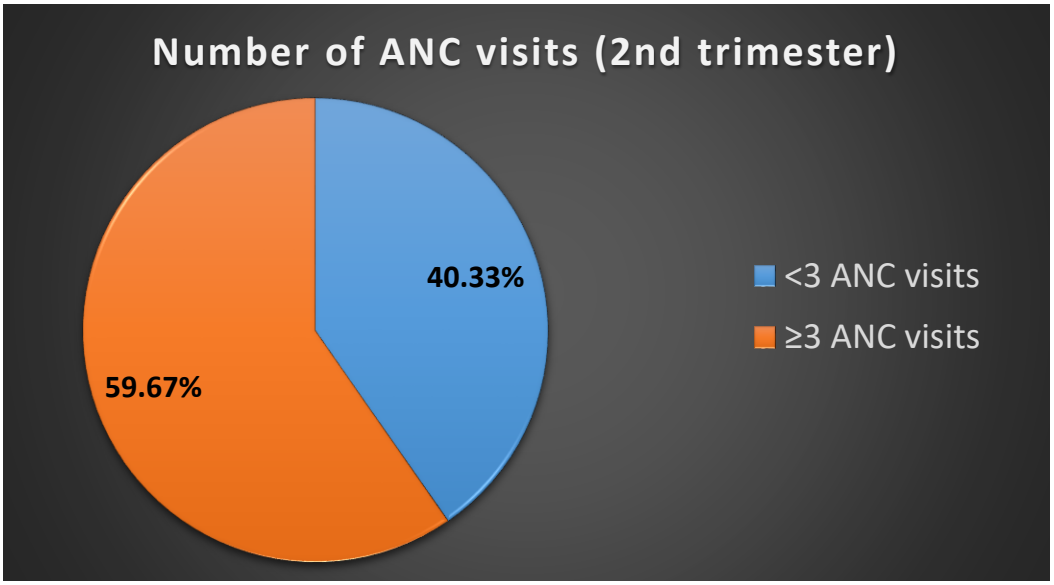
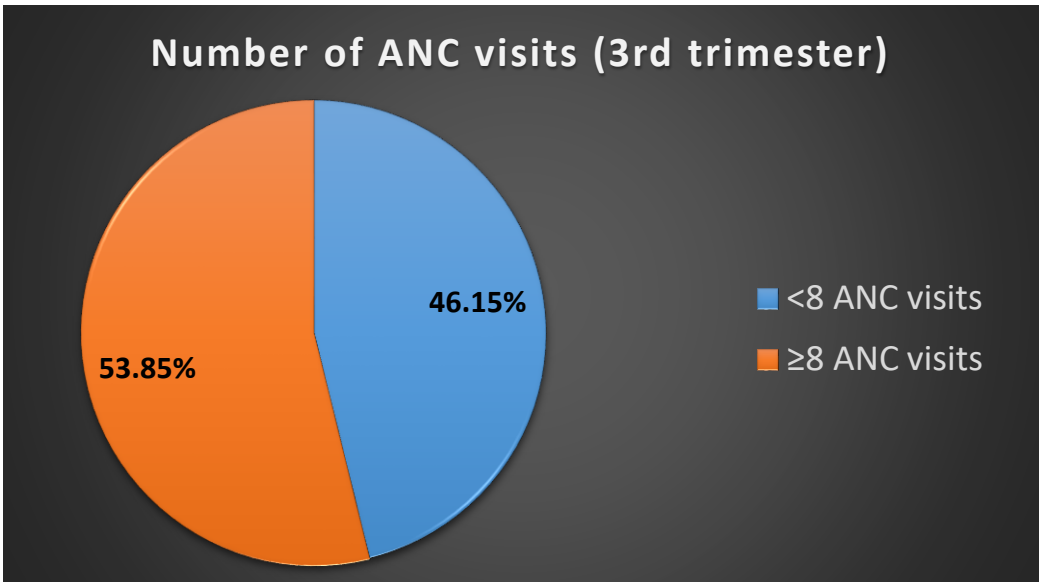


Figure 4.9 (b): Distribution of Frequency of ANC Visits in Third Trimester



Slightly more than half (51.06%) of the respondents reported receiving home visits from Anganwadi workers AWW, while 48.94% denied receiving such visits. The AWW most commonly visited once a month, as reported by 59.45% of those who received the visits. Visits 2-3 times a month and once a week visits were reported by 25.35% and 5.53% respectively. About 5.99% of the participants reported once a month AWW visits, highlighting the variability in AWW visit schedules.

Around 95.76% participants reported of accredited social health activist (ASHA) making home visits. 91.15% of those that visited, made home visits once every month. Among the 'any other' group, 72.22% respondents reported receiving visits 2-3 times in a month.

Dietary counselling was received by a large group of respondents from the community health workers. The most common source was AWWs (7.53%) and ASHA workers (56.47%) alone as well as receiving dietary advice from both AWWs and ASHA workers collectively (28.71%). Dietary advices like including more green leafy vegetables and fruits in the diet, eating protein rich foods, preferring healthy homemade food over outside food, including Take Home Rations (THR) provided from the Anganwadi centers (AWCs) in their diet, etc. were delivered.

Preventive strategies

An overwhelming 99.76% of respondents reported not having heard of fortified foods. The fact that 1 respondent (0.24%) mentioned being aware of THR as a fortified food product, underscores the knowledge gap in the community regarding food fortification. When asked about the availability of fortified foods in the market, 99.76% stated that they were not aware of the availability of fortified foods.

While 13.41% of respondents reported not obtaining THR from AWCs, a significant majority (86.59%) reported they did. Of those who obtained THR, 22.01% did not consume it, while 77.99% incorporated THR in their diet some way or other. A large proportion (83.95%) of respondents reported not consuming THR because they did not like its taste, 2.47% fed it to cattle, 2.47% gave it to other people who need it, and 3.70% reported it being overly sweet. About 2.47% said they had received the THR only recently and 4.94% said they had never tried making anything out of it.

Only 12% said they availed the food rations from the Public Distribution System (PDS) stores, while the remaining (88%) did not make use of the PDS services. Of those who bought food rations from PDS stores 94.12%, 90.20%, and 54.90% reported rice, wheat, and sugar, were available at the stores, respectively.

About 99.76% of respondents had access to washrooms and toilets in their own houses while 0.24% had to defecate in the open. Nearly all the respondents (99.76%) reported having hand washing facilities and almost everybody (99.76%) had access to water in their washrooms. Majority (99.53%) of the participants used detergent or soap for hand washing, while 0.47% had to use soil/mud/ash. About 99.29% had water coming through the pipelines, 0.47% had protected dug well, and 0.24% had to use store bought water.

Nearly 89.41% of participants used some form of mosquito repellent, while 10.59% did not. 46.59% of the participants used vaporizers, 1.88% used repellent creams, and 2.59% used mosquito coils. Only 7.29% participants used Insecticide-treated bed nets, 42.35% used other methods that included incense sticks and camphor. Among those using bed-nets, 90.32% used them daily and 6.45% used them very rarely.

Figure 4.10: Reasons for Not consuming THR (N=425)

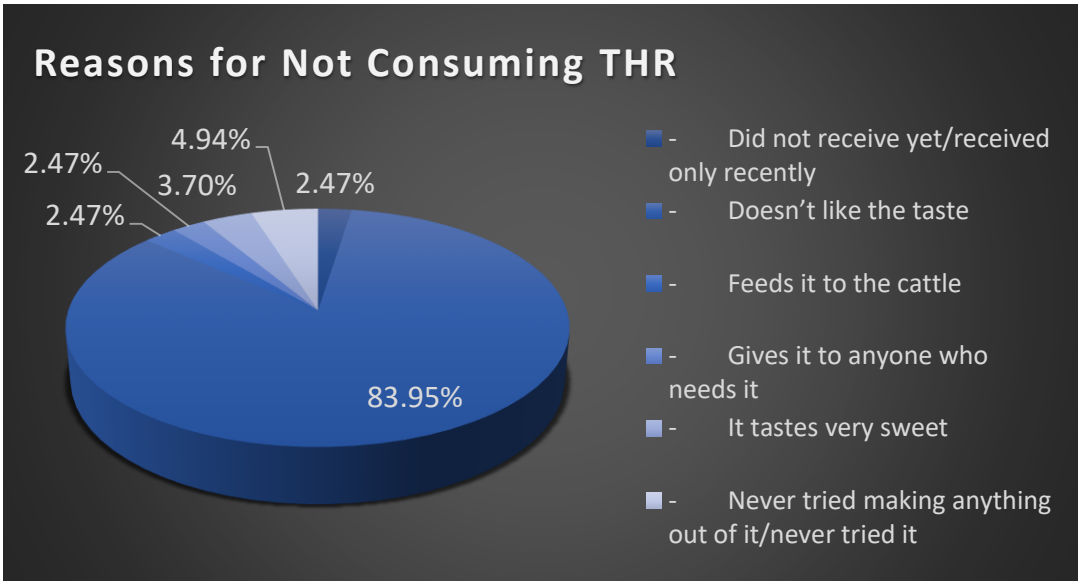


Table 4.8: Anemia Prevention Strategies

Variables	Frequency (%)
What are fortified foods?	
Don't know	424 (99.76%)
Yes, THR	1 (0.24%)
Availability of fortified foods in the market	
Yes	1 (0.24%)
No	424 (99.76%)
THR from AWC	
Yes	368 (86.59%)
No	57 (13.41%)
Consumption of THR	
Yes	287 (77.99%)
No	81 (22.01%)
Rations from PDS shops	
Yes	51 (12%)
No	374 (88%)

Food items available at PDS shops (MR)	
Rice	48 (94.12%)
Salt	0
Sugar	28 (54.90%)
Wheat	46 (90.20%)
Kerosene and edible oils	17 (33.34%)
Pulses and spices	27 (52.94%)
Any other	2 (3.92%)
Don’t know	0
Access to washrooms/toilets	
Yes	424 (99.76%)
No	1 (0.24%)
Where?	
Own house	424 (99.76%)
Neighbor’s house	0
Open defecation	1 (0.24%)
Any other	0
Water availability in the washroom	
Yes	424 (99.76%)
No	1 (0.24%)
Hand washing station near washroom	
Yes	424 (99.76%)
No	1 (0.24%)
Materials used for hand washing	
Soap or detergent	423 (99.53%)
Soil/mud/ash	2 (0.47%)
Water only	0
Any other	0

Primary source of bathing water	
Piped water	422 (99.29%)
Hand pump	0
Protected dug well	2 (0.47%)
River/canal/pond/unprotected dug well	0
Any other	1(0.24%)
Any other	
Water bottles that are sold	1 (100%)
Usage of mosquito repellents	
Yes	380 (89.41%)
No	45 (10.59%)
Which ones?	
Repellent cream	8 (1.88%)
All out/Mortein	198 (46.59%)
Mosquito coils	11 (2.59%)
Insecticide-treated bed nets	31 (7.29%)
Traditional dhuni	3 (0.71%)
Any other	180 (42.35%)
Any other	
Agarbatti	177 (98.33%)
Camphor	3 (1.67%)
Frequency of using Insecticide-treated bed nets	
Daily	28 (90.32%)
2 or 3 times a week	1 (3.23%)
5 or 6 times a week	0
Once in 15 days	0
Any other	2 (6.45)
Any other	
Very rarely	2 (100%)

Discussion

About 79.53% of the participants were aged between 20-30 years, while 7.06% were under 20 years of age, with mean age being 25.74 ±4.29 years. Around 31.76 had a middle school education, 32.94% completed high school, and only 19.06% were graduates, while 4.47% were illiterate. A significant majority (91.06%) were homemakers/unemployed and only 8.94% were employed. Most families (62.12% earned between 10,703 to 31,977 rupees/month, only 14.24% were in high-income class earning 53,361 to 80,109 rupees/month. Around 65.41% lived in joint families, 34012% in nuclear families, and 0.47% in extended families.

About 88.24% of women had been pregnant 1–2 times; 11.6% had 3–5 pregnancies. Around 57.18% were in the second trimester, and 42.82% were in the third trimester. Few had hypothyroidism (1.41%), hypertension or anemia (0.47%), diabetes or other conditions (0.24%). 77.18% had Hb 10.0–12.9 g/dL, 20.94% had 7.0–9.9 g/dL, and only 1.88% had normal Hb (≥13 g/dL). Mean height was 152.99 cm, weight 55.76 kg, and BMI 23.81 kg/m². 34.82% had normal BMI, 17.65% were overweight, 10.59% were underweight, 28.23% had obesity class I, and 8.71% obesity class II.

About 81.65% did not know what anemia was. Around 92.70% didn't know the causes of anemia; only 6.12% cited poor iron intake. Only 27.76% recognized general weakness, and 19.05% dizziness/fainting; 69.88% didn't know any symptoms. Very few recognized complications—9.88% mentioned risks to the baby; only 1.18% mentioned risk of blood loss during delivery. 83.06% knew anemia is preventable; 84% mentioned iron-rich foods, 57.41% Vitamin C, 32.47% iron supplements; very few mentioned WASH (2.35%) or bed nets (1.41%).

All participants had heard of IFA; 97.41% received and 96.38% consumed them; 96.86% followed daily dosage. 52.89% believed it prevents anemia; 20.29% consumed without knowing why. Side effects (nausea, vomiting) were the main barrier for 53.33% of non-adherents; forgetfulness was another reason. About Side effects (nausea, vomiting) were the main barrier for 53.33% of non-adherents; forgetfulness was another reason. Poor knowledge (0.94%) and low consumption (4.71%) were reported.

About 51.29% were vegetarians, 43.53% non-vegetarians, and 5.18% ovo-vegetarians Around 95.77% consumed 2–4 meals/day; 8.71% reported skipping meals, mostly

lunch. Approximately 84.71% drank tea, mostly with meals (83.29%), which can interfere with iron absorption. About 17.18% reported pica, with sand being the most commonly craved item (80.82%). Around 65.18% consumed ≥5 food groups; 34.82% consumed <5.

A large number of participants (98.59%) had attended ANC visits. In 2nd trimester, 50.12% had 1–5 visits; in 3rd trimester, 30.12% had 6–10 visits. More than half (52.75%) accessed private hospitals; 38.19% used government hospitals; few used PHCs/CHCs. About 76% had MCP cards; among these, 77.09% had updated records. Around 51.06% received AWW visits (mostly monthly), while 95.76% received ASHA visits (91.15% monthly). Provided mainly by ASHA (56.47%) and AWW workers (7.53%); combined source for 28.71%.

Only 0.24% had heard of fortified foods; 99.76% unaware of their availability. About 86.59% received THR; 22.01% didn't consume it. Main reason for not consuming was taste (83.95%). Only 12% utilized PDS; among them, rice (94.12%), wheat (90.20%), and sugar (54.90%) were available. About 99.76% had household toilets and handwashing facilities; 99.53% used soap/detergent. Around 89.41% used mosquito repellents; only 7.29% used insecticide-treated nets, but 90.32% of them used them daily.

Maternal nutrition and health outcomes can be improved trough healthcare utilization, while ANC visits, iron supplementation, and deworming can have a significant contribution in reducing anemia prevalence. More than 4 ANC visits and more than 100 IFA tablets, deworming, and weight monitoring attributed to about 7% change in hemoglobin (Hb) levels, in India. Maternal meat and fish consumption explained the 1% change in Hb levels. Average maternal age in India increased from 23.5 to 29.4 years from 2006 to 2016 which contributes to a slight improvement (2%) in Hb levels. Maternal age was increased by one year and was linked to a 3.2% drop in anemia in India. Maternal education played a major role in India (24%), changes in Hb level or anemia were linked to increased education levels. Household wealth was another strong determinant (17%) in improving Hb levels, in India.

Wealthier women had lower odd of anemia across multiple countries. In India, Guinea, Brazil, and Ethiopia, decline in anemia prevalence was linked to improving maternal BMI. Underweight women had higher chances of anemia across several countries, normal or overweight/obese women had significantly lower possibility of having

anemia. Women with HIV had higher possibility of anemia in Zimbabwe between 2005 and 2015. Higher parity was correlated with increased anemia risk; having more than

two children significantly raised chances of developing anemia, in Brazil. A 10 mg/day/household increase in iron intake and a 10 mcg/day/household decrease in phytate intake led to 10% and 1% reductions in anemia, respectively. In Zimbabwe, women who did not take iron supplements during pregnancy had consistently higher possibility of anemia from 2005 to 2015. in Zimbabwe age was a significant predictor of anemia in 2005, but not in 2010 or 2015. [A. Owais. et.al, 2021]

The prevalence of anemia among antenatal mother was 44.16%. Severity distribution was 63.02% mild, 35.46% moderate and 1.5% severe anemia. About 59.78% women were teenage mothers and 45.94% were primigravidae (first time mothers), had higher prevalence compared to other age and parity groups. Among anemic mothers, 52.3% had iron deficiency (serum ferritin <30 mcg/dL and 5.6% had folate deficiency. Even though there was supplementation routine, gaps had remained in diagnosis, dietary diversity, and screening for hemoglobinopathies, highlighting the need for comprehensive anemia control strategies in urban low-income populations. [M. Ghosh. et.al, 2025]

About 80% women were educated upto the secondary level, while those with no formal education had a slightly higher prevalence of anemia. Over 70% of adolescent women were non-vegetarian, yet around 40% a BMI below 18.5, indicating widespread undernutrition. Anemia was more prevalent aong women married before 18 years of age and those with two or more children, particularly if they were currently breastfeeding. West Bengal, Haryana, Bihar, and Andhra Pradesh had the highest anemia prevalence (61-65%) among adolescent women. Northeastern states like Manipur, Mizoram, and Nagaland had the lowest anemia prevalence, with rates below 30% in NFHS-4. The analysis highlights the need to look beyond regional estimates, as state-level variations are critical to designing effective anemia reduction. [M. Chakrabarty, 2023]

One third (3.33%) of the respondents were aged 26-30 years, with a mean age of 28.16 ±0.84 years. The majority (83.9%) were married, and 42.8% were Yoruba. About 53.9% were employed in government or private sectors. Income distribution showed that 18.3% earned less than 10,000 naira, while 23.9% earned more than 50,000 naira

monthly. Over 53% of respondents had attained tertiary education, indicating a relatively well-educated sample. A significant proportion (77.8%) had heard of anemia, and 68.9% demonstrated good overall awareness. About 71.7% correctly identifies causes of anemia, while 44.4% could correctly identified symptoms such as pallor, fatigue, and heart palpitations.

Around 75% recognized that anemia is treatable and 65% identified hospital treatment as the correct approach. However, only 43.9% knew the correct preventive methods. A large majority (94.5%) agreed that anemia poses serious risks ti both mother and baby, and 72.8% had correctly identified maternal and fetal complications. About 73.9% had good overall practiced regarding anemia prevention, while 26.1% had poor practices. About 40.6% sometimes boiled drinking water, majority only sometimes consumed iron-rich diets and sometimes practiced antenatal advice consistently, indicating room for improvement in behavioral consistency. [I.Y. Ademuyiwa, 2020]

SUMMARY AND CONCLUSION

Anemia is globally considered a health challenge, playing a major role in increasing the maternal morbidity and mortality rates among pregnant women, especially in the underdeveloped countries. Anemia is the scarcity of functioning red blood cells that carry oxygen through the whole body. Women in the reproductive age group are at a high risk, with the prevalence estimates of 42% in pregnant women aged between 15-49 years, and 30% in non-pregnant women. Africa and Asia being the most vulnerable at 85% in high risk groups, where the causes of anemia have multiple factors.

As stated by WHO, anaemia is the most common nutritional deficiency affecting about 25% of the global population, especially in women in reproductive age group. To carry the oxygen to the baby, pregnant women are in need of more red blood cells in the body. Iron deficiency anaemia (IDA) is defined by the decrease of natural iron stores in the body as a result to internal and external factors. [International Journal of Pharmaceutical Research & Allied Sciences, 2019]

To assess the knowledge of anemia among pregnant women.
To assess the knowledge of anemia among pregnant women.
To assess dietary intake and pattern among the pregnant women.
To understand the extent to which pregnant women have access and adhere to anemia prevention strategies.
To assess determinants that influence knowledge and prevention strategies of anemia.

SOURCE POPULATION

Pregnant women registered in the Anganwadi centres of Urban Vadodara

TOOLS AND TECHNIQUES

A semi-structured questionnaire was used to collect information on socio-demographic data, anthropometry, knowledge of anemia and adherence to prevention strategies, etc.

OBSERVATIONS

Socio-demographic Characteristics

- About 79.53% of participants were aged 20–30, while 7.06% were under 20.
- Approximately 31.76% had a middle school education, 32.94% completed high school, and only 19.06% were graduates; 4.47% were illiterate.
- A significant majority (91.06%) were homemakers/unemployed, and only 8.94% were employed, indicating financial dependence.
- Most families (62.12%) earned between ₹10,703–₹31,977/month; only 14.24% were in the high-income bracket.
- A majority (65.41%) of participants lived in joint families, 34.12% in nuclear families, and 0.47% in extended families.

Obstetric & Health Characteristics

- Most (88.24%) of the participants had been pregnant 1–2 times; 11.6% had 3–5 pregnancies.
- More than half (57.18%) were in the second trimester, and 42.82% were in the third trimester.
- Few had hypothyroidism (1.41%), hypertension or anemia (0.47%), diabetes, or other conditions (0.24%).
- A vast majority (92.94%) reported NCDs in the family, mostly thyroid disorders (46.67%), hypertension (23.34%), and diabetes (20%).
- Most of the participants, 77.18%, had Hb 10.0–12.9 g/dL, 20.94% had 7.0–9.9 g/dL, and only 1.88% had normal Hb (≥13 g/dL).
- Mean height was 152.99 cm, weight 55.76 kg, and BMI 23.81 kg/m².
- About 34.82% had normal BMI, 17.65% were overweight, 10.59% were underweight, 28.23% had obesity class I, and 8.71% had obesity class II.

Knowledge of Anemia

- Most of the participants (81.65%) did not know what anemia was.
- Approximately 92.70% didn’t know the causes of anemia; only 6.12% cited poor iron intake.
- Only 27.76% recognized general weakness, and 19.05% dizziness/fainting; 69.88% didn’t know any symptoms.

- Very few recognized complications—9.88% mentioned risks to the baby; only 1.18% mentioned the risk of blood loss during delivery.
- About 83.06% knew anemia is preventable; 84% mentioned iron-rich foods, 57.41% vitamin C, and 32.47% iron supplements; very few mentioned WASH (2.35%) or bed nets (1.41%).

Adherence to Anemia Prevention

- All participants had heard of IFA; 97.41% received and 96.38% consumed them; 96.86% followed daily dosage.
- Slightly above 50% of the participants, 52.89%, believed it prevents anemia; 20.29% consumed it without knowing why.
- Side effects (nausea, vomiting) were the main barrier for 53.33% of non-adherents; forgetfulness was another reason.
- About 0.27% got them from the government and 58.65% from private hospitals.
- Poor knowledge (0.94%) and low consumption (4.71%) were reported.

Dietary Patterns and Practices

- About 51.29% were vegetarians, 43.53% non-vegetarians, and 5.18% ovo-vegetarians.
- A majority (95.77%) of the participants consumed 2–4 meals/day; 8.71% reported skipping meals, mostly lunch.
- About 84.71% drank tea, mostly with meals (83.29%), which can interfere with iron absorption.
- A very small proportion of participants (17.18%) reported pica, with sand being the most commonly craved item (80.82%).
- Wheat flour was consumed daily by 96.94% of participants, while other cereals like rice flakes and Bajra had lower frequency of consumption.
- Legumes and pulses such as whole green gram, Bengal gram dal, and black gram dal were consumed infrequently, mostly once in 11–15 days or occasionally.
- GLVs like spinach (73.17%) and fenugreek leaves (95.29%) were widely consumed but only seasonally.
- About 12.23% consumed eggs weekly, while the intake of chicken, meat, and fish was lower.

- There was high seasonal consumption of vitamin C-rich fruits like mango (96.70%), guava (78.58%), and orange (78.11%), along with daily tomato intake (72.47%).
- About 65.18% consumed ≥5 food groups; 34.82% consumed <5.
- Most women failed to meet the EAR for energy (99.29%), iron (98.12%), and folate (97.88%). Protein intake was insufficient in both the second (94.65%) and third trimesters (96.15%).
- Vitamin C intake was comparatively better, yet 68.71% remained below the recommended level.

Utilization of Maternal Health Services

- About 98.59% attended ANC visits. In 2nd trimester, 50.12% had 1–5 visits; in 3rd trimester, 30.12% had 6–10 visits.
- More than half (52.75%) of the participants accessed private hospitals; 38.19% used government hospitals; few used PHCs/CHCs.
- About 76% had MCP cards; among these, 77.09% had updated records.
- About half the percentage of participants, 51.06%, received AWW visits (mostly monthly), while 95.76% received ASHA visits (91.15% monthly).
- Provided mainly by ASHA (56.47%) and AWW workers (7.53%); combined source for 28.71%.

Preventive Strategies

- Only 0.24% had heard of fortified foods; 99.76% were unaware of their availability.
- About 86.59% received THR; 22.01% didn't consume it. The main reason for not consuming was taste (83.95%).
- Only 12% utilized PDS; among them, rice (94.12%), wheat (90.20%), and sugar (54.90%) were available.
- A large proportion of participants (99.76%) had household toilets and handwashing facilities; 99.53% used soap/detergent.
- Approximately 89.41% used mosquito repellents; only 7.29% used insecticide-treated nets, but 90.32% of them used them daily.

CONCLUSION

Even with 96.38% of participants consuming IFA supplements and most of them following the recommended dosage, over 80% of them lack basic knowledge about anemia. It also includes the causes, symptoms, and consequences of anemia. It may highlight the gap between service delivery and knowledge about health. The prevalence of anemia among the participants was 0.71%; participants had Hb levels below 7 g/dL, and 39.29% had Hb levels less than or equal to 11 g/dL.

Though most received Take-Home Rations (THR), 22.01% did not consume them, mainly due to poor taste, reducing the effectiveness of this intervention. Despite moderate dietary diversity (65.18% consumed ≥5 food groups), a high intake of tea with meals (83.29%) likely hinders iron absorption. Also, pica was reported in 17.18% of participants, with a potential link to micronutrient deficiencies.

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APPENDICES

Institutional Ethics
Committee for Human
Research
(IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2024-2025

This is to certify Ms. Hetvi Vishal Shah study titled: "Assessing the Knowledge of Anemia and Its Prevention Strategies Among Pregnant Women registered in the Aanganwadis of Urban Vadodara." from Department of Foods and Nutrition has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number IECHR/FCSc/M.Sc./10/2024/38.

Komal

Prof. Komal Chauhan
Member Secretary
IECHR

Prof. Mini Sheth
Chairperson
IECHR

Chair Person
IECHR
Faculty of Family & Community Sciences
The Maharaja Sayajirao University of Baroda

વડોદરા મહાનગરપાલિકા
સંકલિત બાળ વિકાસ સેવા યોજના,
બીજો માળ, વોર્ડ નંબર-૧૨ ની કચેરીમાં,
સહજાનંદ એપાર્ટમેન્ટ પાસે, અકોટા, વડોદરા-૨૦.
વેબસાઇટ: www.vmc.gov.in, ઇ-મેઇલ: icds@vmc.gov.in

જા.નં.:- VMC/ ICDS/ Home Science/ Permission/ ૬૨૮૮ /૨૪-૨૫, તા: ૦૭-૧૦-૨૦૨૪

પ્રતિ,
પ્રો. મિની શેઠ,
પ્રોફેસર અને હેડ,
ફુડ એન્ડ ન્યુટ્રીશન વિભાગ,
એમ.એસ. યુનિવર્સીટી, વડોદરા.

વિષય: શ્રી હેત્વી શાહને અત્રેની આંગણવાડીઓમાં રીસર્ચ કરવાની મંજુરી આપવા બાબત
સંદર્ભ: આપનો પત્ર ક્રમાંક: No. F.C.Sc. / FND, Date:23/09/2022

જય ભારતસહ, ઉપરોક્ત વિષય અનુંસધાનમાં જણાવવાનુ કે વડોદરા મહાનગરપાલિકા સંચાલીત આઇ.સી.ડી.એસ. અર્બન પ્રોજેક્ટની આંગણવાડીઓમાં શ્રી હેત્વી શાહને "Assess the knowledge and use of preventive strategies related to anemia among pregnant women, specifically those in their second and third trimesters of pregnancy" પર અભ્યાસ/ રિસર્ચ કરવા માટે સંદર્ભના પત્રથી આપશ્રીના દ્વારા મંજુરી માંગવામાં આવેલ છે, જે નીચે મુજબની શરતે માહિતી મેળવવા/ અભ્યાસ/ રિસર્ચ કરવા માટેની મંજુરી આપવામાં આવે છે.

૦૧) સબંધિત ઝોનના બાળ વિકાસ યોજના અધિકારીશ્રીનો સંપર્ક કરી તેઓશ્રી પાસેથી જે આંગણવાડી ખાતે માહિતી મેળવવાની/ કામગીરી કરવાની હોય તે આંગણવાડી કેન્દ્રોની વિગત અને મંજુરી મેળવી આંગણવાડી ખાતેની તમામ કામગીરીઓ સબંધિત સિ.ડી.પી.ઓ.શ્રી અને મુખ્ય સેવિકાશ્રીની જાણમાં રહીને જ કરવાની રહેશે.

૦૨) આંગણવાડીના બાળકો, લાભાર્થીઓને અગવડતા ન થાય, તેમજ મકાન અને ઇન્ફાસ્ટ્રકચરને કોઇ નુકશાન ન થાય તેવી રીતે સરકારશ્રીના ધારા ધોરણ મુજબ કામગીરી (અભ્યાસ) કરવા માટે આપશ્રીને મંજુરી આપવામાં આવે છે, જે દરમીયાન કોઇ અગમ્ય બનાવ કે ઘટનાની સંપૂર્ણ જવાબદારી આપશ્રીની રહેશે, તેમજ તેની ભરપાઇ પણ આપશ્રીને કરવાની રહેશે.

૦૩) અભ્યાસ/ રિસર્ચની કામગીરી પુર્ણ થયેથી અહેવાલની એક નકલ અત્રેની કચેરીને આપવાની રહેશે.

પ્રોગ્રામ ઓફિસર (શહેરી)
આઇ.સી.ડી.એસ
વડોદરા મહાનગરપાલિકા

બિડાણ: સંદર્ભનો પત્ર

નકલ રવાના (ઇ-મેઇલ દ્વારા):

૦૧) ડેપ્યુટી મ્યુનિસિપલ કમિશનરશ્રી, વડોદરા મહાનગરપાલિકા તરફ જાણ થવા સારૂ
૦૨) મુખ્ય આરોગ્ય અધિકારીશ્રી, વડોદરા મહાનગરપાલિકા તરફ જાણ થવા સારૂ
૦૩) બાળ વિકાસ યોજના અધિકારીશ્રી, અને મુખ્ય સેવિકાશ્રી, તમામ, તરફ જાણ અને અમલ કરવા સારૂ
૦૪) ડૉ. શોનીમા વેણુગોપાલ (ગાઇડ), અને શ્રી હેત્વી શાહ તરફ જાણ અને અમલ કરવા સારૂ

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QUESTIONNAIRE

Background Information

1. Respondent's name _____
2. Respondent's contact number: _____
3. Respondents address (zone or area they live in)

   _____
4. Religion _____
5. Respondent's age (in years) _____
6. Date of birth _____
7. Respondent's education (also mention the actual)
   - Illiterate
   - Primary school
   - Middle school
   - Higher school
   - Intermediate or diploma
   - Graduate
   - Profession or honors

8. Respondent's occupation (also mention the actual)
   - Skilled workers and shop and market sales workers
   - Skilled agricultural and fishery workers
   - Craft and related trade workers
   - Plant and machine operators and assemblers
   - Elementary occupation
   - Unemployed/homemaker

9. Type of family
   - Joint
   - Nuclear family
   - Extended family

10. Total number of family members: _____

11. Number of members that earn in the family _____

12. What are the other sources of income? _____

13. Head of the family's education
    - Illiterate
    - Primary school
    - Middle school
    - Higher school
    - Intermediate or diploma
    - Graduate
    - Profession or honours

14. Head of the family's occupation
    - Legislators, senior officers, and managers
    - Professionals
    - Technicians and associate professionals
    - Clerks
    - Skilled workers and shop and market sales workers
    - Skilled agricultural and fishery workers
    - Craft and related trade workers
    - Plant and machine operators and assemblers
    - Elementary occupation
    - Unemployed

15. Gravidity (mention exact number in brackets)
    - 1-2
    - 3-5
    - >5

16. No of children _____

17. Trimester
    - First
    - Second
    - Third

18. Do you have any of the following medical conditions?

a.	Diabetes	Yes	No
b.	Hypothyroidism	Yes	No
c.	Hypertension	Yes	No

e. Any other (such as PCOD/PCOS) _____

19. Family history of the following non-communicable diseases

Non-Communicable Diseases	Immediate (Father/Mother/sibling/own child)	Distant (Grandparent from either side/Uncle/Aunt/First Cousin)
1. Diabetes (Type 1 or Type 2)		
2. Hypertension		
3. Chronic obstructive pulmonary disease (COPD)		
4. Dyslipidemia		
5. Cancer		
6. Others (Please specify)		

20. What is the total monthly income of the family?
    - 2,13,814 rupees and above
    - 1,06,850 to 2,13,813 rupees
    - 80,110 to 1,06849 rupees
    - 53,361 to 80,109 rupees
    - 31,978 to 53,360 rupees
    - 10,703 to 31,977 rupees
    - <=10,702 rupees

Dietary Pattern

1. Dietary preferences
    - Vegetarian
    - Non-vegetraian

- Ovo-vegetarian
- Any other _____

2. Do you have any allergies?
   - Yes
   - No

- If yes, which allergy _____

3. Number of meals you have in a day _____

4. Do you skip any meals in the day?
   - Yes
   - No

- If so, which meal do you tend to skip? _____
- How often _____

5. How many times do you have tea/coffee in a day?

- Coffee _____ cups

- Tea _____ cups

6. When do you have it?
   - 1-2 hours before meals
   - 15-20 minutes before meals
   - During/with meals
   - 15-20 minutes after meals
   - 1-2 hours after meals

7. Do you have the urge to eat non-edible things like ice cubes, sand, slate pen etc?
   - Yes
   - No

If so, what do you crave? _____

Anemia, IFA, deworming, malaria, calcium

1. Is there an increased need for iron during pregnancy?
    - Yes
    - No

    - If so, why? _____

2. Do you know what anemia is?
    - Yes
    - No

    If yes, what is it?

    - Iron deficiency/Low hemoglobin
    - Don't know
    - Any other _____

3. Do you know what the cut off is for hemoglobin during pregnancy?
    - < 7 g/dl
    - >9.9 g/dl
    - >=11 g/dl
    - Any other _____
    - Don't know

4. What is the cause of anemia?
    - Low intake of iron-rich foods
    - Low intake of vitamin C-rich foods
    - Excessive menstrual bleeding
    - Multiple pregnancy and spacing
    - Malaria or parasitic infestation
    - All listed above
    - Don't know

5. What are the symptoms of anemia?
    - Shortness of breath/palpitations
    - Fatigue
    - General body weakness
    - Poor appetite
    - Dizziness or fainting
    - Pallor of face
    - Brittle nails
    - All listed above
    - Don't know

6. What are the consequences of anemia?
    - Anemia and developmental delays in the baby
    - Preterm labour
    - Increased blood loss during delivery
    - Low birth weight baby
    - Decreased concentration (affects learning ability)
    - Decreased ability to work (physical work capacity)
    - Don’t know

7. Do you know how to prevent anemia?
    - Yes
    - No

    If so, how?

    - Fortified foods
    - Dietary diversity
    - Using iron supplements
    - Deworming tablets
    - WASH practices
    - Using insecticide-treated bed nets
    - All listed above
    - Don’t know

8. How can you prevent anemia through diet?
    - Eating iron-rich foods (green leafy, meat, seafood, dried fruits, etc.)
    - Vitamin C-rich foods (lemons, guavas, amlas, citrus fruits, etc.)
    - Fortified foods
    - Including different food groups in the diet throughout the day
    - All of the above
    - Don’t know

9. Are you Anemic

    - Yes
    - No

10. Are you aware of iron folic acid supplements?
    - Yes
    - No

11. If yes, do you get it?
    - Yes
    - No

12. Where do you get IFA supplements from?
    - PHC
    - AWC
    - Any other _____

13. Who provides the IFA supplements?
    - AWW
    - ASHA
    - ANM
    - Any other person _____
    -

14. How often are you recommended to take IFA supplementation? (prophylactic dosage only)
    - Weekly
    - Biweekly
    - Daily
    - Don't know
    - Any other _____

15. Do you consume it?
    - Yes
    - No

    If so, how often do you consume the IFA supplements? (Wo kitni baar lete hai)

    - Daily
    - Once a week
    - Once in 15 days
    - Any other _____

16. If so, how long have you been taking it for?
    - < 1 month
    - 1 month
    - 2 - 3 months
    - 100 days
    - Irregularly
    - Don't remember
    - Any other _____

17. If not, what are the reasons?
    - Ignorance about importance of IFA
    - Because of the side effects
    - Insufficient IFA supply
    - Inadequate counselling to encourage IFA consumption
    - Any other _____

18. Why should you consume IFA tablets?
    - It prevents anaemia
    - Improves normal growth and delivery of the baby
    - Helps them stay healthy
    - Reduces dizziness and fatigue
    - Don't know
    - Any other _____

19. Are you able to take IFA regularly?
    - Yes
    - No

    If so, what helps you consume the tablets on a regular basis?

    - Family support
    - Free of cost
    - Reminding technique
    - Reinforcement from the service provider (AWW/ASHA) _____
    - Reinforcement through advertisements/social media
    - Any other _____

    If not, why?

    - Stops taking IFA tablets due to too many medications
    - Job Commitment
    - Household Chores
    - Forgetfulness
    - Any other _____

20. When should you take IFA supplement?
    - Before meal
    - With meal
    - Immediately after meal
    - After half hour to one hour gap
    - After 1-2 hours of meal
    - Don't know
    - Any other _____

21. Do you experience any side effects after taking IFA?
    - Yes
    - No

If so, which among the following do you experience?

- Nausea/vomiting
- Constipation
- Diarrhoea
- Metallic taste
- Flatulence
- Black stool
- Any other _____

22. Have you had any parasitic infestations?
    - Yes, how recent? _____
    - No

23. Have you had malaria?
    - Yes, how recent? _____
    - No

24. Have you had any other infections?
    - Yes, how recent? _____
    - No

25. Where do you get deworming tablets from?
    - PHC
    - AWC
    - Home visits
    - Any other _____
    - Don't know

26. Who provides deworming tablets?
    - AWW
    - ASHA
    - ANM
    - Any other _____
    - Don't know

27. Do you consume deworming tablets?
    - Yes
    - No

    - If so, how often is the dose given?
        - Once a year
        - Twice a year
        - Any other _____

28. Where do you get calcium supplements from?
    - PHC
    - AWC
    - Home visits
    - Any other _____

29. Who provides calcium supplements?
    - AWW
    - ASHA
    - ANM
    - Any other _____

ANC visit, ASHA/AWW visit, PHC visit, MCP card

1. Do you visit the health center for an antenatal care (ANC) checkup?
    - Yes
    - No

- If so, how many ANC visits have you been to so far? _____

- If not, what are the reasons?
    - Health Centre is far away from home
    - Ignorance of the subject
    - Objection by the family members
    - Don't know
    - Any other _____

2. Place of ANC visit
    - PHC/clinic
    - Private hospitals
    - Government hospitals
    - Any other _____

3. Do you have the Mother and Child Protection card (MCP card)?
    - Yes
    - No
    - Registered but not yet received

4. Is your MCP card up to date? (whether the number of ANC visits are up to date)
    - Yes

- No

5. Does the Anganwadi Worker (AWW) make home visits?
   - Yes
   - No

   If yes, how frequently does she visit? (2 visits in third trimester, note accordingly)

   _____

6. Does the ASHA worker make home visits?
   - Yes
   - No

   If yes, how frequently does she visit?

   - Once a month
   - Once in 2 to 6 months
   - Once a year
   - Any other _____
   - Don't know

7. Who gives you dietary advice?
   - AWW
   - ASHA
   - Both AWW and ASHA
   - Any other _____

8. What dietary advice was given to you?

_____

_____

_____

Preventive strategies

1. What are fortified foods?

   _____

_____

_____

2. Do you know what fortified foods are available in the market?
   - Yes
   - No

3. If so, which ones do you consume?

_____

_____

4. Do you receive THR from the AWC?
   - Yes
   - No

- If so, do you consume it?
  - Yes
  - No
    If not, what are the reasons?

    _____

Do you take rations from PDS shops?

- Yes
- No

What food items do you get from PDS shops?

- Rice
- Salt
- Sugar
- Wheat
- Kerosene and edible oils
- Pulses and spices
- Any other _____
- Don’t know

What food items do you buy from the PDS shop?

_____

1. Do you have access to washrooms/toilets?
    - Yes
    - No

- If so, where?
    - Own house
    - Neighbour's house
    - Open defecation
    - Any other _____

2. Is water available in the washrooms/toilets?
    - Yes
    - No

3. Is there a handwashing station near the washroom?
    - Yes
    - No

4. What do you use to wash hands after using washrooms/toilets?
    - Soap or detergent
    - Soil/mud/ash
    - Water only
    - Any other _____

5. What is the primary source of bathing water?
    - Piped water
    - Hand pump
    - Protected dug well
    - River/canal/pond/unprotected dug well
    - Any other _____

6. Do you use any mosquito repellents?
    - Yes
    - No

7. If so, which one?
    - Repellent cream
    - All out/Mortein
    - Mosquito coils
    - Insecticide-treated bed nets
    - Traditional dhuni
    - Any other _____

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8. How often do you use insecticide-treated bed nets?
    - Daily
    - 2 or 3 times a week
    - 5 or 6 times a week
    - Once in 15 days
    - Any other _____

Anthropometric measurements

Height (in cm) _____

Weight (in kgs) _____

Biochemical indicators (from the MCP card) -

- Hb: _____ g/dL
- Bleeding during pregnancy _____
- Blood pressure: _____ mmHg
- Gestational diabetes mellitus _____
- Urine albumin _____
- Urine sugar _____

24 hour dietary recall:

Sr. No.	Meal Time	Name of the food recipe	Ingredients	Raw weight (g/ml)	Cooked volume (g/ml)
1.	**Breakfast**				
2.	**Mid-Morning snacks**				
3.	**Lunch**				
4.	**Evening snacks**				

5.	**Dinner**				
6.	**Late-night snack/drink**				

Food frequency questionnaire: (Iron and Vitamin C-rich foods)

Iron (EAR) = 21 mg/day

Food groups	Food item	Iron content (mg/100 gm)	Daily	5-6 times/week	2-4 times/week	Once a week	Once in 11-15 days	Once a month	Occasionally	Seasonally	Never
Cereals and millets	Amaranth grain (rajagro)	9.33									
	Pearl millet (Bajra)	6.42									

	Finger millet (Ragi/nachani)	4.62									
	Puffed rice (Mamra)	4.55									
	Rice flakes (Poha)	4.46									
	Wheat flour (Ghaun no lot)	4.10									
	Broken wheat (ghaun na fada)	3.86									
	Sorghum (Jowar)	3.95									
Legumes and pulses	Horse gram (kulthi)	8.76									
	Soya bean	8.29									
	Lentil whole, yellow/brown (aakha masoor)	7.91									

	Moth bean (math)	7.90									
	Lentil dal (masoor ni dal)	7.06									
	Bengal gram, whole (aakha chana, includes kabuli chana)	6.78									
	Rajmah, red/black/brown	6.13									
	Bengal gram dal (chana ni dal)	6.08									
	Black gram, whole (aakha adad)	5.97									
	Cowpea, brown (chauli)	5.90									

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	Field bean (val)	5.50									
	Whole green gram (aakha mag)	4.89									
	Black gram dal (adad ni dal)	4.67									
	Green gram dal (mag ni dal)	3.93									
Green leafy vegetables	Amaranth leaves, red (lal tandalja ni bhaji)	7.25									
	Amaranth leaves, green (leela tandalja ni bhaji)	6.37									
	Fenugreek leaves (Methi ni bhaji)	5.69									

	Drumstick leaves (Saragva ni bhaji)	4.56									
	Radish leaves (mula ni bhaji)	3.82									
	Colocasia leaves (arbi na pan/patra)	3.41									
	Spinach (palak)	2.95									
Other vegetables	Cluster beans (guvar)	3.90									
	Onion stalk (leela kanda ni bhaji)	3.09									
Dried fruits, nuts, and seeds	Sesame seeds, white (safed tal)	15.04									
	Sesame seeds, black	13.90									

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	(kala tal)										
	Peanuts (sing dana)	3.44									
	Dates, processed (Khajur)	0.89									
Meat, Fish and, Poultry	Eggs										
	Chicken										
	Meat										
	Fish										

Vitamin C (EAR) = 65 mg/day

Food groups	Food item	Iron content (mg/100 gm)	Daily	5-6 times/ week	2-4 times/ week	Once a week	Once in 11-15 days	Once a month	Occasionally	Seasonally	Never
Green leafy vegetables	Drumstick leaves (Saragvani bhaji)	108									
	Amaranth leaves, red (lal tandaljani bhaji)	86.20									
	Amaranth leaves, green (leela tandaljani bhaji)	83.54									
	Cabbage, green (kobij)	33.25									
	Spinach (palak)	30.28									
Other vegetables	Capsicum (yellow/red/green)	127									
	Bitter gourd (karela)	54.30									

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	Cauliflower (Flower)	47.14									
	Drumstick (Saragvani sing)	71.86									
	Onion stalk (leela kanda ni bhaji)	27.23									
	Fresh peas (leela vatana)	38.40									
	Ripe tomato (tameta)	27.47									
Fruits	Indian gooseberry (Amla)	252									
	Guava white/pink flesh (Jamfal)	214									
	Karonda	135									
	Zizyphus jujube (Bor)	60.93									
	Strawberry	50.20									
	Mango (Himsagar)	49.09									

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	Sweet lime (Mosambi)	46.96									
	Papaya	43.09									
	Orange (Narangi)	42.72									
	Pineapple (ananas)	36.37									
	Mango (Kesar)	29.08									

CONSENT FORM:

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Title of Study: Assessing the Knowledge of Anaemia and its Prevention Strategies Among Pregnant Women

Investigators:

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Purpose of the Study:
The rate of anemia among pregnant women in Gujarat has increased from 51.3% in NFHS-4 to 62.6% in NFHS-5. For women of reproductive age, the rate rose from 54.9% to 65.0%. This high prevalence shows the need for urgent action. Anemia is often linked to poor nutrition, poverty, infections, and lack of knowledge about its causes and prevention. This study aims to evaluate what pregnant women in their second or third trimesters know about anemia and how well they follow prevention strategies.

Protocol of the Study:
If you decide to join this study, you will be asked questions on anaemia, its risk factors, symptoms, and prevention strategies. If you do not wish to answer any of the questions included in the questionnaire, you may skip them.

Costs:
This study requires only your time and co-operation. All the costs included will be borne by the researcher, and there is no financial compensation for your participation in this research.

Possible Benefits and Risks:
This study will help in understanding the knowledge of anaemia. We believe there is no risk associated with participation in this research study.

Confidentiality:
All information collected will be solely used for research purpose and will be kept confidential.

Voluntary Participation and Right to Withdraw:
Your participation is entirely voluntary, and is important for the success of the study. You may refuse to participate or withdraw from the study for any reason, without notice, at any point in time without any consequences.

Availability of Results:
At the end of the study, relevant information will be shared with you.

Contact:
If you have any questions regarding this study, you can contact the investigators.

I have read (or have been read to) and understood the description of the study, I agree to take part in the research being carried out by Dr. Shonima Venugopal and her student Ms. Hetvi V. Shah, on assessing the knowledge of anemia and its prevention strategies among pregnant women. I am also aware of my right to opt-out of the study anytime.

Name and signature of the student _____

Date: _____

Name and signature of the participant _____

Date: _____

<u>સંમતિ ફોર્મ</u>

સંશોધન માટે ભાગ લેનારા પુખ્ત વયના લોકો માટે જાણકાર સંમતિ ફોર્મ:

સંશોધન માર્ગદર્શિકા -
ડો.શોનિમા વેણુગોપાલ
આસિસ્ટન્ટ પ્રોફેસર (CES)
ખાદ્ય અને પોષણ વિભાગ
ફેકલ્ટી ઓફ ફેમિલી એન્ડ કોમ્યુનિટી સાયન્સ
મહારાજા સયાજીરાવ યુનિવર્સિટી ઓફ બરોડા
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સંશોધન વિદ્યાર્થી -
કુ. હેત્વી વી. શાહ
ખાદ્ય અને પોષણ વિભાગ
ફેકલ્ટી ઓફ ફેમિલી એન્ડ કોમ્યુનિટી સાયન્સ
મહારાજા સયાજીરાવ યુનિવર્સિટી ઓફ બરોડા
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પ્રોજેક્ટનું નામ - સગર્ભા સ્ત્રીઓમાં એનિમિયા અને તેની નિવારણ વ્યૂહરચનાના જ્ઞાનનું મૂલ્યાંકન કરવું

અભ્યાસનો હેતુ :
સગર્ભા સ્ત્રીઓમાં એનિમિયાનો વ્યાપ ઘટાડવામાં સક્રિય એનિમિયા મુક્ત ભારત કાર્યક્રમ હજી સફળ થયો નથી. આ જાહેર આરોગ્ય સમસ્યા, સામાજિક-સાંસ્કૃતિક પરિબળો, ગરીબ આહારની આદતો, ગરીબી અને એનિમિયા વિશે જાગૃતિના અભાવથી પ્રભાવિત છે. નિવારણ વ્યૂહરચનાઓનું પાલન મહત્ત્વપૂર્ણ છે, છતાં IFA સપ્લિમેન્ટેશન જેવી વર્તમાન સરકારની પહેલો નોંધપાત્ર સુધારા તરફ દોરી નથી. આ અભ્યાસનો ઉદ્દેશ્ય વડોદરામાં એનિમિયાના નિવારણમાં ખામીઓને ઓળખવાનો અને મુદ્દાની સમજ વધારવાનો છે.

કાર્યવાહી:
જો તમે આ અભ્યાસમાં જોડાવાનું નક્કી કરો છો, તો તમને અર્ધ-સંરચિત પ્રશ્નાવલીમાંથી પ્રશ્નો પૂછવામાં આવશે જેમાં એનિમિયા વિશેના તમારા જ્ઞાન, તેના જોખમી પરિબળો, લક્ષણો અને નિવારણ વ્યૂહરચનાઓ વિશેના પ્રશ્નોનો સમાવેશ થાય છે. જો તમે પ્રશ્નાવલીમાં સમાવિષ્ટ કોઈપણ પ્રશ્નોના જવાબ આપવા માંગતા નથી, તો તમે તેને છોડી શકો છો.

ગુપ્તતા :
એકત્રિત કરવામાં આવેલી તમામ માહિતીનો ઉપયોગ ફક્ત સંશોધન અભ્યાસ હેતુ માટે કરવામાં આવશે અને તેને ગુપ્ત રાખવામાં આવશે. તમારા પ્રતિભાવો અનામી રહેશે.

સ્વૈચ્છિક ભાગીદારી:
તમારી સહભાગિતા સંપૂર્ણપણે સ્વૈચ્છિક છે, અને અભ્યાસની સફળતા માટે મહત્વપૂર્ણ છે. તમે કોઈપણ કારણસર, નોટિસ આપ્યા વિના, કોઈપણ સમયે કોઈપણ પરિણામ વિના ભાગ લેવાનો ઇનકાર કરી શકો છો.

કોનો સંપર્ક કરવો:
જો તમને આ અભ્યાસ અંગે કોઈ પ્રશ્નો હોય, તો તમે તપાસકર્તાઓનો સંપર્ક કરી શકો છો.

<u>સહભાગીનું નિવેદન</u>
મેં અભ્યાસનું વર્ણન વાંચ્યું છે અને સમજ્યું છે, હું સગર્ભા સ્ત્રીઓમાં એનિમિયાના જ્ઞાન અને તેના નિવારણની વ્યૂહરચનાઓનું મૂલ્યાંકન કરવા પર ડૉ. શોનિમા વેણુગોપાલ અને તેમના વિદ્યાર્થી સુશ્રી હેત્વી વી. શાહ દ્વારા હાથ ધરવામાં આવેલા સંશોધનમાં ભાગ લેવા માટે સંમત છું. . હું કોઈપણ સમયે અભ્યાસમાંથી નાપસંદ કરવાના મારા અધિકારથી પણ વાકેફ છું.

વિદ્યાર્થીનું નામ અને સહી: _____

તારીખ: _____

સહભાગીનું નામ અને સહી: _____

તારીખ: _____