ASSESSMENT OF KNOWLEDGE & PRACTICES REGARDING ANTENATAL CARE GUIDELINES AND IMPACT OF DIETARY PRACTICE ON THE NUTRITIONAL STATUS OF PREGNANT WOMEN IN THE ROHINGYA COMMUNITY

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Session: July – December, 2019

A thesis submitted in the partial fulfillment of the requirements for the degree of Masters of Science in Applied Human Nutrition & Dietetics

Department of Applied Food Science and Nutrition

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August 2022

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PLAGIARISM VERIFICATION

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List of abbreviations

Words	Abbreviation
%	Percent
Hr	Hour
Kg	Kilogram
Mg	Milligram
ANC	Ante-natal care
AOR	Adjusted odd ratio
BMI	Body mass index
DHS	Demographic and health surveys
DDS	Dietary diversity score
FAO	Food and Agriculture Organization
FGD	Focus group discussion
LMIC	Low and middle-income countries
LGA	Large for gestational age
LBW	Low birth weight
MUAC	Mid upper arm circumference
MMR	Maternal mortality rate
NMR	Neonatal mortality rate
SES	Socio-economic status
SPSS	Statistical package for social sciences
SGA	Small for gestational age
UNICEF	United Nations Children's Fund
UNDP	United Nation for Development Program
WHO	World Health Organization

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Abstract

Pregnant and lactating women (PLW), along with children, are the most vulnerable groups of population during emergencies. Despite being a vulnerable population, pregnant women's health especially proper antenatal care and adequate dietary diversity does not receive the same attention as child health does in the Rohingya refugee scenario. This study was aimed to examine pregnant women's level of knowledge and practice regarding antenatal care guidelines and their dietary practices along with nutritional status. A community based cross-sectional study was conducted from January-June 2022, among 463 randomly selected pregnant mothers, residing on Kutupalong (Camp 5 & Camp 6), located at Cox's Bazar. Data were collected using systematic sampling method. A pre-tested researcher administered questionnaire was used to collect data. The Women Dietary Diversity Score (WDDS) was adopted to assess dietary diversity by using a 24-hr dietary recall method and nutritional status was measured using MUAC measurements and via BMI. SPSS version 25 IBM was used for analysis purpose. About 71.5% of the participants were found of having a good knowledge score and 55.5% with a good practice score. Underwhelming level of knowledge was found on consumption of iron and folic acid during pregnancy (23.3%), on the impact of nutrients deficiency (40.6%) and on the benefits of ANC checkup (46%). The least level of practice was seen on consuming additional food (12.1%) ensuring a variety of food (16.6%), and having at least 8 hr. of sleep (27.2%). No of the respondent's child, husband's occupational status and household income source were found positively associated ($p<0.05$) with both knowledge and practice score. About 64% pregnant women had medium, 32% had low and only 4% had high dietary diversity score. Respondent's age, educational level, occupational status along with husband's educational level, occupational status and household income source were found positively associated ($p<0.005$) with dietary diversity score. Around 10.6% of the pregnant women were malnourished based on MUAC. On multivariable logistic regression analysis, respondent's age, pregnancy status, respondent's educational level, household income was significantly associated with the nutritional status of pregnant women. Actions like comprehensive nutritional and antenatal care education, efficient interventions devised for overcoming behavioral, perceptional, and socioeconomic constraints are suggested.

Keywords: Pregnant women, antenatal care, MUAC, dietary diversity, Rohingya.

Chapter 1: Introduction

1.1 Background

Children are a country's future, and as such, the need for their proper growth and development is seen as one of the world's top priorities. Recognizing the significance of a child's health, the "Golden 1000 days" awareness program is highly promoted worldwide. The first 1000 days of life - between conception to the end of the second year after birth- offer a unique window of opportunity for laying the groundwork for optimum health and development throughout the lifespan (Bellieni, 2016). Mothers are credited as being the primary catalyst in sowing the seed of the quintessential development of children both physically and mentally. Hence, it is rightfully believed that healthy mothers mean healthier children which translates to healthier countries. Nonetheless, women's nutrition in the pregnancy and lactation stage is frequently overlooked in policies and programs aimed at this key developmental stage.

In order to develop a healthy fetus in the womb, women require proper nutrition, rest, antenatal care, and an enabling environment (Onis et al., 2019). The ability of a child to develop, learn, and flourish is significantly influenced by how well a woman is nourished and cared for throughout pregnancy. Pregnancy is a stage of life that requires intensive physiologic and metabolic changes (Shrestha et al., 2021). According to World Health Organization (WHO) a positive pregnancy experience, is defined as "*Maintaining physical and sociocultural normality, maintaining a healthy pregnancy for mother and baby (including preventing or treating risks, illness and death), having an effective transition to positive labor and birth, and achieving positive motherhood (including maternal self-esteem, competence and autonomy)*"(WHO, 2016). On 7th November 2016, the World Health Organization released 39 comprehensive recommendations for antenatal care to induce a positive pregnancy experience (Tunçalp et al., 2017). Antenatal care (ANC) is the care a woman gets while she is pregnant to have a safe pregnancy and a healthy baby. It is universally acknowledged as a simple and cost-effective method for boosting maternal and perinatal health outcomes during pregnancy through prevention, health education, health promotion, and treatment (Jo et al., 2019).

Pregnancy demands a diverse diet that meets metabolic and physiological demands along with the increased need of the growing fetus for energy, protein, vitamins, and minerals (Aliwo et al., 2019). Energy requirements during pregnancy rise by an average of 300 kcal/day as compared to pre-pregnancy (Nita Dalmiya, 2022). More micronutrients and macronutrients are needed by the body during pregnancy than at any other time in life (Darnton-Hill and Mkparu, 2015). So, to accommodate adaptations in the woman's body, a diversified dietary intake throughout pregnancy is a must to satisfy the increased nutritional needs. Dietary diversity is defined as the intake of a variety of food groups during a specific period, which is recognized as a feature of dietary quality that can reflect nutritional adequacy (Arimond et al., 2000). Insufficient dietary diversity can be detrimental to both the mother and the fetus, with consequences on the fetus that perhaps can last into adulthood which can even compromise the future work capacity and survival of the child. Nutrition becomes even more crucial during pregnancy because of the development of lactation reserves required post-pregnancy (Chen et al., 2018). It is essential to acknowledge pregnant women's dietary diversity practices to boost maternal nutrition and child development.

Low birth weight (LBW), an early stage of malnutrition that is strongly correlated with the nutritional status of pregnant mothers, affects roughly 20 million babies worldwide each year, more than half of them in Asia. (Onis et al., 2019). Nearly 300,000 women worldwide lose their lives to pregnancy and childbirth-related problems each year, in addition to 3 million neonatal deaths and 2.6 million stillbirths (Cousens et al., 2011). Poor nutrition beforehand and throughout pregnancy can lead to stunting, wasting, and micronutrient deficiencies in children, placing them at risk for long-term unfavorable effects including chronic diseases in adulthood or impaired growth, development, and learning readiness in early childhood (Victora et al., 2021). Deficits in important vitamins and minerals, such as iodine, iron, and calcium, have also been associated with poor health outcomes during pregnancy, including miscarriage, stillbirths, congenital abnormalities, LBW, infant mortality, delayed cognitive development, and cardiometabolic risks in adulthood (Li et al., 2020). Anaemia is correlated to iron, folate, and vitamin A deficits, and it is projected that 0.8 million pregnant women worldwide have severe anaemia (defined as a blood haemoglobin content of 70 g/L) (Mundial de la Salud, 2011). Severe anaemia during pregnancy raises the risk of mother and newborn fatalities. Along with anaemia fetal neural tube defects are also tied to

folate (vitamin B9) deficiency (WHO et al., 2012). Along with weakened immunity, inadequacies of other vitamins and minerals, such as vitamin E, C, B6, and zinc, have been shown to contribute to pre-eclampsia (Roohani et al., 2013).

According to the Sustainable Development Goals (SDG) 2030 agenda, one of the goals is to eliminate all kinds of malnutrition and respond to the nutritional needs of elderly people, pregnant and lactating women, and adolescent girls. Aligning with that, another significant goal is to minimize premature mortality from non-communicable diseases by one-third through treatment and prevention (SDG, 2015). Realizing the need for accelerated global actions to alleviate the burden of malnutrition, six Global Nutrition Targets were established by World Health Assembly in 2012, to achieve them by 2025. Three of the targets are to reduce anaemia in women of reproductive age by 50% and to lessen low birth weight by 30% to achieve a 40% reduction in the number of children under 5 who are stunted (World Health Organization, 2018). These objectives indicate the amount of emphasis given to maternal health in order to minimize complex overlays of connected malnutrition burdens. At the moment, 29.4% of women of reproductive age have anemia, but the target for 2025 is to be 14.7%. The rates of low birth weight haven't changed much, and if the goal of a 30% drop by 2025 is to be met, then progress needs to speed up (World Health Organization, 2018). Also, only 59% of pregnant women worldwide attended at least four prenatal care visits, and only 38% of pregnant women received 90+ iron and folic acid tablets, thus highlighting the necessity of growth in antenatal care (Global Nutrition Report, 2020).

In resource-poor environments across the globe such as in low and middle-income countries (LMICs) like Bangladesh, pregnant women typically consume a monotonous, low-quality diet that is dominated by grain or tuber-based staple foods and contains few micronutrient-dense foods from animal sources, fruits, and vegetables (Darnton-Hill & Mkparu, 2015). Because of that maternal undernutrition is ubiquitous and is recognized as a critical cause of poor perinatal outcomes in resource-poor nations where numerous nutritional deficiencies frequently co-exist (Nita Dalmiya, 2022). On top of that, there are more humanitarian crises than ever before, which necessitates an enormous amount of substantial attention. Maternal health struggles adversely in humanitarian situations like the Rohingya situation in Bangladesh because of poor diets, inadequate services, incorrect practices, and a weak supportive environment. Promoting maternal health before, during, and after pregnancy and ensuring the right

interventions for a positive pregnancy, especially in times of crisis, helps reduce the risk of mortality, morbidity, and malnutrition remarkably (Corna et al., 2019).

1.2 Problem Statement:

In August 2017, a vast influx of Rohingya refugees from Myanmar sought safety in Bangladesh has created the fastest-growing refugee crisis in the world (Ainul et al., 2018). Rohingya women experience a variety of sexual and reproductive health (SRH) issues, including higher maternal morbidity and mortality rates. Previous studies revealed that women who are refugees or forcibly relocated are highly susceptible to sexual and reproductive health complications (Metusela et al., 2017). Compared to pre-conflict circumstances, it is obvious that women in humanitarian contexts are more likely to face pregnancy-related problems and unfavorable delivery outcomes (Joarder et al., 2020). In 2015, conflict-affected states accounted for 61% of the 303,000 maternal fatalities worldwide (UNFPA, 2015). Many crises affected women endure not only the consequences of violence and relocation but also sexual abuse, unintended pregnancy and limited access to reproductive health care (Parmar et al., 2019). Rohingya women of the childbearing stage are in dire need of SRH services, such as antenatal care, delivery assistance, postpartum care & family planning services (Jannat et al., 2022).

There are 316,000 Rohingya women of childbearing age, 63,700 of whom are pregnant (Hossain and Dawson, 2022). In the Rohingya population pregnancy and childbirth-related complications, as well as violence against women, were the most prevalent health issues among the women (Rawal et al., 2021). Out of 253 fatalities of women of reproductive age over 12 months, from January 2021 to December 2021, 96 (or 37.94%) were documented as maternal deaths among those aged 18 to 49 (UNFPA, 2020). The latest data shows that 23% of reported deaths were due to maternal death (31), neonatal deaths (143), and stillbirths (143) in the first half of 2022 (Health Sector, 2022). An assessment by Save the Children revealed that 179 Rohingya children die from preventable causes of childbirth out of every 100,000 live births (Islam and Nuzhath, 2018).

Two years before COVID-19, the dietary intake situation among the Rohingya population with an adequate food consumption score (FCS) was observed. During the pandemic, changes in the frequency and mode of food aid, as well as the increased

sensitivity of food assistance to market prices led to a fall in the FCS of households. Around 45% of the Rohingya community continued to have inadequate FCS (Relief web report, 2022). Around 57.2% of women in the Rohingya population are estimated to have anaemia (Joarder et al., 2020). According to a survey conducted in 2018, around 10% of Rohingya women were undernourished (Leidman et al., 2018).

Numerous types of research were found orchestrating around the health and nutrition of Rohingya children, but few were revealed in the field of maternal health, particularly on antenatal care and dietary practice of pregnant women. To address this void, this study sought to examine pregnant women's level of knowledge and practice of antenatal care guidelines and their dietary practice along with nutritional status.

1.3 Objectives of the study

The objectives of this study were:

i. To determine demographic and socio-economic characteristics among Rohingya pregnant women.
ii. To evaluate the knowledge and practice of antenatal care guidelines in Rohingya pregnant women.
iii. To assess the dietary practice and nutritional status among Rohingya pregnant women.
iv. To establish the relationship among socio-economic and demographic characteristics, knowledge and practice of antenatal guidelines, dietary practice and nutritional status of Rohingya pregnant women.

1.4 Significance of the study

The study will provide baseline information on the context-specific knowledge of antenatal guidelines and to what extent those guidelines are adopted and practiced. One of the biggest strengths of this study is the identification and operation in the emergency context where little similar research was done. Proper information on the dietary diversity of pregnant women is scanty in Rohingya pregnant women. This study will give a close-up look at the dietary practice of pregnant women and how it impacts their nutritional status. The study findings can be used to holistically reform policies and interventions implemented by the public and private sectors aimed at addressing maternal health in the Rohingya refugee context.

Chapter 2: Literature Review

2.1 Demographic and socio-economic characteristics:

A study on the socio-economic factors influencing teenage pregnancy stated that, in developed and developing countries, females with less education, those from low-income households, and those living in rural regions are more likely to become pregnant as adolescents (Akanbi et al., 2021). The prevalence of anaemia was found significantly associated with socio-economic status in a study on anaemia during pregnancy (Ndukwu et al., 2012). Kadawathagedara et al., (2021) found in their study that a substandard diet during pregnancy was associated with social vulnerability factors such as maternal age, single motherhood, and unemployment. Poverty, illiteracy, migration, length of residence in the community, and high parity were found to be significant predictors of not seeking ANC (Ghosh-Jerath et al., 2015). The effect of maternal education, and socio-economic status on maternal nutritional knowledge, educational status and monthly income was found to have positive impact on nutritional awareness (Mohannad et al., 2012)

Some researchers did a study on the nutritional status among early childbearing young mothers in Bangladesh where they discovered that young mothers from remote regions, impoverished households, uneducated or with a low level of education, working, and married to an unemployed spouse were more likely to be underweight (Islam et al., 2016). Another study in Bangladesh revealed that there was a substantial correlation between maternal health care and the socioeconomic status of women (Shirin, 2011). A study exploring the predictors of LBW in Bangladesh stated that education, socioeconomic position, and nutritional condition of mothers are significant predictors of delivering LBW babies (Karim et al., 2016). Islam and Sultana, (2019) did a study among urban women in Bangladesh where early maternal age, primiparity, undesired pregnancy, women living in slum regions, and women relocating from other cities or non-urban areas were linked to a higher probability of pregnancy-related problems. Another study found, significantly increased odds of institutional delivery in Bangladesh were associated with first-time pregnancies, higher education, wealth, autonomy, TV ownership, non-Muslims, antenatal care recipient, pregnancy difficulties, and urban dwellers (Kamal et al., 2013).

2.2 Antenatal care in pregnancy

2.2.1 ANC visit to the healthcare facility

A study assessing the antenatal care services and their inference to health outcomes of children based on 193 surveys in 69 low-income and middle-income countries published that at least one ANC visit was linked to a 1.04% lower chance of neonatal mortality, a 1.07% lower likelihood of infant mortality, a 3.82% lower incidence of giving birth to an LBW baby, a 4.1% and 3.26% lower risk of stunting and underweight. Having at least four ANC visits and seeing a skilled provider at least once reduces the risk of neonatal mortality by 0.56%, infant mortality by 0.42%, LBW baby by 2 .83%, stunting by 1.41%, and underweight by 1.90 % in addition (Kuhnt and Vollmer, 2017). In a Malaysian study, researchers found that over 50 percent of low-risk women got antenatal care that was adequate or better. On the other hand, 26% of the women who were at high risk did not get the expected intensive care (Yeoh et al., 2016).

2.2.2. Iron folic acid supplementation during pregnancy

According to WHO recommendations on antenatal care for a positive pregnancy experience. pregnant women are advised to take 400 g (0.4 mg) of folic acid daily in addition to 30 mg to 60 mg of elemental iron to prevent maternal anaemia, puerperal sepsis, low birth weight, and premature birth. When a pregnant woman is identified as anaemic, her daily elemental iron dosage needs to be increased to 120 mg until her Hb level returns to normal (Hb 110 g/L or higher) WHO, (2016). A research stated that in comparison to the no-intervention control group, daily iron supplementation reduced the incidence of anaemia at term by 73% (RR = 0.27; 95% CI: 0.17 - 0.42) and iron deficiency anaemia by 67% (RR = 0.33; 95% CI: 0.16 - 0.69) (Yakoob and Bhutta, 2011). A retrospective cohort study done in Nepal found out that children whose mothers consumed IFA supplements had a 14% reduced adjusted relative risk of stunting than someone whose mothers did not. Furthermore, when antenatal IFA supplementation was initiated at ≤6 months and ≥90 IFA supplements were taken during pregnancy, the adjusted relative risk of stunting was reduced by 23%. (Nisar et al., 2016). Agrawal et al., (2015) stated that mothers who took iron and folic acid supplements for at least 90 days during their previous pregnancy had a 36% decreased chance of reporting pre-eclampsia or eclampsia symptoms (OR: 0.64; 95% CI: 0.47-0.88). A study done using health survey data for 3 years revealed that mothers who took

IFA supplements throughout pregnancy had a reduced risk of postnatal and under-5 mortality (Tanvir Abir et al., 2016). Folic acid supplementation started before pregnancy was linked to a lesser incidence of small for gestational age (SGA) neonates below the 10th centile (aOR 0.80, 95% CI 0.71–0.90, P <0.01) and SGA below the 5th centile (aOR 0.78, 95% CI 0.66–0.91, P <0.01) (Hodgetts et al., 2015). According to a study exploring the birth weights of infants in India, taking an IFA supplement during pregnancy for longer than three months is significantly linked to a 23 percent lower risk of having a low-birth-weight child (Chatterjee & Dubey, 2022).

2.2.3 Smoking and alcohol consumption during pregnancy

A systematic review and meta-analysis of 34 studies revealed that active smoking during pregnancy increases the likelihood of having an LBW by twice compared to the women who don't smoke while being pregnant. A cohort study on Norwegian mothers and children found that women smoking during pregnancy was correlated with higher anxiety and depression in the offspring (Moylan et al., 2015). Active maternal smoking was linked to higher risks of stillbirth (sRR = 1.46), newborn fatality (sRR = 1.22), and perinatal death (sRR = 1.33) (Pineles et al., 2016). According to certain research, drinking alcohol during pregnancy may harm children's intelligence quotient (IQ), mental health, memory, and linguistic or visual ability (Polańska et al., 2015). A study done in Japan found that alcohol consumption throughout the last two trimesters has been associated with an elevated risk of premature childbirth. (Ikehara et al., 2019).

2.2.4 Adequate rest and physical activity during pregnancy

Exploring different trials, evidence represented that a reduction in the incidence of pre-eclampsia and gestational hypertension was associated with a daily rest period of 30 minutes and nutritional supplementation (Facco et al., 2017). Meher and Duley, (2006) found that a shorter sleep duration and a later sleep midpoint were linked to a higher risk of gestational diabetes. According to some cohort studies, participation in leisure-time physical exercise was associated with less weight gain during pregnancy, reduced risk of gestational diabetes, and a lower chance of preterm delivery (Silva et al., 2016). Without exercise, pregnant women are 2.5 times more likely to deliver a macrosomic baby, 1.5 times more likely to acquire too much weight, and 3 times more likely to experience hypertension (Barakat et al., 2016). In Hispanic women, household and caregiving duties were found to be linked to an increased risk of very poor sleep quality

and short sleep duration. Along with that, light-intensity physical activity was related to a reduced risk of lengthy sleep duration (Hawkins et al., 2018)

2.2.5 Tetanus toxoid vaccine during pregnancy

The exotoxin generated by *Clostridium tetani* causes the acute, often deadly condition known as tetanus. It affects newborns whose mothers lack enough circulating antibodies to passively protect the child through transplacental transfer. Tetanus toxoid immunization of pregnant or non-pregnant women, or both, may be able to prevent this adverse outcome (Demicheli et al., 2015). If a pregnant woman has not previously been immunized against tetanus, according to the WHO guideline on '*Maternal immunization against tetanus'*, two doses of tetanus toxoid-containing vaccination (TT-CV) should be given to her, one month apart, with the second dose given at least two weeks before birth (WHO, 2016). Research disclosed that mothers who received at least two or more Tetanus Toxoid vaccines had a decreased risk of postnatal and under-5 mortality (OR = 0.43, 95% CI: 0.49-0.78) (Tanvir Abir et al 2016). Based on the pooled prevalence of perinatal mortality in Ethiopia, the meta-analysis revealed that antenatal care visits, maternal tetanus toxoid vaccination, and partograph monitoring decreased the risk of perinatal mortality (Desta et al., 2018). According to a comprehensive analysis, TT immunization with at least two doses in pregnant women and women of reproductive age had a significant impact on reducing neonatal tetanus mortality by 94%. (Blencowe et al., 2010).

2.2.6 Mental health during pregnancy

Recent systematic evaluations found antenatal anxiety disorders to have a prevalence of 15-20% and postnatal anxiety disorders to have a prevalence of 10%, with greater rates in low- and middle-income countries than in high-income countries (Dennis et al., 2017). In addition, a multi-generational pregnancy cohort found that depression during pregnancy was on average 51% more prevalent among young mothers in the most recent generation compared to their mothers' generation 25 years before (Pearson et al., 2018). It is well known that women with both common mental disorders and severe mental illness are more likely to have unfavourable obstetric and pregnancy outcomes, such as preterm births and foetal growth abnormalities (Howard & Khalifeh, 2020). A systemic review of 39 articles revealed that there was compelling evidence of antenatal distress during pregnancy raises the risk of premature birth (Staneva et al., 2015).

Reportedly, Rohingya refugee women suffered from flashbacks of the massacre, anxiety, extreme stress, repeated nightmares, sleep deprivation, sexual assault, and even speech dysfunction. Since refugees are dependent on humanitarian aid for existence and struggle every day for food aid, this also acted as a source of stress for the majority of them (M. M. Islam & Nuzhath, 2018).

2.3 Knowledge, attitude and practice of pregnant women regarding antenatal care

A survey of pregnant women in rural Lahore found that 83.1% of women thought prenatal checkups were important for monitoring the mother and fetus' well-being. In addition, 64.7% of pregnant women had adequate knowledge about antenatal care, 69.6% had a positive attitude towards antenatal care, and 61% had good antenatal care practices (Akhtar et al., 2018). Another study in Nepal found a strong relationship between the amount of knowledge and educational status in the prevention of anaemia during pregnancy ($p=0.002$). Additionally, the study discovered a significant connection between the frequency of antenatal care (ANC) visits and mothers' degree of awareness ($p=0.007$) as well as a level of practice ($p=0.043$) about anaemia prevention in pregnancy (Ghimire, 2013). Patel et al., (2016) did a study on Indian pregnant women attending an antenatal clinic, where around 58% of women had adequate knowledge of ANC. It was discovered that practically all characteristics, including age, education, occupation, parity, family type, and socioeconomic status (SES), had a positive relation with ANC awareness. 100% of the women were enthusiastic about ANC, around 70% of women practised appropriately, and characteristics like education and socioeconomic status exhibited a strong association with ANC habits. According to one survey conducted in Andhra Pradesh, India, 20.6% of women had completed three antenatal consultations, and 96.1% of pregnant women said that registration for antennal care and checkups is required. Moreover, 87.2% said they took iron and folate throughout pregnancy, whereas 11% said they don't. In addition, 92% of pregnant women agreed that the tetanus toxoid (TT) vaccine should be administered during pregnancy. When asked how many hours they slept per day, 24.2% said 5-6 hours, 35.4% said 7-8 hours, and 35.6% said more than 8 hours. Furthermore, 55.8% of expectant women said had the willingness to give birth at a hospital (Sitalakshmi et al., 2020). According to the findings of a study carried out among mothers in a remote part of Ethiopia's Gesha district, the total proportions of good knowledge, positive attitude, and good practice in accessing professional maternal

health care services were 39.15%, 37.5% and 34.67% , respectively (Hassen & Lelisho, 2022). An evaluation of prenatal care in rural Bangladesh revealed that approximately 25% of women attended at least four ANC visits, with just 11% beginning ANC visit in the first trimester (Siddique et al., 2018).

2.4 Nutrient needs during pregnancy

A balanced diet consists of a variety of foods that provide sufficient energy, protein, vitamins, and minerals obtained by the intake of green and orange vegetables, meat, fish, beans, nuts, whole grains, and fruit (WHO, 2015). When a woman is pregnant, she requires additional nutritional support to fulfil the requirements of both the growth and development of the fetus as well as the maintenance of her metabolism and tissue accumulation. Deficits in essential macronutrients and micronutrients can thus have a significant impact on maternal health, pregnancy outcomes and newborn health (Mousa et al., 2019).

2.4.1 Macronutrients during pregnancy

Additional energy is required during pregnancy for the growth of existing tissue (uterus, breast, and maternal adipose tissue) as well as the formation of new tissue (foetus, placenta, and amniotic fluid) (Williamson, 2006). Appropriate maternal energy intake is critical for avoiding poor pregnancy outcomes caused by both inadequate and excessive gestational weight gain (Mousa et al., 2019). Energy requirements typically do not change from those of non-pregnant women in the first trimester, but between 10 and 30 weeks of gestation, when maternal and fetal tissue is growing at its fastest rate, they do (Williamson, 2006). During the second and third trimesters of pregnancy, women are advised to raise their average daily energy consumption by 300 kcal, according to the US Recommended Dietary Allowance (Murphy & Abrams, 1993). Energy intake during pregnancy is estimated to range between 1843 to 2213 kcal/day globally, with larger intakes observed in the Americas and the Eastern Mediterranean as opposed to Africa, Southeast Asia, and the Western Pacific (MacDonald-Wicks, et al., 2012).

According to certain observational studies from the UK and Spain, consuming more protein throughout pregnancy can increase the birth weight of an infant (Cucó et al., 2006). Similar results were noted in a Cochrane review of 12 randomized trials, which revealed that balanced energy/protein supplementation (<25% energy from protein)

boosted birthweight and reduced the likelihood of stillbirth and small-for-gestational-age (SGA) newborns (Ota et al., 2015). Thus, moderate protein consumption during pregnancy ranging between 10 to 25 percent of total energy is considered healthy and adequate (Mousa et al., 2019).

An observational study found that consuming higher total fibre three months before pregnancy and throughout the first trimester of pregnancy decreased the risk of preeclampsia via lowering pregnancy-related dyslipidemia (Qiu et al., 2008). For women at risk of gestational diabetes mellitus or large-for-gestational-age infants, low glycemic load diets may be effective, however, they could increase the risk of small-for-gestational-age infants (Mousa et al., 2019).

During pregnancy, it's critical to consume enough fatty acids in the diet, especially long-chain polyunsaturated fatty acids (PUFAs) like DHA and EPA, to meet both the demands of the expectant mother and the growing fetus (Mousa et al., 2019). While EPA may perhaps lessen the risk of preeclampsia and the time of parturition, DHA may have an impact on the development of the foetus's brain and retina. According to a review paper, pregnant women who take omega-3 supplements have a lower risk of preterm delivery (<37 weeks' gestation) and early preterm birth (<34 weeks' gestation), but they also have a higher chance of having a pregnancy that lasts longer than 42 weeks (Middleton et al., 2018).

2.4.2 Micronutrients during pregnancy

Although the need of having enough nutrients throughout pregnancy is widely recognized, still 20%-30% of pregnant women around the world experience some sort of vitamin deficiency during their pregnancy period (Baker et al., 2013).

Folic acid supplementation during preconception and early pregnancy is crucial, as it can prevent 40-80% of neural tube abnormalities such as spina bifida (Berry et al., 1999). Besides having a folate-rich diet, all reproductive-age women should consume 400 µg/day of folic acid through fortified foods, supplements, or both (total intake 600 µg/day) from at least one month prior to conception until at least 12 weeks' gestation (Bale et al., 2003).

During pregnancy, the requirement for iron grows from 0.8 to up to 7.5 mg/day of ferritin absorbed (Beard, 2000). This increased need is required to boost maternal

erythrocyte bulk, meet foetal iron requirements, and compensate for iron losses (e.g., blood loss after birth) (Milman, 2006). The chance of having iron deficiency and/or anaemia rises during pregnancy, and it has been linked to a higher risk of preterm birth, LBW or SGA newborns, impaired maternal function, and weakened immune systems (Peña-Rosas et al., 2015). Prenatal iron supplementation of 30 to 60 mg/day is suggested for women throughout pregnancy to prevent anaemia, with 60 mg being the preferred amount in areas where maternal anaemia affects more than 40% of pregnancies (WHO, 2016).

Around 19 million pregnant women struggle with vitamin A deficiency, predominantly in Africa and Southeast Asia, resulting in night blindness (WHO, 2015). During pregnancy, additional vitamin A is required to support foetal growth and tissue maintenance, as well as to give foetal reserves and aid in maternal metabolism (Mccauley et al., 2015). Pregnant women have a minimum requirement of 370 µg/day and a daily intake of 770 µg/day is advised, which is presumed to be delivered by maternal liver storage in women who do not have a deficiency (Stipanuk and Caudill, 2013). According to research, maternal night blindness is associated with an increased likelihood of infant mortality and LBW infants (Black et al., 2013). Vitamin A supplementation is only suggested by WHO for pregnant women in regions where vitamin A deficiency is a serious public health problem (WHO, 2016).

Calcium is actively transferred through the placenta during pregnancy, and maternal calcium demands climb, particularly during the third trimester (Mousa et al., 2019). Maternal calcium deficiency can cause osteopenia, paraesthesia, muscle cramps, tetanus, and tremor, as well as delayed growth and LBW infant (Hofmeyr et al., 2014). According to another research, women who consume inadequate calcium are more likely to develop hypertensive problems during pregnancy. A WHO report that pooled data from two Cochrane studies stated that calcium supplementation lowered the chance of preeclampsia by more than 50% in all women (WHO, 2013). According to the WHO guidelines, for pregnant women in populations with poor dietary calcium intake, daily calcium supplementation (1.5-2.0 g oral elemental calcium) is advised to lower the incidence of pre-eclampsia (WHO, 2016).

Multiple micronutrient supplements, Vitamin B6 (pyridoxine) supplements, Vitamin E and C supplements, and Vitamin D supplements are not suggested for pregnant women

to boost maternal and perinatal outcomes (WHO, 2016). Recently WHO revised its guidelines and stated that antenatal multiple micronutrient supplements (MMS) containing 13-15 micronutrients that include iron and folic acid are recommended in the specific context. But before switching from IFA supplements to MMS requires a proper evaluation of acceptability, feasibility, sustainability, equity and cost-effectiveness in the particular context (WHO, 2020).

2.5 Dietary diversity during pregnancy

Dietary intake during pregnancy is the primary source of nutrition during the antenatal period and can therefore affect embryonic, placental, and fetal development (Blumfield et al., 2012). A pregnant woman whose diet is devoid of variety is likely to be lacking in key nutrients, depriving the fetus of the nutrients it needs for optimal growth (Neggers & Goldenberg, 2003). Dietary diversity has been described as the number of various food categories consumed over a specific period, with the reference period varying but usually being the prior day or week (FAO, 2013). Existing scientific empirical research suggests that dietary diversity score can serve as a proxy measure for household food security and/or micronutrient sufficiency of diets of women of reproductive age (Herforth, 2016). In both research and programmatic contexts, dietary diversity has been measured in multiple ways. However, few simple food group diversity indicators have been advocated for widespread use at the population level in settings with limited resources. These are the Household Dietary Diversity Score (HDDS), the Minimum Dietary Diversity Score (MDD), and the Women's Dietary Diversity Score (WDDS) (FAO and FHI 360, 2016). Several reliable recall reference timeframes, such as the preceding 24 hours, the previous 3 or 7 days, and in the case of certain foods, the past month, are applied to measure dietary diversity. FAO prefers a 24-hour recall period because it is less susceptible to recall bias, less burdensome for the responder, data is easier to analyze, and it conforms to the recall period adopted in numerous studies of dietary diversity.

Women in resource-poor countries are more likely to suffer from dietary inadequacy due to nutrient deficiencies at the start of pregnancy, insufficient dietary intakes during pregnancy (eg, limited availability and consumption of foods high in micronutrients and poor absorption), frequent infection, adolescent pregnancy, high fertility rates, and short inter-pregnancy intervals (Torheim et al., 2010). Sociodemographic

characteristics, economic status, physical conditions, household income, food security, adequate knowledge, ANC visits, distinctive cultural norms and taboos have a substantial impact on the dietary habits of pregnant women (Ali et al., 2014). In rural India, women's diets were less varied compared to the rest of the family (Gupta et al., 2020). As a result of cultural beliefs affiliated with the assumption that giving birth will be difficult, 37% of pregnant women in Eastern Nigeria and South Africa practised food taboos, such as not eating meat and eggs (Chakona and Shackleton, 2019).

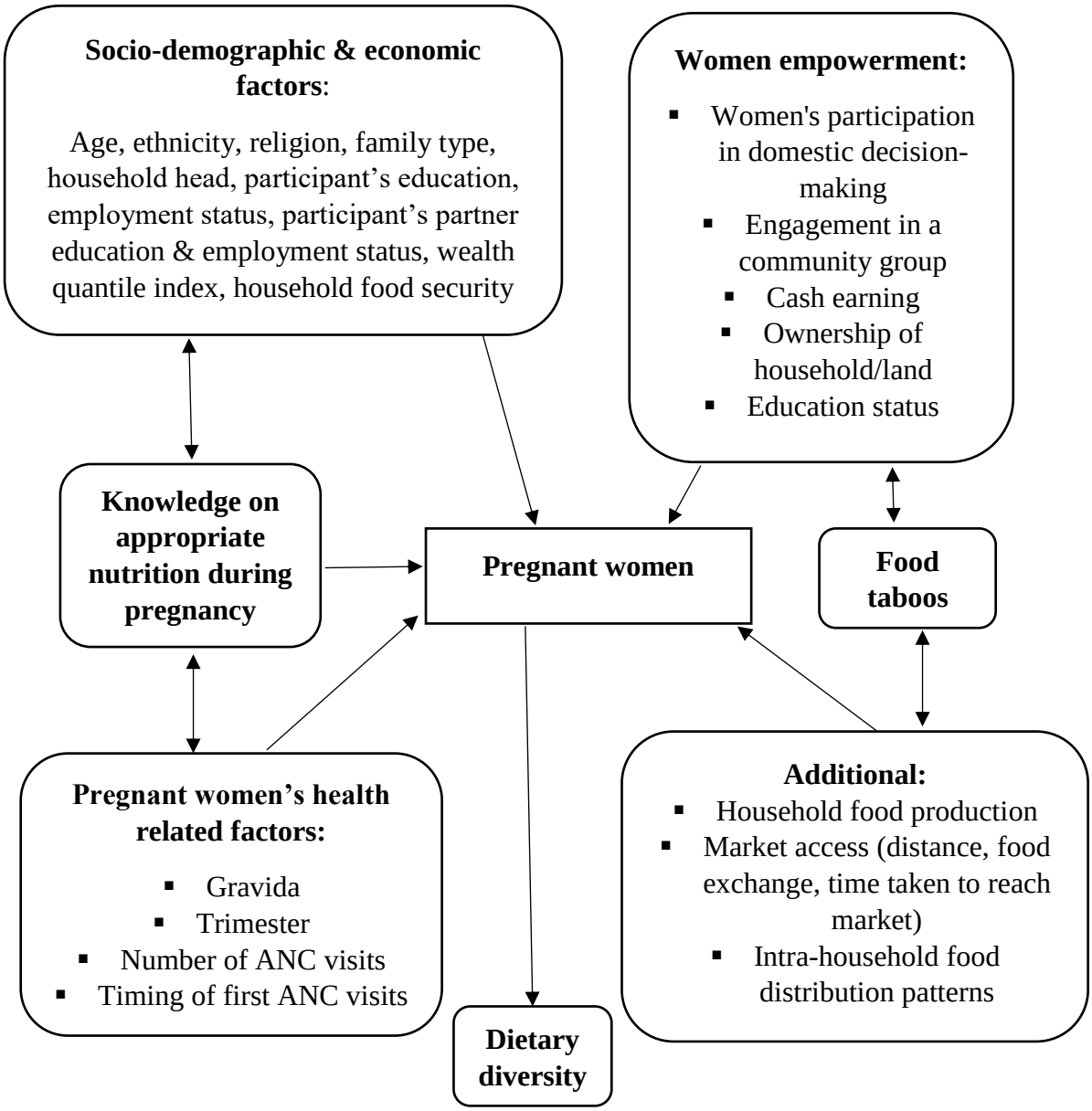

Figure 1: Conceptual framework on factors associated with dietary diversity (Shrestha et al., 2021)

2.6 Knowledge, attitude and practice of pregnant women regarding nutrition

KAP studies that concentrate on nutrition analyze and evaluate peoples' knowledge, attitude & practice concerning diet, food, and closely affiliated hygiene and health issues. An individual's understanding of nutrition is referred to as having nutritional knowledge, which includes the cognitive capacity to retain and recall food and nutrition-related terminology, particular information, and facts. Attitudes concerning nutrition are psychological, inspirational, perceptual, and cognitive beliefs that influence the nutritional behavior or practice of an individual, either positively or adversely. Nutritional practice refers to an individual's apparent behaviors that may affect his or her own or others' nutrition, such as eating, feeding, hand-washing, cooking, and food selection. Evaluating nutrition-related information, attitudes, and practices enables one to gain a deeper understanding of a situation by providing insights into the social, psychological, and behavioral influences on nutritional status (Yvette et al., 2014).

A study conducted in India revealed that 40.1% of its respondents were indeed aware of healthy nutrition, 45.5% of pregnant patients were acquainted with the meaning of food and the significance of a balanced (47%), and healthy diet (43.9%), and 59.9% had adequate knowledge regarding the necessity of food for appropriate functioning and fighting infections (67.2%) (Nagi et al., 2016). Another study in Ethiopia found that of 322 pregnant women surveyed, 87 (27%), 156 (48.4%), and 111 (34.5%) , respectively had good knowledge, a positive attitude, and adequate dietary practices throughout pregnancy (Zelalem et al., 2018). However, Harb et al., (2018) stated that in Lebanon 56% of the investigated community lacked knowledge about maternal nutrition during pregnancy, 25% had a cynical outlook toward antenatal care services and nutrition during pregnancy, and 47% of the participants had poor dietary practices in their pregnancy period.

2.7 Maternal nutrition status during pregnancy

Pregnancy increases the risk of malnutrition in women due to increased nutrient requirements, resulting in deficits in both micronutrients and macronutrients if dietary intake is not adjusted correspondingly (Nagi et al., 2016). Malnutrition during pregnancy is deleterious not only to maternal health but also to foetal and neonatal health (Williamson, 2006). Maternal malnutrition can be detected using anthropometric

indicators such as a low mid-upper arm circumference (MUAC) or Body mass index (BMI) or biochemical tests for example tests to identify anaemia or a specific vitamin deficiency (Kpewou et al., 2020). Mid-upper-arm circumference (MUAC) is widely applied for screening PLW in humanitarian settings. The universally acknowledged SPHERE Guidelines also propose using MUAC for PLW assessment and enrollment in feeding programs. These guidelines state that values below 21 cm could be utilized to identify and treat PLW at risk for undernourishment & growth retardation of the foetus (The Sphere Project, 2011)

Maternal malnutrition (i.e., BMI <18.5 kg/m2) is more prevalent in low- and middle-income countries (LMICs), with rates ranging from 20% in sub-Saharan Africa and south/central America to about 40% in India, according to one study (Black et al., 2013). A recent study in India found that anaemic pregnant women were more likely to have low birthweight infants, an impact that was exacerbated if the women were already underweight (Patel et al., 2018). Utilizing data extracted from Bangladesh Demographic and Health Survey (BDHS)-2011 focusing on early childbearing mothers (age ≤ 24, and who had delivered their first child ≤ 20) revealed that early childbearing mothers were more likely to be underweight than average (32.1%) (rural 35.1% and urban 25%). The majority of the underweight mothers (62.2%) had mild chronic energy deficiency (CED), while the remainder had either moderate (24.9%) or severe CED (11.9%). Multiple logistic regression analysis revealed that young mothers from impoverished homes, illiterate or with a lower educational status, workers, and those who were married to unemployed husbands were more inclined to be underweight (Islam et al., 2016). A study linking MUAC during pregnancy and linear growth among Cambodian infants during the first months of life discovered that in comparison to infants born from mothers with a MUAC >23 cm, infants born from mothers with a low MUAC during pregnancy had a 1.6 times higher chance of being stunted in the first 3.5 months of life (Kpewou et al., 2020). Applying MUAC <21 cm as a measure, under a humanitarian setting in Ethiopia it was reported that 216 (24%) of the assessed mothers were malnourished. In a multivariate logistic regression analysis, mothers who did not receive antenatal care (ANC) throughout their pregnancy were 1.83 times more likely to be malnourished (MUAC<21 cm) than mothers who did receive ANC (Gebre et al., 2018). As a result, maternal nutrition before and during pregnancy is critical for a healthy pregnancy outcome.

Chapter 3: Materials & Methods

3.1. Research design

A community-based cross-sectional descriptive survey was conducted from January 2022 to June 2022, among 463 randomly selected pregnant mothers ranging from 14-44 years, residing in Kutupalong, located in the coastal district of Cox's Bazar, which is currently the largest refugee camp in the world (Kutupalong Refugee Camp - Wikipedia.). An interviewer-administered structured questionnaire was used to collect data. Data were collected using a systematic sampling method. The selected mothers were interviewed while they visited the Nutrition Center and also through door-to-door visits.

3.2. Study area

This year marked five years since more than 700,000 Rohingya women, men and children fled Myanmar for Bangladesh and took shelter in two government-run refugee camps; Kutupalong and Nayapara refugee camp (Bangladesh Operational Update-2022, UNHCR)

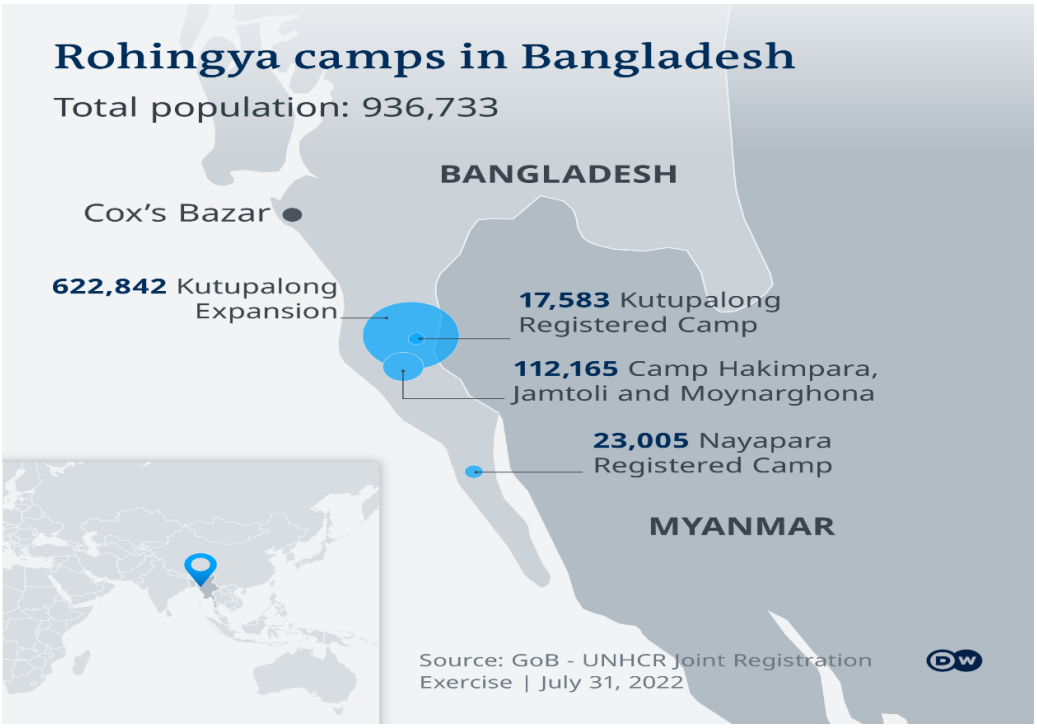

Figure 2: Current population of Rohingya camp (Source: UNHCR, 2022)

The study was undertaken in Kutupalong which is situated in Ukhiya, Cox's Bazar. The study area was focused on Camp 5 and Camp 6 with an area of 615,297 sq.m and 361,088 sq.m respectively. Camp 5 has a population of 26433 and camp 6 has 24383 (UNHCR, 2020).

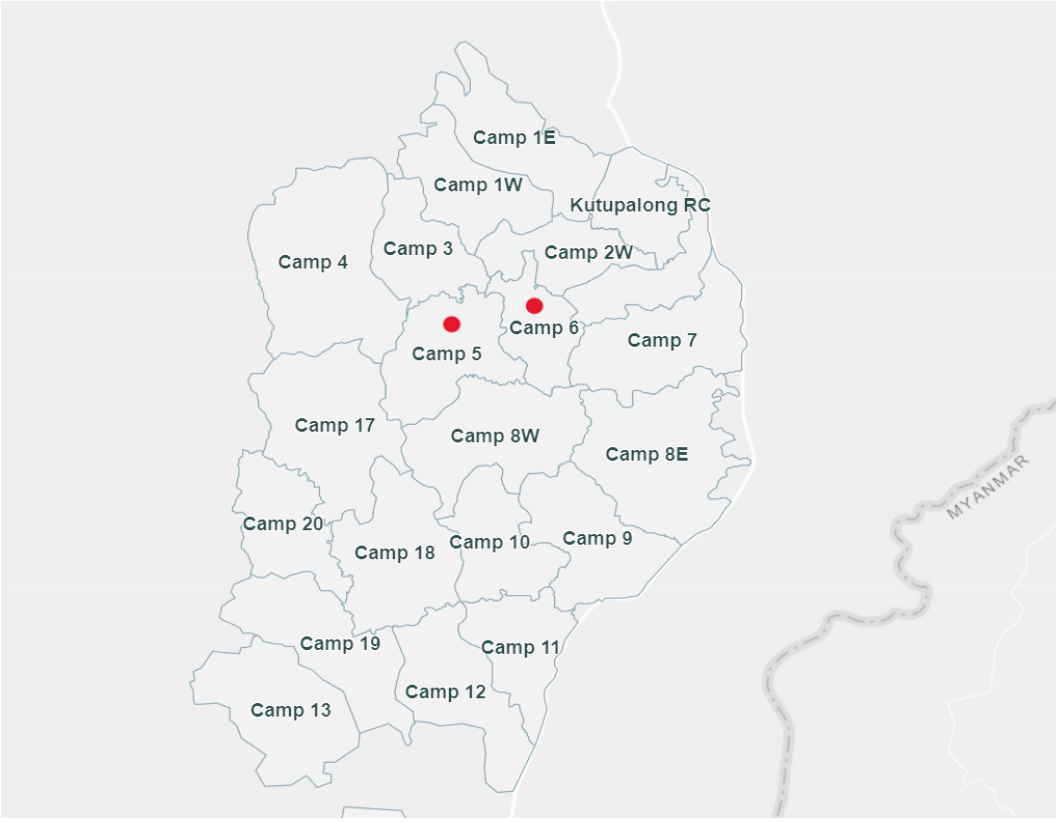

Figure 3: Study area

3.3. Research variables

3.3.1. Independent variables

Socio-economic status, demographic factors, antenatal care, and knowledge and practice score were the independent variables for this study.

3.3.2. Dependent variables

The dependent variables for this study were nutritional status (MUAC, height, weight, BMI) and dietary diversity.

3.4 Target population

The study's target population comprised of all pregnant women residing in Camp 5 and Camp 6.

3.4.1 Inclusion criteria

About 2-8 months pregnant women who consented to participate in the study, have a residence on Camp 5 and Camp 6 and whose pregnancy was confirmed via checkup either from a health post or primary health care centre were included in this study.

3.4.2 Exclusion criteria

Pregnant women in their 9^{th} month of pregnancy were excluded from the sample, as there was a possibility that by the time they will be reached for interview purposes, they might have delivered the baby or were on the verge of delivering which might cause some missing data. Any women who had reservations about the study or didn't want to reveal their information were also excluded. Pregnant women with pre-existing chronic diseases like Tuberculosis, diabetes, HIV/AIDS etc. or other comorbidities were also excluded from the study as their health condition can cause a significant influence on their nutritional status. The associated information regarding diseases was obtained from the participant and cross-checked from the ANC card.

3.5 Sampling size

As a similar study regrading antenatal care guidelines and dietary practice was not available so prevalence couldn't be identified for the standard sampling size calculation. But, a specific listing frame consisting of the pregnant women of each camp was available. So, the Taro Yamane method for sample size calculation was adopted for this study.

Taro Yamane method: (Tepping, 2014)

n= N/ (1+N (e) 2)

Where,

n= sample size

N= population under study

e= margin error (it could be 0.10, 0.05 or 0.01)

Using this method, the sample size for camp 5 came to 252 (pregnant women population=688, margin error 0.05) and for camp 6 at 262 (pregnant women population=762, margin error=0.05) thus formulating a sample size of 514.

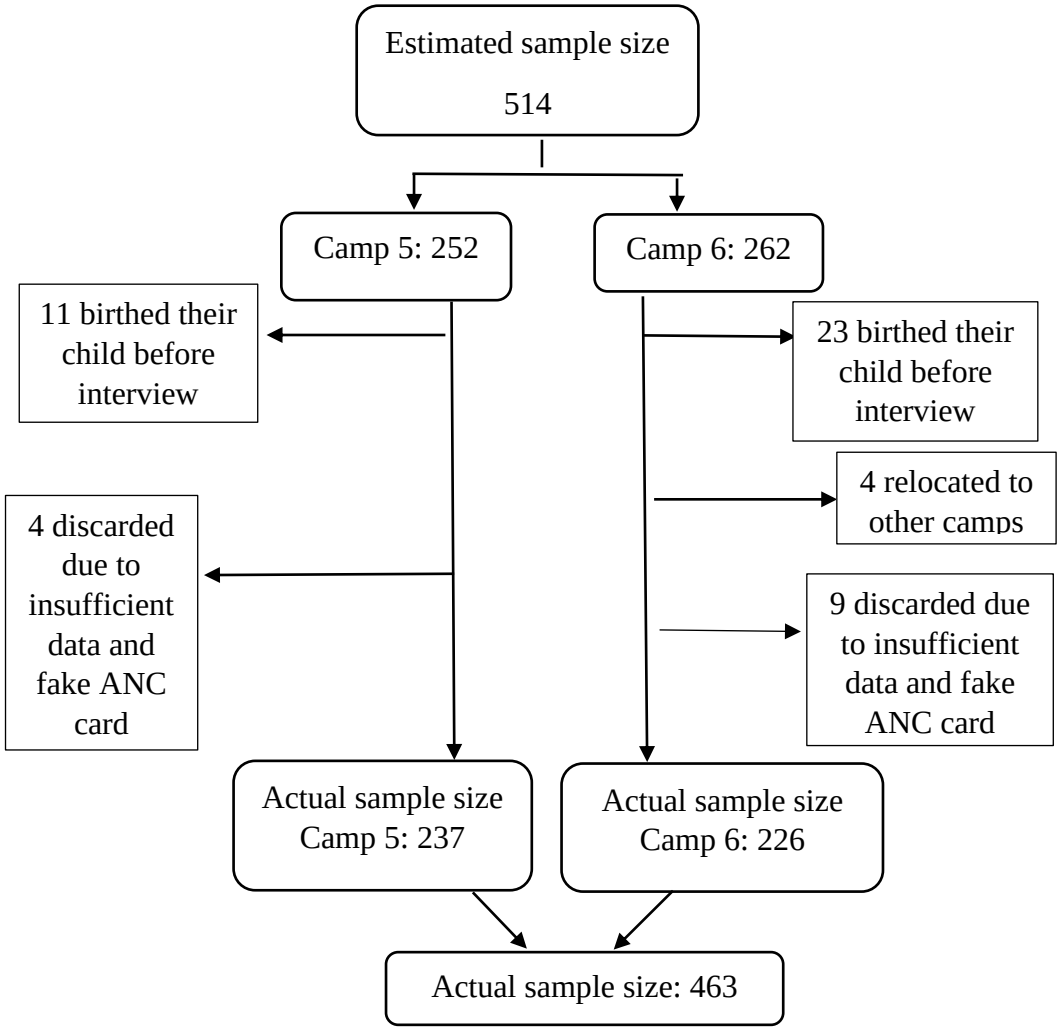

Figure 4: Sampling size

3.6 Sampling technique

Kutupalong was purposively selected as the study area as it is not only the largest camp in the world but also the most densely populated and has exceeded its capacity (Refugee Camp Cox's Bazar - Bangladesh , 2021). The nutrition centres of camp 5 & 6 which provides nutritional service along with WSB (Wheat Soy Blend) for pregnant and lactating mother were also purposively chosen as they have a list of all the pregnant women in the particular area and they do monthly screening to identify new pregnant women and new lactating mothers. The listing fame was required for the next process of our sampling process. Systemic sampling was chosen as the sampling method because it allowed to add of a degree of system or process into the random selection method while assuring that the population will be evenly sampled. A random starting

point from the list was selected via lottery and each sample was collected after a fixed periodic interval, known as a sampling interval (Systematic Random Sampling - Mathstopia**)**. The sampling interval was calculated by dividing the population size by the desired sample size. After that, all the selected sample's information was listed in an excel file to ensure that every sample was approached for the interview. The interviews were done during their monthly visits to nutrition centres and those who didn't attend were reached via door-to-door visits and interviewed in their home.

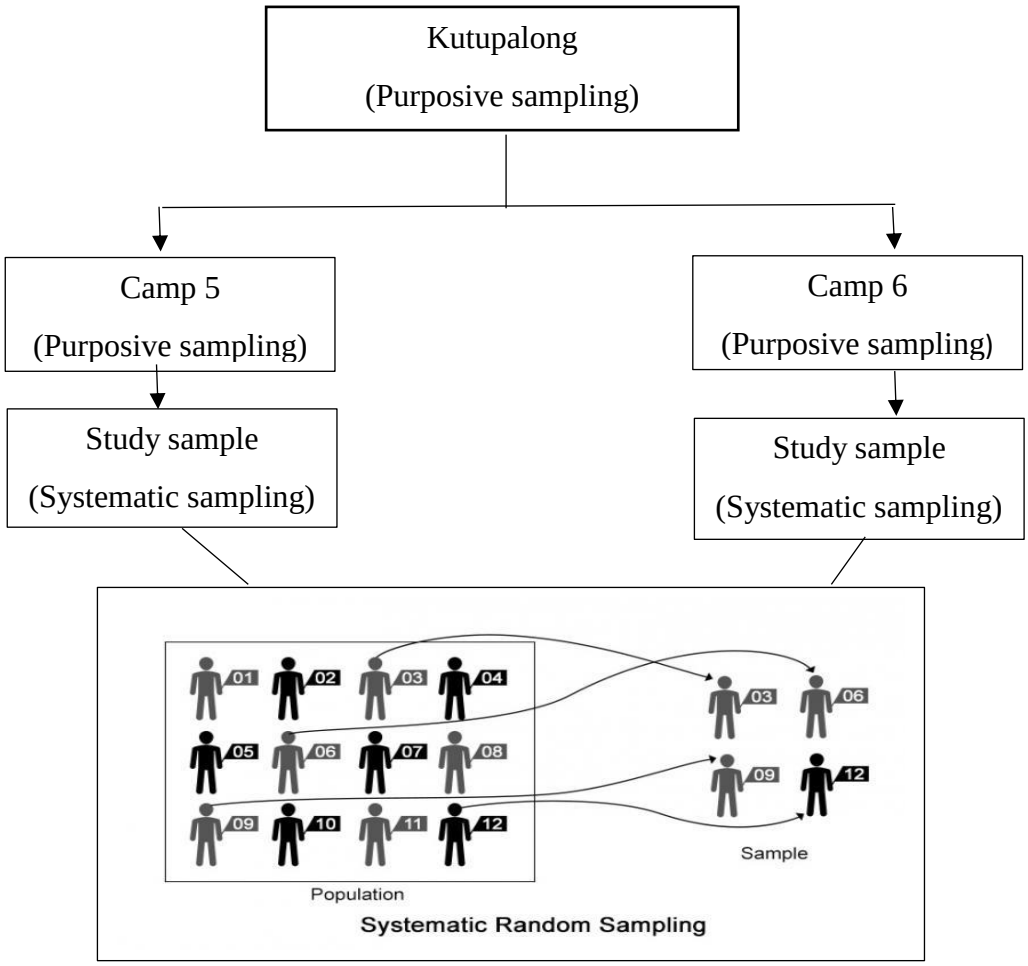

Figure 5: Sampling procedure

3.7 Research instruments

A pre-tested, structured and researcher-administered questionnaire (Appendix A) was used to collect data on socio-economic and demographic characteristics, obstetric characteristics, knowledge and practice regarding health guidelines during pregnancy, antenatal care, nutritional status, food intake and dietary diversity. The questions used

in the questionnaire were prepared based on a review of related literature and previous questionnaires. A weighing machine and a MUAC measuring tape were used to get anthropometric data. The data on height was collected from the ANC booklet for maximum cases and a height measuring tape was used to measure the rest. After obtaining the weight and height data, they were entered into the BMI index algorithm.

Food consumption data were collected using a 24-hr recall method. Participants were asked about the consumption status (consumed or not consumed) of the nine food groups over the past 24 h. The WDDS (Women Dietary Diversity Score) method was chosen to measure dietary diversity. The WDDS measures the likelihood of a diet's micronutrient adequacy. As a result, the food categories included in the score are specifically designed for this purpose. Dietary diversity scores are calculated by summing the number of food groups consumed by the individual respondent over the 24-hour recall period.

3.8 Pretesting of data collection tools

The tool was pretested on 5% of the sample selected from the community of each camp in order to confirm the quality of data. The pretest was done to ensure that the questionnaire was the correct length, topic, question phrasing, and language. The pretest also helped to figure out whether the tools could generate the information needed as per the study objective and also the understandability of the survey. This allowed modifications on the questionnaires by correcting mistakes that may have been missed out or may not be applicable at the camp context level. To assure clarity and extract the necessary information, ambiguous questions were corrected, hence boosting the reliability. Along with the thesis supervisor, three nutrition experts also examined and validated the tools to verify that the questions elicited the information desired.

3.9 Training of research assistant

Two female research assistants were recruited with a minimum of a graduate degree and previous work experience in the Rohingya camp, for assistance and better facilitation of the study. The research assistants were also fluent in the local language and accustomed to the Burmese language, which helped them explain the questions to the interviewees efficiently and also understand the responses. They were vigorously trained for 3 days before pre-testing on the purpose and objective of the study, data collection tools, anthropometric measurements, ethical issues and expectations from

each question. Two Rohingya women, who were recognized as community leaders in the survey area, also aided in the data collection process in the camp. They helped in establishing rapport and gaining the participants' confidence. With the presence of someone from their community, participants felt comfortable chatting freely and discussing intimate matters.

3.10 Data collection procedure

Each questionnaire was completed via a face-to-face interview in a private room at the nutrition center or in the comfort of their own home to ensure that they were comfortable enough to open up easily regarding the questions. All anthropometric measurements were also done in a private room, respecting their privacy and preference. The interviews took around 20-25 minutes on average to complete. Participants were assured that the information revealed during the interview would remain secret, so they were encouraged to respond freely. Information on Pregnant women was collected, by reading through questions of the questionnaire several times to ensure familiarization and clarity of the responses.

3.10.1 Demographic and socio-economic data

A structured questionnaire was employed to capture data on the socio-economic and demographic aspects of the study participants which covered the respondent's age, gestation period, number of pregnancies, number of respondent's children, respondent's level of education, respondents' occupation, family type, husband's level of education, husband's occupation and source of household income. Apart from the respondent's age, her gestation period and the number of a child the respondent has, all the other data were categorized beforehand based on the information collected in the pre-testing stage.

3.10.2 Knowledge and practice data

The next segment was about the knowledge and practices of health guidelines during pregnancy. Here, ten closed-ended questions addressed to knowledge, and another ten closed-ended questions regarding practices were asked in the interview. The questions were formulated from the guideline "WHO recommendations on antenatal care for a positive pregnancy experience" (WHO, 2016) to find out the level of current knowledge and practice regarding antenatal guidelines for a positive pregnancy. Every question

regarding knowledge and practice of antenatal guidelines was graded on a scale of 0 to 1; the answer "No" received a score of 0 and a score of "1" was given for "Yes,". Among 39 recommendations of whom the knowledge and practice of the below recommendations were considered to conceptualize our knowledge and practice question consisting of 10 in each section. (WHO, 2016)

- Increasing pregnant women's daily caloric intake and protein consumption in their pregnancy period and maintaining a balanced dietary intake throughout pregnancy.
- Pregnant women should take supplementation of 400 g (0.4 mg) of folic acid in combination with 30 mg-60 mg of elemental iron daily.
- Restrictions on the use of cigarettes and alcohol during pregnancy, as well as exposure to second-hand smoke.
- Depending on prior tetanus immunization exposure, tetanus toxoid vaccination is recommended for all pregnant women.
- Antenatal care contact with a minimum of four contacts during the pregnancy period.
- Moderate physical activity, reduced heavy work load and adequate rest during pregnancy for pregnant women to stay healthy.
- Maternal well-being during pregnancy.

The selected recommendations were chosen keeping in mind the current interventions that were available in the camp context and what access the pregnant women have to the recommended suggestions. The chosen health guidelines were tailored and reformed in the pre-testing stage and then finalized for the study.

3.10.3 Antenatal care

For a better understanding, more specific questions were asked regarding antenatal care. Pregnant women were asked about the number of ANC visits at the time of the interview, their preferred place of delivery and how frequently they were consuming IFA during the pregnancy period. All of the answers to the questions were categorized beforehand. This segment was included to assess the current practice of antenatal care during pregnancy.

3.10.4 Dietary practice and diversity

In under to get a better picture of how pregnancy impacted pregnant woman's dietary behavior whether daily food intake has increased, decreased or there was no change. They were also asked how many meals per day they usually consume. Next to find out their dietary diversity a 24-hour recall method was used. In a qualitative open 24-hour recall method, pregnant women were asked a series of conventional pertinent questions to help the participant recall all foods and beverages ingested the previous day and night both at home and away from home, as well as queries for the key constituents of the mixed dishes. The recall period, in particular, spans from when the respondent woke up the previous day, to throughout the day and night for 24 hours (FAO, 2016). In addition, participants were prompted to recall any between-meal snacks they may have had. Several methods have been used to quantify dietary diversity in academic and programmatic contexts. However, only a limited handful of unambiguous food group diversification indicators have been suggested for general usage at the population level in resource-constrained contexts. The Women Dietary Diversity Score (WDDS) indicator used in this study reviews one key aspect of the quality of diet which is micronutrient adequacy (FAO, 2016). The food groups considered while calculating the WDDS score priority was placed on micronutrient intake than on financial capability to access food. Nine food groups made up the WDDS score. (FAO, 2013). The food groups are:

- Starchy staples: Rice, Roti, Bread, Noodles, wheat, potato, corn etc.
- Dark green leafy vegetables:
- Vitamin A rich fruit and vegetables: Carrot, pumpkin, tomato, mango, watermelon, papaya etc.
- Other fruits and vegetables: apple, banana, cauliflower, eggplant, string beans, okra etc.
- Organ meat: liver, kidney, heart or any other organ meat
- Meat and fish: fresh or dried fish, chicken, beef, mutton, pigeon etc.)
- Eggs: chicken, duck, pigeon eggs etc.
- Legumes, nuts and seeds: dried beans, dried peas, chickpeas, lentils, nuts, seeds etc.
- Milk and milk products: milk, cheese, yoghurt or other milk products.

Dietary diversity scores are computed by tallying the number of food types consumed by each respondent throughout the 24-hour recall period (FAO, 2013). Food items that were consumed during the reference period received a score of "1," while those that were not consumed received a score of "0." For WDDS, the possible score range is 0–9. The score for dietary diversity was transformed into a tertile and divided into three groups (FAO, 2013).

- High dietary diversity: 7-9
- Medium dietary diversity: 4-6
- Low dietary diversity: 1-3

3.10.5 Anthropometric measurement:

3.10.5.1 MUAC

The circumference of the left upper arm measured at the midpoint between the olecranon process and the acromium which lies between the tip of the shoulder and elbow is known as the Mid-Upper Arm Circumference (MUAC) (Anthropometry of the Upper Arm - Wikipedia). MUAC measurement can be used instead of BMI to identify underweight pregnant women and to evaluate the prevalence of malnutrition in the population. (Tang et al., 2020). Measuring MUAC is affordable, user-friendly, and offers a small range of cut-off values for underweight status that is independent of pregnancy status. It is widely used to assess the nutritional health of pregnant women and to establish their suitability for nutrition assistance programmes, especially in emergency or humanitarian settings where determining weight and height may be difficult. Although a global MUAC cut-off for pregnant women has not yet been defined, in emergency situations such as the Rohingya refugee crisis, a cut-off of 21cm is usually implemented. (Nita Dalmiya and Roland Kupka, 2022). Maternal MUAC <21 cm is termed as malnourished and is admitted to the TSFP (Targeted Supplementary Feeding Program) and MUAC >21 cm are categorized as normal so they are enrolled in BSFP (Blanketed Supplementary Feeding Program) of the nutrition support program.

According to (UNICEF, 2020) MUAC was measured by following certain steps which are:

i. Bent the left arm to a 90-degree angle, put the wide end of the measuring tape on the shoulder, and measured the length from the shoulder to the elbow.
    i. Determined the left upper arm's midpoint and marked it with a pen.
    ii. Measured the MUAC while keeping the arm straight and placing the tape in the center.
    iii. Ensured that the tape was not overly tight or too loose.

3.10.5.2 Weight measurement

Weight had been calculated with a calibrated weighing scale. At first, the respondent was asked to remove any heavy object or heavy jewellery that she might be carrying. The participant was then requested to stand straight on the middle of the scales, arms relaxed at their sides. They were asked to look straight-ahead and remain as still as possible. The posture was vital since it implied that their weight was uniformly distributed, allowing for an accurate assessment. Finally, the presented weight was recorded. The weighing procedure was maintained following the current guideline of UNICEF with a standardized electronic scale.

3.10.5.3 Height measurement

Maximum data of respondents' height was collected via their ANC checkup card which was measured in the health facility using a stadiometer. A wall-mounted long ruler was called a stadiometer. It had an adjustable, moveable horizontal headpiece that rests on the head. In cases where the height wasn't found in their ANC booklet or the ANC card wasn't still prepared a height measuring tape was used to measure their height. At first, the respondent was asked to stand against a flat wall and on a flat floor after removing shoes, braids, headbands etc. The individual stood with their feet flat on the floor and their heels pressed at the wall-floor intersection. It was assured that the buttocks, shoulders, and head of the participant touched the wall at all times. The individual maintained a straight posture and held a forward gaze. A hardcover book, ruler or any other flat object was placed against the wall at a right angle. It was then lowered, until it lightly rested on top of the head. At the point of the wall where the ruler or book or other flat object touched the head was softly traced with a pencil. Finally, a tape measure was used to determine how far the mark on the wall was from the floor. The measurement was then recorded.

3.10.5.4 Body mass index (BMI)

Body mass index (BMI) is calculated by dividing a person's weight in kilograms by their height in meters squared. BMI is a low-cost and simple evaluation measure to assess whether one is in the range of underweight, healthy weight, overweight, and obesity. (About Adult BMI, CDC). According to BMI, nutritional status is categorized into some groups which are: (Hall and Cole, 2006)

BMI	Nutritional status
Below 18.5	Underweight
18.5-24.9	Healthy weight / Normal
25.0-29.9	Overweight
30.0 and above	Obesity

Table 3.10: BMI categories

3.11 Statistical analysis

The data was primarily recorded in excel and then exported to SPSS for analysis purposes. Statistical Package for Social Science (SPSS) version 25 IBM was used to analyze the data. Three types of analysis were done e.d. Descriptive statistics, chi-square test & multivariable logistic regression analysis. Descriptive statistics were used to organize and summarize the data and get frequency distribution for different variables and categories. the chi-square test was done to figure out any association between 2 categorical variables. 95% confidence interval was used and a p-value <0.05 were considered the cut point of stating a positive relationship between 2 categorical variables. In this study, the chi-square test measured the association among dietary diversity and practice, demographic and socio-economic status of the respondents, knowledge and practice score, obstetric characteristics and nutritional status of the pregnant women. Bivariate logistic regression models to assess the association between undernutrition and the different potential risk factors in this study. The strength of association between the different risk factors and the study outcomes was reported using crude and adjusted odds ratios and the presence of statistically significant

association was considered at alpha less than or equal to 0.05. The adjusted odds ratio (AOR.) was observed to assess the strength of the associations at 95% CI for the significance test. Both (bivariate and multivariable analyses) were performed to identify risk factors of maternal underweight during pregnancy. Regression analyses were further carried out to determine the contribution of nutritional status.

The knowledge and practice index was created through the sum of binary input variables, where the highest and lowest value were selected for each underlying pointer. The enactment of individual information was articulated using a unit-free index between 0 and 1, following the structure technique of the Human Development Index. The Score was created and then categorized as the groups labelled as poor and good knowledge and practices.

3.12 Ethical consideration:

Permission and approval to carry out the research was sought from Chattogram Veterinary and Animal Sciences University. Permission was similarly sought from the nutrition centers of the area of study. The study objectives and purpose were made clear to respondents and after being briefed respondents were offered the opportunity to ask questions about the study before initiating the interview. Permission was ensured from respondents prior to data collection, and both written and verbal consent was obtained, which was recorded as part of the questionnaire responses. The information provided by all respondents was kept private. Respondents had the option to discontinue participation in the study at any time during the interviews. To ensure privacy, no names or other forms of identification were used during data collection. It guarantees that all information obtained was kept strictly confidential and was only used for the purpose of the study. The confidentiality and privacy of the collected data were also ensured and maintained throughout and after the study.

Chapter 4: Result

This chapter comprises and articulates the study findings after the analysis of the data. Data on a comprehensive sample of 463 respondents were properly analyzed as per the objective of the study and presented in an organized way. Findings have been presented via bar charts, graphs and tables.

4.1 Socio-economic & demographic characteristics of the respondents

Table 4.1 shows the socio-demographic characteristics of the respondents. Among 463 pregnant women 57.9% resided between age 20-29, which is considered primary reproductive age. About 15.8% women aged less than 20 years and only 3.2% fell on the category over 40 years. Around 69.8% pregnant women has 0-3 children and only 2.2% has more than 10 children. The level of education was not that prominent in the respondent as 90.3% were found to have no formal education and only 9.3% women had primary level of education with no single woman identified of having an education level above secondary. The pregnant women of the study area were predominantly housewife as around 95.9% were identified in this category with a small number of women involved in either NGO job or other occupation.

The educational qualifications of the respondent's husband were superior compared to the respondents. Around three fourth of the respondent's husband (75.6%) had no formal education with only 20.1% having primary education, 3.2% secondary education and only 1.1% above secondary level. Educational attainment is critical since it has a substantial impact on a person's attitude and health behavior. Regarding employment status it was noticed that 64% of the participant's husband were unemployed. Apart from that, day laborer (13.8%) was seen the most as a line of work, following small business owner (10.6%) and NGO job (6.9%). Household income acts as a major contributor on determining what type of life one can lead. In the studied population, around 42.5% family were identified as having no extra income and 18.8% depending on selling relief goods for some cash flow. Income from daily wages, business, NGO job, others were more or less similar to the percentage of husband's occupation.

Table 4.1: Demographic & socio-economic characteristics of the respondents (n=463)

Variables	Level	Frequency	Percentage
Age of the respondent	<20	73	15.8
	20-29	268	57.9
	30-39	107	23.1
	>=40	15	3.2
Number of children	<=3	323	69.8
	4-6	103	22.2
	7-9	27	5.8
	>=10	10	2.2
Respondent's educational level	No formal education	418	90.3
	Primary	43	9.3
	Secondary	2	0.4
	Above Secondary	0	0.0
Respondent's occupation	Housewife	444	95.9
	NGO worker	8	1.7
	Others	11	2.4
Family type	Joint	235	50.8
	Nuclear	228	49.2
Husband's educational level	No formal education	350	75.6
	Primary	93	20.1
	Secondary	15	3.2
	Above Secondary	5	1.1
Husband's occupation	Day laborer	64	13.8
	NGO worker	32	6.9
	Small business owner	49	10.6
	Unemployed	287	62.00
	Others	31	6.7
Source of household income	Selling relief goods	87	18.8
	Daily wages	73	15.8
	NGO work	32	6.9
	Small Business	45	9.7
	Other's	29	6.3
	No extra income	197	42.5

4.2 Obstetric characteristics

Majority of the participants were in their 2nd trimester at the time of survey, around 234 (50.5%), following by 1st trimester scoring at 146 (31.5%) and at last ranked the 3rd trimester participants with 83 (17.9%) individuals (Figure: 6).

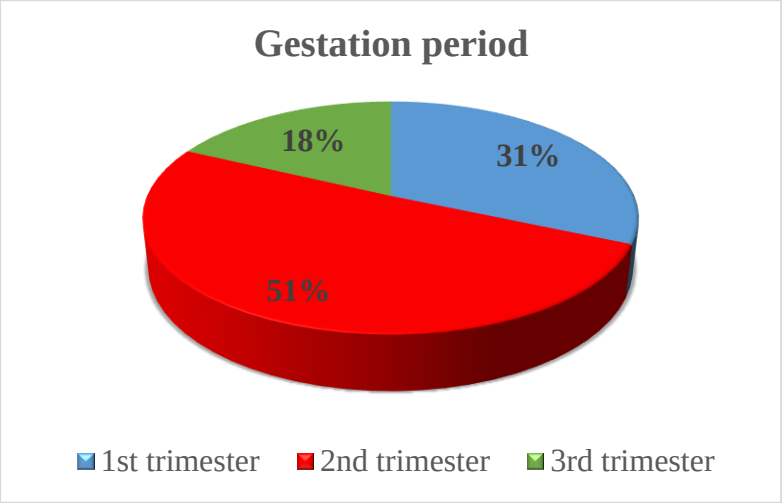

Figure 6: Gestation period

Among 463 pregnant women, 47 (10.2%) were pregnant for the first time and rest of the 416 (89.8%) pregnant women were at least pregnant for the 2nd time during the study time (Figure:7).

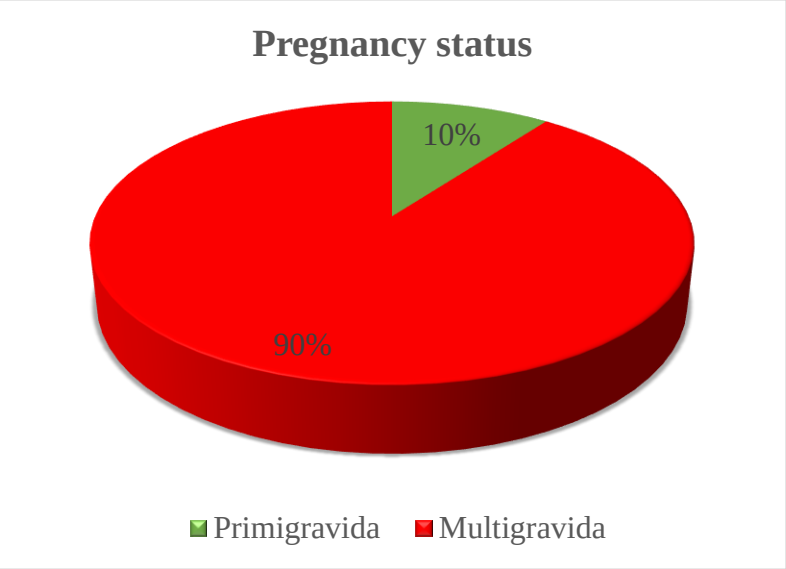

Figure 7: Pregnancy status

4.3 Knowledge of antenatal care guidelines of the pregnant women

After assessing the level of knowledge of the participant's it was revealed that 92% had knowledge on minimizing vigorous physical activity and ensuring sound rest during pregnancy, 85.3% on the importance of Tetanus Toxoid (TT) vaccine, 79.7% on additional food intake, 61.1% on consuming a balanced diet, 55.9% on facility-based delivery, 46% on the benefits of antenatal care, 40.6% on the impact of nutrients deficiency, 38% on the potential harmful effects of smoking and/or alcohol consumption, 23.3% on consuming more iron and folic acid and 20.5% on the impact of maternal mental well-being on the fetus (Table: 4.3).

Table 4.3: Knowledge on antenatal care guidelines of the pregnant women (n=463)

Knowledge variables	Categories	Frequency	Percentage
Know about the need of additional food intake during pregnancy period (around 300 kcal)	Yes	369	79.7
	No	94	20.3
Know the importance of consuming a balanced diet during pregnancy	Yes	283	61.1
	No	180	38.9
Know the need of consuming more iron & folic acid during pregnancy than pre-pregnancy period	Yes	108	23.3
	No	355	76.7
Know nutrients deficiency during pregnancy could affect the health status of both the mother & the infant	Yes	188	40.6
	No	275	59.4
Know the benefits of antenatal visit in health care center during pregnancy	Yes	213	46.0
	No	250	54.0
Know the benefits of facility-based delivery during childbirth	Yes	259	55.9
	No	204	44.1
Know the potential harmful effects of smoking and/or alcohol consumption during pregnancy	Yes	176	38.0
	No	287	62.0
Know to minimize vigorous physical activity and ensure sound rest during pregnancy	Yes	426	92.0
	No	37	8.0
Know the importance of Tetanus Toxoid (TT) vaccine required to be given during pregnancy	Yes	395	85.3
	No	68	14.7
Know the impact of maternal mental well-being on the fetus during pregnancy	Yes	95	20.5
	No	368	79.5

Around 71.5% studied population representing 331 pregnant women were identified of having a good knowledge whereas 132 pregnant women (28.5%) were found to have a poor knowledge score (Figure: 8).

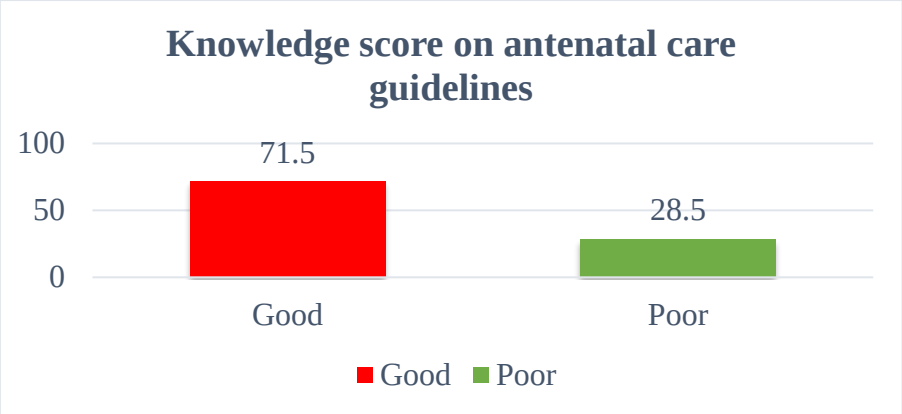

Figure 8: Knowledge score

4.4 Practice of antenatal care guidelines of the pregnant women

Evaluation on practice of antenatal care guidelines during pregnancy depicted that 98.3% participant has gone for antenatal check-up at least once in her current pregnancy, 80.8 % were emotionally well & stress free, 79.7% were taking IFA supplementation, 74.3% got at least one TT vaccination, 70.45 were still engaged in physically intensive day to day task, 27.2% were taking at least 8 hours of sleep daily, 16.6% were ensuring a variety diet daily, 12.1% were consuming additional food in their pregnancy period, 11.4% were willing to have an assisted delivery and only 7.1% smoking and/or consuming some form of alcohol. Practice of intaking additional food and ensuring a variety diet was comparatively way lower than their level of knowledge regarding those issue. Almost 410 pregnant women did not want to deliver their child on a health facility or a hospital and 337 pregnant women were having inadequate rest.

Table 4.4: Practice of antenatal care guidelines of the pregnant women (n=463)

Practice variables	Categories	Frequency	%
Consuming additional food in pregnancy	Yes	56	12.1
	No	407	87.9
Ensuring a variety of food in daily diet	Yes	77	16.6
	No	386	83.4
Taken Iron Folic Acid (IFA) supplementation	Yes	369	79.7
	No	94	20.3

Practice variables	Categories	Frequency	%
Doing laborious or physically intensive work on a daily basis	Yes	326	70.4
	No	137	29.6
Had gone for antenatal check-up at least once	Yes	455	98.3
	No	8	1.7
Willing to deliver baby in a health post/hospital	Yes	53	11.4
	No	410	88.6
Smoking and/or consuming alcohol	Yes	33	7.1
	No	430	92.9
Having at least 8 hours of sleep daily	Yes	126	27.2
	No	337	72.8
Had taken at least one Tetanus Toxoid (TT) vaccine in pregnancy period	Yes	344	74.3
	No	119	25.7
Emotionally well & stress free	Yes	374	80.8
	No	89	19.2

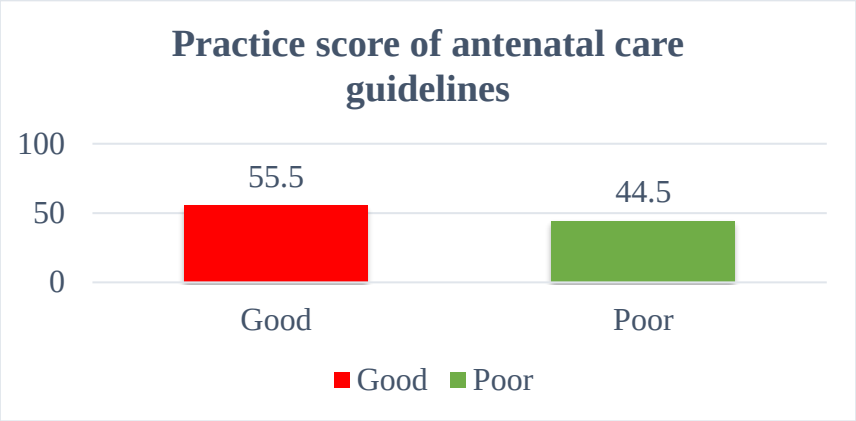

Figure 9: Practice score

In the studied population 257 pregnant women representing 55.5% were found to have good practice score regarding antenatal care guidelines and 206 pregnant women representing 44.5% of the population had poor practice (Figure: 9).

4.5 Association between knowledge and demographic & socio-economic characteristics

Among the 8 demographic & socio-economic parameters measured against the knowledge score of respondents, 5 variables were significantly associated ($p < 0.05$). Respondent's age ($p<0.001$), no of child ($p=0.011$), family type ($p<0.001$), husband's

occupational status (p=0.033) and household income source (p=0.003) parameters relationship with knowledge score was found to be significant (Table: 4.5).

Table 4.5: Association between knowledge and demographic & socio-economic characteristics

Demographic & socio-economic parameters		***Knowledge score***			**P Value**
Variables	**Categories**	**Good 331 (71.5%)**	**Poor 132 (28.5%)**	**Total N=463**	
Respondent's age	<20	17 (5.1%)	56 (42.4%)	73 (15.8%)	**<0.001**
	20-29	210 (63.4%)	58 (43.9%)	268 (57.9%)	
	30-39	91 (27.5%)	16 (12.1%)	107 (23.1%)	
	>=40	13 (3.9%)	2 (1.5%)	15 (3.2%)	
No of child the respondent has	0-3	216 (65.3%)	107 (81.1%)	323 (69.8%)	**0.011**
	4-6	85 (25.7%)	18 (13.6%)	103 (22.2%)	
	7-9	22 (6.6%)	5 (3.8%)	27 (5.8%)	
	>=10	8 (2.4%)	2 (1.5%)	10 (2.2%)	
Respondent's education level	No formal education	295 (89.1%)	123 (93.2%)	418 (90.3%)	0.336
	Primary	34 (10.3%)	9 (6.8%)	43 (9.3%)	
	Secondary	2 (0.6%)	0 (0.0%)	2 (0.4%)	
	Above Secondary	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Respondent's occupational status	Housewife	313 (94.6%)	131 (99.2%)	444 (95.9%)	0.066
	NGO worker	8 (2.4%)	0 (0.0%)	8 (1.7%)	
	Others	10 (3.0%)	1 (0.8%)	11 (2.4%)	
Family type	Joint	135 (40.8%)	100 (75.8%)	235 (50.8%)	**<0.001**
	Nuclear	196 (59.2%)	32 (24.2%)	228 (49.2%)	

Demographic & socio-economic parameters		*Knowledge score*			P Value
Variables	**Categories**	**Good 331 (71.5%)**	**Poor 132 (28.5%)**	**Total N=463**	
Husbands educational level	No formal education	241 (72.8%)	109 (82.6%)	350 (75.6%)	0.090
	Primary	72 (21.8%)	21 (15.9%)	93 (20.1%)	
	Secondary	14 (4.2%)	1 (0.8%)	15 (3.2%)	
	Above Secondary	4 (1.2%)	1 (0.8%)	5 (1.1%)	
Husbands occupational status	Day laborer	49 (14.8)	15 (11.4)	64 (13.8%)	**0.033**
	NGO worker	29 (8.8)	3 (2.3)	32 (6.9%)	
	Small business owner	38 (11.5)	11 (8.3)	49 (10.6%)	
	Unemployed	192 (58.0)	95 (72.0)	287 (62.0%)	
	Others	23 (6.9)	8 (6.1)	31 (6.7%)	
Source of household income source	Selling relief goods	68 (20.5)	19 (14.4)	87 (18.8%)	**0.003**
	Daily wages	55 (16.6)	18 (13.6)	73 (15.8%)	
	NGO work	29 (8.8)	3 (2.3)	32 (6.9%)	
	Small Business	35 (10.6)	10 (7.6)	45 (9.7%)	
	Other's	22 (6.6)	7 (5.3)	29 (6.3&)	
	No extra income	122 (36.9)	75 (56.8)	197 (42.5%)	

Positive association between respondents age and knowledge score indicates the prevalence of proper knowledge varies according to age which shows a statistically significant relationship. Same goes for the no of child, husband's occupational status & household income source. Respondents educational level, respondent's occupational status & husband's educational level showed a negative association (p value > 0.05). This indicates the relationship between these variables and knowledge score was statistically insignificant.

4.6: Association between practice & demographic and socio-economic characteristics

While evaluating the association between demographic & socio-economic characteristics and practice score, among 8 parameters 5 were found to be positively associated. No of child of the respondent (p=0.041), respondents' educational level (p<0.001), husband's educational level (p=0.039), husband's occupational status (p=0.025) and household income source (p<0.001) parameters relationship with practice score was found to be significant. Respondents age (0.060>0.05), respondent's educational level (0.192>0.05) & family type (0.187>0.05) were found to be negatively associated with practice score of the participants (Table: 4.6).

Table 4.6: Association between practice and demographic & socio-economic characteristics

Demographic & socio-economic parameters		***Practice score***			**P value**
Variables	**Categories**	**Good 257 (55.5%)**	**Poor 206 (44.5%)**	**Total N=463**	
Respondent's age	<20	49 (19.1%)	24 (11.7%)	73(15.8%)	0.060
	20-29	152 (59.1%)	116 (56.3%)	268 (57.9%)	
	30-39	52 (20.2%)	55 (26.7%)	107 (23.1%)	
	>=40	4 (1.6%)	11 (5.3%)	15 (3.2%)	
No of child the respondent has	0-3	202 (78.6%)	121 (58.7%)	323 (69.8%)	**0.041**
	4-6	43 (16.7%)	60 (29.1%)	103 (22.2%)	
	7-9	9 (3.5%)	18 (8.7%)	27 (5.8%)	
	>=10	3 (1.2%)	7 (3.4%)	10 (2.2%)	
Respondent's education level	No formal education	218 (84.8%)	200 (97.1%)	418 (90.3%)	**<0.001**
	Primary	38 (14.8%)	5 (2.4%)	43 (9.3%)	
	Secondary	1 (0.4%)	1 (0.5%)	2 (0.4%)	
	Above Secondary	0 (0.0%)	0 (0.0%)	0 (0.0%)	

Demographic & socio-economic parameters		***Practice score***			**P value**
Variables	**Categories**	**Good 257(55.5%**	**Poor 206(44.5%)**	**Total N=463**	
Respondent's occupational status	Housewife	239 (93.0%)	205 (99.5%)	444 (95.9%)	0.192
	NGO worker	8 (3.1%)	0 (0.0%)	8 (1.7%)	
	Others	10 (3.9%)	1 (0.5%)	11 (2.4%)	
Family type	Joint	138 (53.7%)	97 (47.1%)	235 (50.8%)	0.187
	Nuclear	119 (46.3%)	109 (52.9%)	228 (49.2%)	
Husbands educational level	No formal education	170 (66.1%)	180 (87.4%)	350 (75.6%)	**0.039**
	Primary	68 (26.5%)	25 (12.1%)	93 (20.1%)	
	Secondary	15 (5.8%)	0 (0.0%)	15 (3.2%)	
	Above Secondary	4 (1.6%)	1 (0.5%)	5 (1.1%)	
Husbands occupational status	Day laborer	51 (19.8%)	13 (6.3%)	64 (13.8%)	**0.025**
	NGO worker	29 (11.3%)	3 (1.55%)	32 (6.9%)	
	Small business owner	36 (14.0%)	13 (6.3%)	49 (10.6%)	
	Unemployed	120 (46.7%)	167 (81.1%)	287(62.0 %)	
	Others	21 (8.2%)	10 (4.9%)	31 (6.7%)	
Source of Household income	Selling relief goods	23 (8.9%)	64 (31.1%)	87 (18.8%)	**<0.001**
	Daily wages	54 (21.0%)	19 (9.2%)	73 (15.8%)	
	NGO work	30 (11.7%)	2 (1.0%)	32 (6.9%)	
	Small Business	34 (13.2%)	11 (5.3%)	45 (9.7%)	
	Other's	20 (7.8%)	9 (4.4%)	29 (6.3%)	
	No extra income	96 (37.4%)	101 (49.0%)	197 (42.5%)	

4.7 Antenatal care practices

4.7.1 ANC visit

Among 463 respondents 455 (98.3%) had gone for an ANC check up during their current pregnancy and 8 (1.7%) didn't attend. In those 455 women 76% had 1 ANC visit, 16% had 2 ANC visit, 6% had 3 ANC visit and only 2% had visited nearby hospital or health care center 4 times for their ANC checkup (Figure: 10).

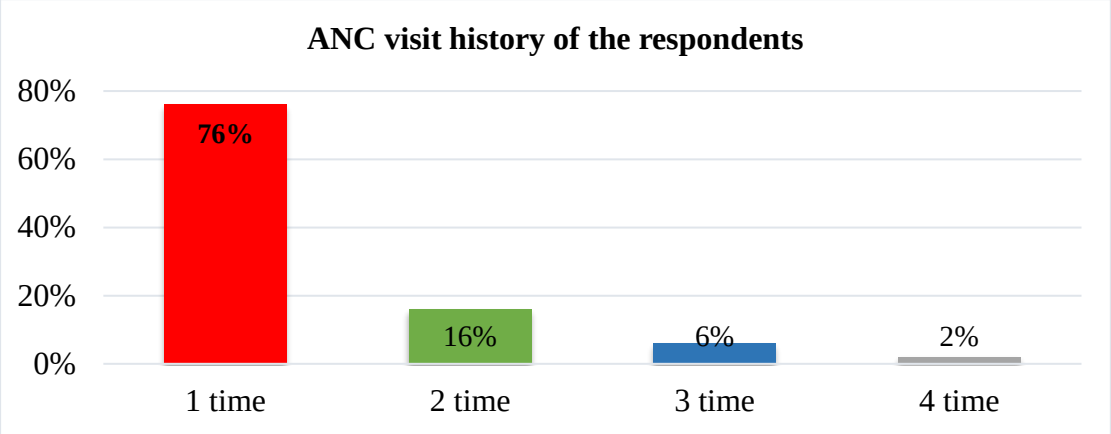

Figure 10: ANC visit story of the respondents

4.7.2 Preference for place of delivery

About 57% of the participants responded that they want to give birth of their unborn child at home, 32% preferred going to a local midwife/healer of their community and 11% said that they want to deliver their child at a hospital (Figure: 11).

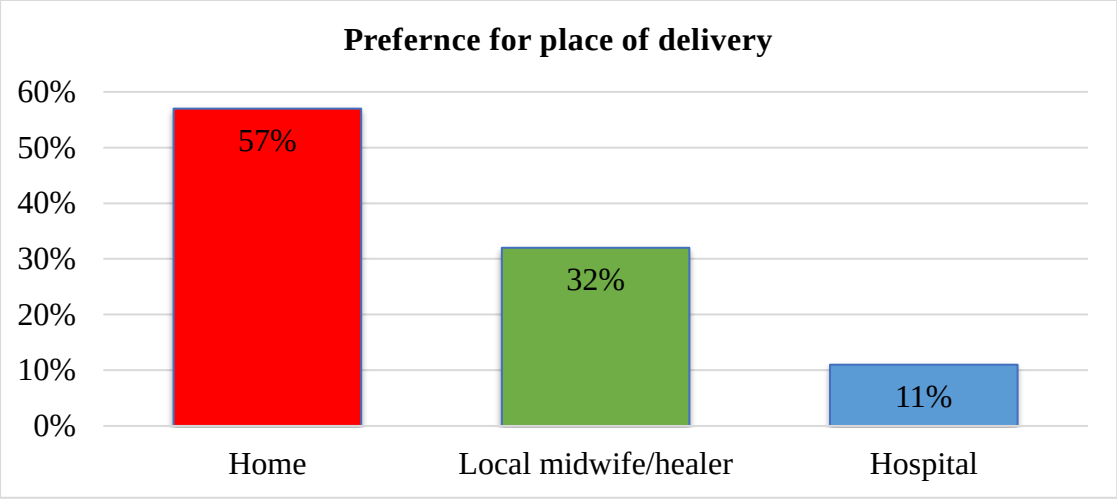

Figure 11: Preference for place of delivery

4.7.3 IFA consumption:

Among 463 participants 369 stated that they were consuming IFA during their pregnancy. In these 369 women 60% consumed IFA once a day, 12% consumed once every 3 days and 8% consumed once a week. The rest 94 women stated that they were not having IFA which estimated at around 21% of the population (Figure: 12).

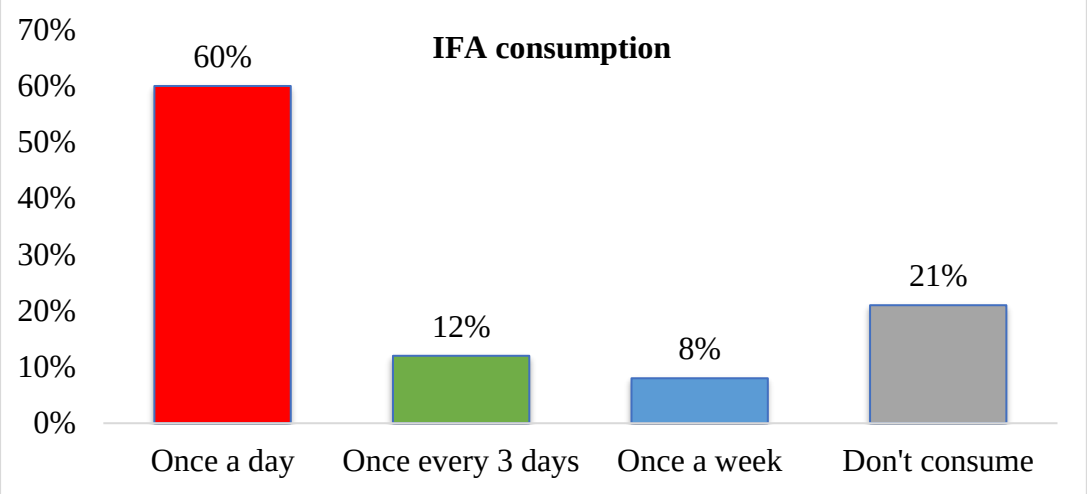

Figure 12: IFA consumption

4.8: Frequency of food intake

4.8.1 Food intake practice

Pregnancy influences the dietary intake of a women in various ways. When asked, how pregnancy has influenced their food intake, only 56 women said that their food intake increased thus representing 12% of the population. Among the rest 407 participants 70% replied that their food intake decreased and 19% stated that there was no change in their pre-pregnancy and pregnancy food consumption (Figure: 13).

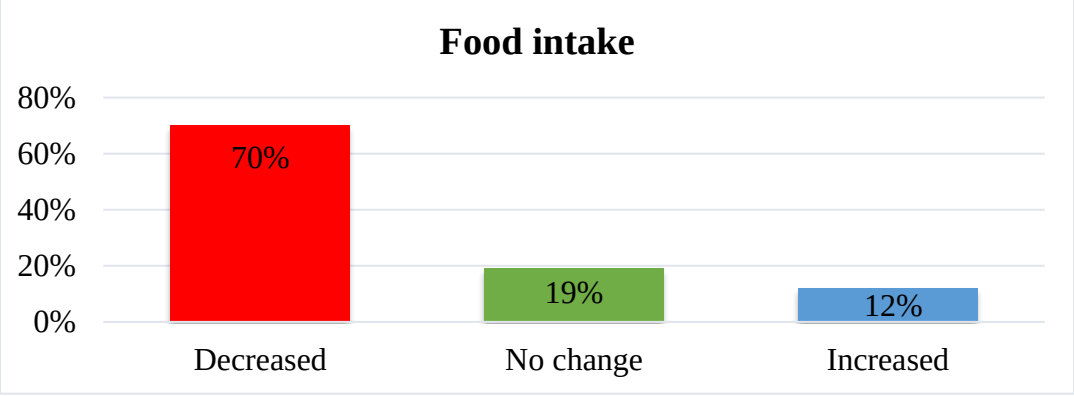

Figure 13: Food intake

4.8.2 Frequency of taking a meal

Each participant was asked how many meals they usually take per day after being pregnant. More than half of them (55%) replied that they take around 2-3 meals, 27% replied of having 1-2 meals and 11% confessed of taking 3-4 meals per day. Only 4% of the studied population stated that they take only 1 meal a day and 3% said to have more than 4 meals per day (Figure: 14).

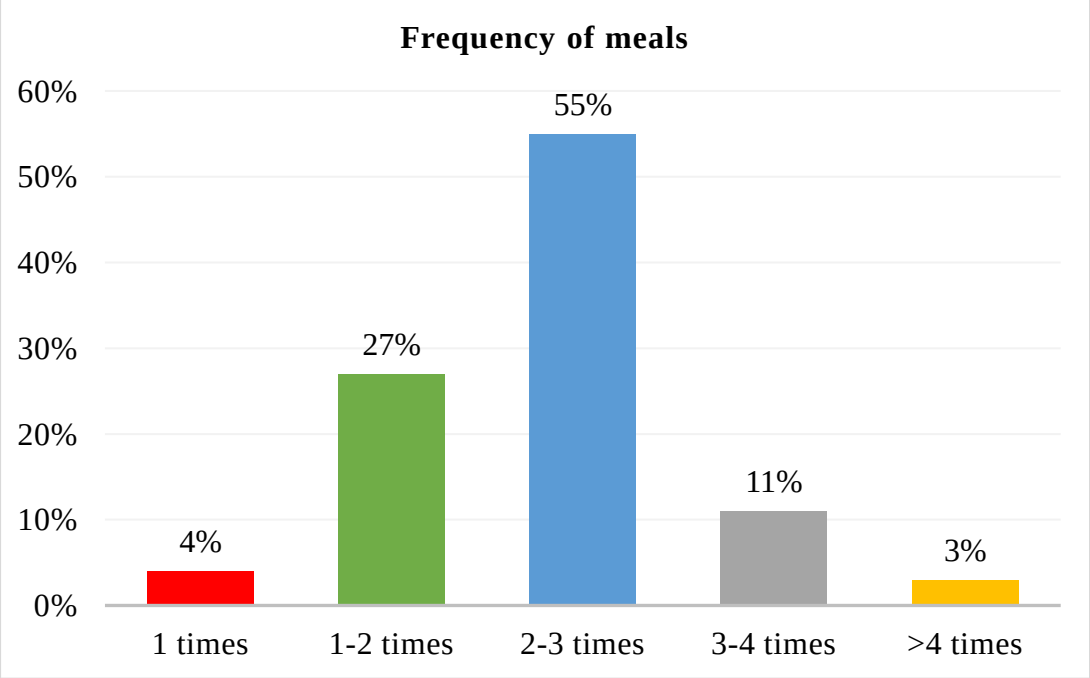

Figure 14: Frequency of meals taken per day

4.9 Dietary practice:

4.9.1 Food group consumption:

To assess the dietary practice participants were asked what they ate in the last 24 hour and from that information types of food groups they consumed in one day was identified. 9 food groups were considered for evaluation based on the Women Dietary Diversity Score (WDDS). Any in between meals consumed both in home or outside home were also considered for a holistic picture. Visual aids like flip books of UNICEF were used for better and accurate identification of food groups consumed throughout the day.

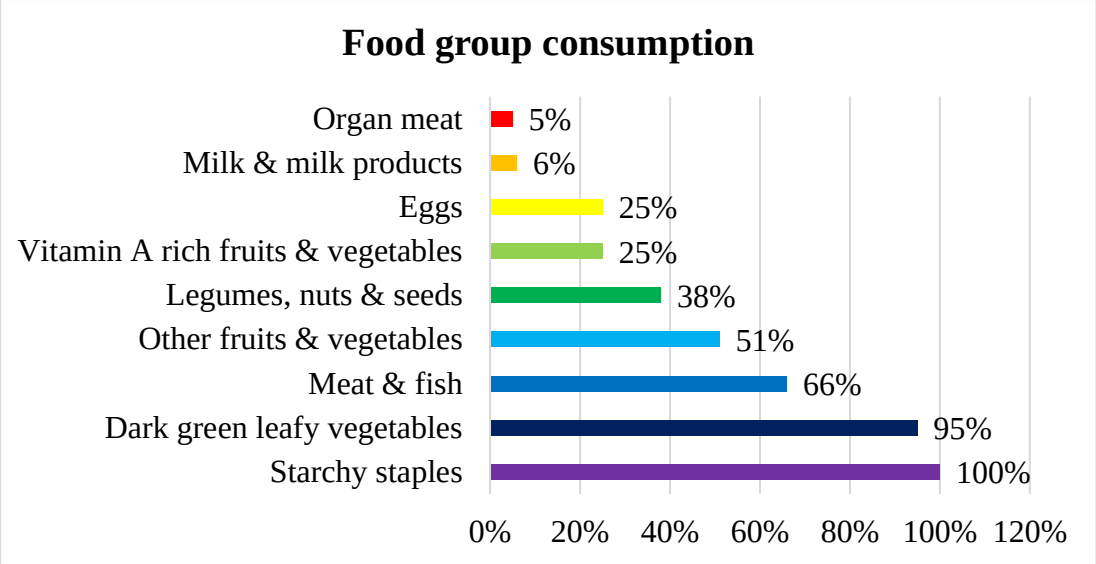

Figure 15: **Food group consumption**

Based on the extracted data it was noticed that every participant consumed some sort of starchy staples. Dark green leafy vegetables were widely popular with 95% people eating it. Although other fruits & vegetables (51%) and vitamin-A rich fruits & vegetables (25%) were not as extensively consumed as dark green leafy vegetables. Meat and fish were the most popular among the protein sources (66%), legumes, nuts & seeds (38%) being second and eggs (25%) scoring last. The least consumed food group was milk & milk products (6%) and organ meat (5%) (Figure: 15).

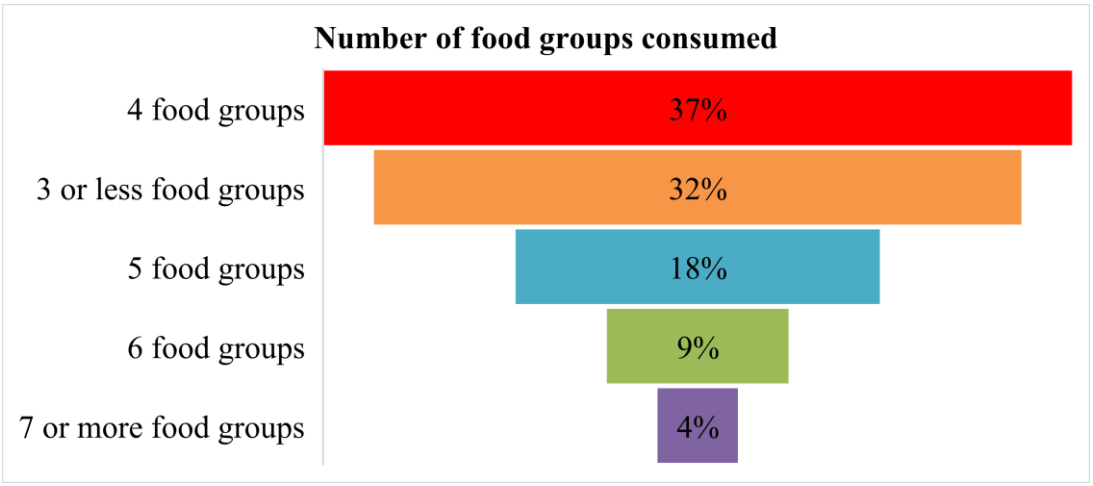

Figure 16: **Number of food groups consumed**

While weighing how many types of food groups were consumed by the participants in the 24 period, it was discovered that around 37% consumed 4 food groups, 32% consumed ≤3 food groups, 18% consumed 5 food groups and 9% consumed 6 food groups. Only a minute 4% consumed ≥7 food groups in the entire day (Figure: 16).

Table 4.9.1: Frequency of each food group consumed

Food group	None	1/day N (%)	2/ day N (%)	3/ day N (%)	4/day N (%)
Starchy staples	---	21 (4.5%)	256 (55.3%)	182 (39.3%)	4 (.9%)
Dark green leafy vegetables	22 (4.8%)	224 (48.4%)	216 (46.7%)	1 (0.2%)	---
Vitamin A rich fruits & vegetables	346 (74.7%)	94 (20.3%)	23 (5%)	---	---
Other fruits & vegetables	231 (49.9%)	224 (48.4%)	8 (1.7%)	---	---
Organ meat	442 (95.5%)	21 (4.5%)	---	---	---
Meat & fish	156 (33.7%)	226 (48.8%)	81 (17.5)	---	---
Eggs	349 (75.4%)	107 (23.1%)	7 (1.5%)	---	---
Legumes, nuts & seeds	287 (62%)	165 (35.6%)	11 (2.4)	---	---
Milk & milk products	435 (94%)	28 (6%)	---	---	---

Starchy staples were consumed by each participant in which over half (55.3%) of them ate it 2 times, 39.3% ate it 3 times, 4.5% ate it 1 time and only 9% ate it 4 times in a day. The second most popular food, dark green leafy vegetables was consumed 2 times by 46.7% and 1 time by 48.4%. Vitamin A rich fruits and vegetables was eaten 2 times by 5% and 1 time by 20.3% study population. 17.5% participant ate meat and fish 2 times and 48.8% ate 1 time. 1 Egg was eaten by 23.1% and only 7 participants ate 2 eggs at the reference period. 35.6% ate legumes, nuts and seeds once that day and only 2.45% ate twice. Other fruits and vegetables were eaten twice by 48.4% and once by 1.7% women. Being the least consumed food, organ meat (4.5%) and milk & milk products (6%) were only eaten once (Table: 4.9.1).

4.9.2 Dietary diversity

Nine food groups were proposed on the WDDS measurement method to assess dietary diversity of women. The score was divided into 3 categories representing low, medium and high dietary diversity score. High dietary diversity score ranges from 7-9, Medium dietary diversity score ranges from 4-6 & Low dietary diversity score ranges from 1-3.

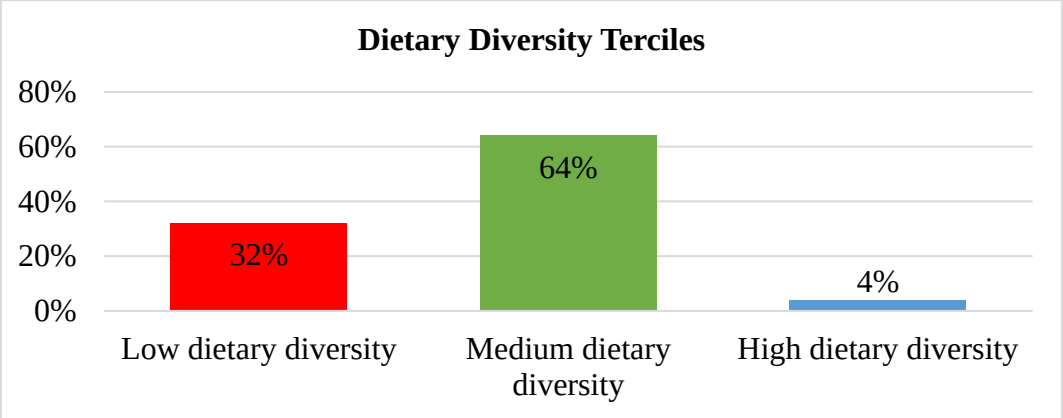

Figure 17: Dietary diversity score terciles

Around 2/3rd (64%) of the participants were found to have medium dietary diversity score, 1/3rd (32%) to have low dietary diversity score and only 4% to have a high dietary diversity score (Figure: 17).

4.10. Association between dietary diversity score and demographic & socio-economic characteristics

The association between the parameters of demographic & socio-economic characteristics were measured against the dietary diversity of the respondents. Among 8 parameters, 6 were found positively associated with a p value of <0.001 for respondent's age, <0.001 for respondents' educational level, <0.001 for respondents' occupational status, 0.048 for husband's educational level, 0.037 for husband's occupational status and household income source. These indicates that the relationship between these six demographic and socio-economic characteristics with dietary practice were statistically significant. A negative association was found for no of children of the respondent (0.075>0.05) and family type (0.262>0.05) against dietary practice which means that there is no relationship between dietary diversity and family type and between dietary diversity and no of the children of the respondent.

Table 4.10: Association between dietary diversity score and demographic & socio-economic characteristics

Demographic & socio-economic parameters		***Dietary diversity***				**P Value**
Variables	**Categories**	**High dietary diversity N (%) 18 (3.9)**	**Low dietary diversity N (%) 148 (32.0)**	**Medium dietary diversity N (%) 297 (64.1)**	**Total N (%) 463**	
Respondent's age	<20	0 (0.0)	39 (26.4)	34 (11.5)	73 (15.8)	**<0.001**
	20-29	15 (83.3)	70 (47.3)	182 (61.5)	267(57.8)	
	30-39	3 (16.7)	32 (21.6)	72 (24.3)	107 (23.2)	
	>=40	0 (0.0)	7 (4.7)	8 (2.7)	15 (3.2)	
Number of children the respondent has	0-3	18 (100)	105 (70.9)	199 (67.2)	322 (69.7)	0.075
	4-6	0 (0.0)	26 (17.6)	77 (26.0)	103 (22.3)	
	7-9	0 (0.0)	13 (8.8)	14 (4.7)	27 (5.8)	
	>=10	0 (0.0)	4 (2.7)	6 (2.0)	10 (2.2)	**<0.001**
Respondents educational level	No formal education	5 (27.8)	145 (98.0)	267 (90.2)	417 (90.3)	
	Primary	12 (66.7)	3 (2.0)	28 (9.5)	43 (9.3)	
	Secondary	1 (5.6)	0 (0.0)	1 (0.3)	2 (0.4)	
	Above Secondary	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Respondents occupational status	Housewife	6 (33.3)	148 (100.0)	289 (97.6)	443 (95.9)	**<0.001**
	NGO worker	6 (33.3)	0 (0.0)	2 (0.7)	8 (1.7)	
	Others	6 (33.3)	0 (0.0)	5 (1.7)	11 (2.4)	
Family type	Joint	4 (22.2)	89 (60.1)	141 (47.6)	234 (50.6)	0.262
	Nuclear	14 (77.8)	59 (39.9)	155 (52.4)	228 (49.4)	

Demographic & socio-economic parameters		***Dietary diversity***				**P Value**
Variables	**Categories**	**High dietary diversity N (%) 18 (3.9)**	**Low dietary diversity N (%) 148 (32.0)**	**Medium dietary diversity N (%) 297 (64.1)**	**Total N (%) 463**	
Husbands educational level	No formal education	0 (0.0)	126 (85.1)	223 (75.3)	349 (75.5)	**0.048**
	Primary	9 (50.0)	22 (14.9)	62 (20.9)	93 (20.1)	
	Secondary	6 (33.3)	0 (0.0)	9 (3.0)	15 (3.2)	
	Above Secondary	3 (16.7)	0 (0.0)	2 (0.7)	5 (1.1)	
Husbands occupational status	Day laborer	1 (5.6)	13 (8.8)	50 (16.9)	64 (13.9)	**0.037**
	NGO worker	10 (55.6)	3 (2.0)	19 (6.4)	32 (6.9)	
	Small business owner	3 (16.7)	6 (4.1)	40 (13.5)	49 (10.6)	
	Unemployed	1 (5.6)	119 (80.4)	166 (56.1)	286 (61.9)	
	Others	3 (16.7)	7 (4.7)	21 (7.1)	31 (6.7)	
Source of household income	Selling relief goods	0 (0.0)	36 (24.3)	50 (16.9)	86 (18.6)	**<0.001**
	Daily wages	1 (5.6)	14 (9.5)	58 (19.6)	73 (15.8)	
	NGO work	11 (61.1)	3 (2.0)	18 (6.1)	32 (6.9)	
	Small Business	3 (16.7)	6 (4.1)	36 (12.2)	45 (9.7)	
	Other's	3 (16.7)	7 (4.7)	19 (6.4)	29 (6.3)	
	No extra income	0 (0.0)	82 (55.4)	115 (38.9)	197 (42.6)	

4.11. Nutritional status of the respondents

Nutritional status of a women can be measured both by assessing MUAC and BMI. In humanitarian context MUAC is preferred for its simplicity and user-friendliness. In this study both of the method was adopted to identify the nutritional status of the respondents. Result revealed that 10.6% (49) studied population was malnourished (MUAC<21cm) and the rest 89.4% (414) were identified as normal or nourished (≥21 cm). Whereas using BMI as the assessment method the results showed a slightly altered outcome where 18.8% (87) fall into the category of underweight (<18.5), 63.3% (293) in normal (18.5-24.9), 17.1% (79) in overweight (25.0-29.9) and only 0.9% (4) at obese (≥30) category (Table :4.1).

Table 4.11: Nutritional status by MUAC & BMI of the respondents

Variables	Categories	Frequency	Percentage
MUAC	Malnourished (<21.0 cm)	49	10.6%
	Normal (>21.0 cm)	414	89.4%
BMI	Underweight (<18.5)	87	18.8%
	Normal (18.5-24.9)	293	63.3%
	Overweight (25.0 – 29.9)	79	17.1%
	Obese (≥30.0)	4	0.9%

4.12. Association with respondents age and dietary practice

The dietary practice of the participants to be specific food intake during pregnancy, frequency of meals per day and IFA supplementation were assessed against the respondents age. The results stated positive association with respondents age and all the segments of dietary practice. A p value of <0.001 was found for frequency of meals. For food intake variables the p value was 0.042. Thus, this indicates that the relationship between dietary practice and respondents age is statistically significant. The relationship between respondents age and IFA supplementation were negatively associated as the p value was 0.078 which is more than 0.05.

Table 4.12: Association with respondents age and dietary practice

Dietary Practice		***Respondents age***					**P value**
Variables	**Categories**	**<20 N (%) 73 (15.8)**	**>=40 N (%) 15 (3.2)**	**20-29 N (%) 268 (57.9)**	**30-39 N (%) 107 (23.1)**	**Total N (%) 463**	
Food intake	Increased	0 (0.0)	0 (0.0)	42 (15.7)	12 (11.2)	54 (11.7)	**0.042**
	Decreased	63 (86.3)	10 (66.7)	178 (66.4)	71 (66.4)	322 (69.5)	
	No Change	10 (13.7)	5 (33.3)	48 (17.9)	24 (22.4)	87 (18.8)	
Frequency of meals	1 time	11 (15.1)	0 (0.0)	6 (2.2)	1 (0.9)	18 (3.9)	**<0.001**
	1-2 times	32 (43.8)	5 (33.3)	62 (23.1)	26 (24.3)	125 (27.0)	
	2-3 times	28 (38.4)	7 (46.7)	152 (56.7)	68 (63.6)	255 (55.1)	
	3-4 times	2 (2.7)	3 (20.0)	36 (13.4)	10 (9.3)	51 (11.0)	
	More than 4 times	0 (0.0)	0 (0.0)	12 (4.5)	2 (1.9)	14 (3.0)	
IFA supplementation	Don't consume	19 (26.0)	10 (66.7)	42 (15.7)	24 (22.4)	95 (20.5)	0.078
	Once a day	44 (60.3)	3 (20.0)	183 (68.3)	48 (44.9)	278 (60.0)	
	Once every 3 days	5 (6.8)	0 (0.0)	30 (11.2)	19 (17.8)	54 (11.7)	
	Once a week	5 (6.8)	2 (13.3)	13 (4.9)	16 (15.0)	36 (7.8)	

4.13.Association between dietary practice and gestation period

The dietary practice of the participants to be specific food intake during pregnancy, frequency of meals per day and IFA supplementation were assessed against the gestation period of the respondents. Food intake during pregnancy, frequency of meals per day were found positively associated with a p value of <0.001 whereas negative association was found between IFA supplementation and gestation period with a p value of 0.109. This interprets that, the IFA supplementation consumption practice doesn't vary according to gestation period thus showcasing a statistically insignificant relationship (Table: 4.13).

Table 4.13: Association between dietary practice and gestation period

Dietary Practice		***Gestation period***				
Variables	**Categories**	**1st trimester N(%)=146 (31.5)**	**2nd trimester N(%)=234 (50.5)**	**3rd trimester N(%)=83 (17.9)**	**Total N(%)= 463**	**P value**
Food intake	Increased	11 (7.5)	23 (9.8)	20 (24.1)	54 (11.7)	**<0.001**
	Decreased	112 (76.7)	157 (67.1)	53 (63.9)	322 (69.5)	
	No Change	23 (15.8)	54 (23.1)	10 (12.0)	87 (18.8)	
Frequency of meals	1 time	7 (4.8)	8 (3.4)	3 (3.6)	18 (3.9)	**<0.001**
	1-2 times	41 (28.1)	61 (26.1)	23 (27.7)	125 (27.0)	
	2-3 times	86 (58.9)	134 (57.3)	35 (42.2)	255 (55.1)	
	3-4 times	10 (6.8)	29 (12.4)	12 (14.5)	51 (11.0)	
	More than 4 times	2 (1.4)	2 (0.9)	10 (12.0)	14 (3.0)	
IFA supplementation	Don't consume	33 (22.6)	39 (16.7)	23 (27.7)	95 (20.5)	0.109
	Once a day	81 (55.5)	153 (65.4)	44 (53.0)	278 (60.0)	
	Once every 3 days	18 (12.3)	29 (12.4)	7 (8.4)	54 (11.7)	
	Once a week	14 (9.6)	13 (5.6)	9 (10.8)	36 (7.8)	

4.14 Factors Associated with nutritional status among Pregnant Women

Table 4.14: Factors Associated with nutritional status among Pregnant Women

Variable	Categories	Malnourished <21 cm MUAC	Normal >21 cm MUAC	COR 95% CI (uni-variable)	AOR 95% CI (multi-variable)
Age of respondent	<20	25 (34.2)	48 (65.8)	-	-
	≥40	3 (20.0)	12 (80.0)	2.08 (0.60-9.76)	2.08 (0.29-16.27)
	20-29	18 (6.7)	250 (93.3)	7.23 (3.69-14.47)	3.63 (1.40-9.48)
	30-39	3 (2.8)	104 (97.2)	11.06 (4.97-28.47)	4.76(1.98-14.44)
Gestation period	1st trimester	8 (5.5)	138 (94.5)	-	-
	2nd trimester	30 (12.8)	204 (87.2)	0.39 (0.16-0.85)	0.36 (0.14-0.86)
	3rd trimester	11 (13.3)	72 (86.7)	0.38 (0.14-0.98)	0.23 (0.07-0.69)
Pregnancy status	Primi-gravida	14 (29.8)	33 (70.2)	-	-
	Multi-gravida	35 (8.4)	381 (91.6)	4.62 (2.21-9.32)	1.22 (0.43-3.46)
Respondents educational level	No formal education	48 (11.5)	370 (88.5)	-	-
	Primary	1 (2.3)	42 (97.7)	3.45 (1.14-11.69)	2.59 (1.21-15.63)
	Secondary	0 (0.0)	2 (100.0)	746959.51 (0.00-NA,)	2322585.63 (0.00-NA)
	Above Secondary	0 (NaN)	0 (NaN)	-	-

Variable	Categories	Malnourished <21 cm MUAC	Normal >21 cm MUAC	COR 95% CI (uni-variable)	AOR 95% CI (multi-variable)
Family type	Joint	38 (16.2)	197 (83.8)	0.26 (0.12-0.51)	0.60 (0.20-1.68)
	Nuclear	11 (4.8)	217 (95.2)	-	-
Husbands educational level	No formal education	40 (11.4)	310 (88.6)	-	-
	Primary	8 (8.6)	85 (91.4)	1.37 (0.65-3.26)	0.49 (0.16-1.53)
	Secondary	1 (6.7)	14 (93.3)	1.81 (0.35-33.17)	0.05 (0.00-2.01)
	Above Secondary	0 (0.0)	5 (100.0)	742943.59 (0.00-NA)	2898604.51 (0.00-NA)
Source of household income	Selling relief goods	9 (10.3)	78 (89.7)	-	-
	Daily wages	3 (4.1)	70 (95.9)	2.69 (0.77-12.50)	4.39 (1.13-32.99)
	NGO work	2 (6.2)	30 (93.8)	1.73 (0.42-11.79)	2.94 (0.34-37.79)
	Small Business	1 (2.2)	44 (97.8)	4.08 (0.91-25.17)	5.30 (1.32-65.43)
	Other’s	3 (10.3)	26 (89.7)	1.00 (0.27-4.76)	2.11 (0.39-13.65)
	No extra income	31 (15.7)	166 (84.3)	0.62 (0.27-1.31)	0.88 (0.57-1.95)

Variable	Categories	Malnourished <21 cm MUAC	Normal >21 cm MUAC	COR 95% CI (uni-variable)	AOR 95% CI (multi-variable)
Knowledge score	Good	18 (5.4)	313 (94.6)	-	-
	Poor	31 (23.5)	101 (76.5)	0.19 (0.10-0.35)	0.38 (0.16-0.85)
Practice score	Good	23 (8.9)	234 (91.1)	-	-
	Poor	26 (12.6)	180 (87.4)	0.68 (0.37-1.23)	0.52 (0.24-1.11)

On multivariable logistic regression analysis, respondent's age, pregnancy status, respondent's educational level, household income was significantly associated with the nutritional status of pregnant women.

Compared to pregnant women of <20 years old, ≥40 years old were 2.08 times more likely [AOR: 2.08, 95% (0.29-16.27)], 20-29 years old were 3.63 times more likely [AOR:3.63, 95% (1.40-9.48)] and 30-39 years old were 4.76 times more likely [AOR:4.76, 95% (1.98-14.44)] to have a normal nutritional status. Pregnant women with a multigravida status were 1.22 times more likely [AOR: 1.22, 95% (0.43-3.46)] to have a good nutritional state than pregnant women with a primigravida status. Pregnant women with a primary level education were 2.59 times more likely [AOR: 2.59, 95% (1.21-15.63)] to have a normal MUAC than pregnant women with no formal education. Compared to selling relief goods as household income, other source of household income were 2.11 times more likely [AOR: 2.11, 95%(0.39-13.65)], NGO work as household income were 2.94 times more likely [AOR: 2.94, 95%(0.34-37.79)] , daily wages as household income were 4.39 times more likely [AOR:4.39, 95%(1.13-32.99)] and small business as household income were 5.30 times more likely [AOR: 5.30, 95%(1.32-65.43)] to have a pregnant women with normal nutritional status.

4.15. Summary of the result:

Around 71.5% of the participants were identified of having a good knowledge score and 28.5% with a poor knowledge score. Underwhelming level of knowledge was found on the need of consuming more iron and folic acid during pregnancy (23.3%), on the impact of nutrients deficiency during pregnancy (40.6%) & on the benefits of ANC checkup (46%). Respondent's age, no of child of the respondent, family type, husband's occupational status, source of household income were found positively associated with knowledge score. In terms of practice 55.5% were found to have good practice score and 44.5% with a poor practice score. The least level of practice was seen on consuming additional food during pregnancy (12.1%) ensuring a variety of food in daily diet (16.6%), and having at least 8 hr. of sleep daily (27.2%). No of child of the respondent, respondents' educational level, husband's educational level, husband's occupational status and household income source were found positively associated with practice score.

Among the participants who had ANC visit, 76% had visited once, 16% had visited twice, 6% had visited thrice and only 2% had gone for an ANC checkup 4 times. 79.7% were found of consuming IFA supplementation in which 60% consume once a day, 12% consume once every 3 days, 8% consume once a week and 21% doesn't consume any form of IFA. Around 57% pregnant women preferred a home delivery, 32% preferred an assisted delivery by a local midwife/healer and only 11% showed willingness to deliver their child at a health post or hospital.

In terms of dietary practice, 70% pregnant women stated that their food intake decreased, 19% stated no change and only 12% confirmed of increased food intake during their pregnancy. 55% of pregnant women were identified of having 2-3 meals per day, 27% of having 1-2 meals. 11% of having 3-4 times. The most consumed food group was starchy staples (100%) and dark green leafy vegetables (95%). The least consumed food group was vitamin A rich fruits & vegetables (25%), eggs (25%), milk & milk products (6%) and organ meat (5%). Only 37% pregnant women were identified of having 4 food groups daily and 32% had ≤3 food groups. Among 463 participants, 64% had medium dietary diversity, 32% had low dietary diversity & only 4% had high dietary diversity. Respondent's age, respondents' educational level, respondent's occupational status, husband's educational level, husband's occupational status and

household income source was found positively associated with dietary diversity score. Food intake during pregnancy & frequency of meals per day were identified of having a positive relationship with both respondent's age & gestation period.

Around 10.6% of the pregnant women were malnourished based on MUAC assessment. But according to BMI 18.8% were identified as underweight and 63.3. % as normal. On multivariable logistic regression analysis, respondent's age, pregnancy status, respondent's educational level, household income was significantly associated with the nutritional status of pregnant women.

Chapter 5: Discussion

5.1 Introduction

The objective of this study was to determine the demographic and socio-economic characteristics among Rohingya Pregnant women, evaluate the knowledge and practice of antenatal care guidelines in Rohingya pregnant women, assess the dietary practice and nutritional status among Rohingya pregnant women, establish the relationship among socio-economic and demographic characteristics, knowledge and practice of antenatal guidelines, dietary practice and nutritional status of Rohingya pregnant women. This segment discusses the study findings based on the study objective & analyzes the extracted result with the findings of other similar research.

5.2. Demographic & socio-economic characteristics of the respondents

A survey to assess the state of the Rohingya population situation right after they sought refuge in Bangladesh discovered 76% of Rohingya family members over the age of 15 reported of having no formal education (Mahmud, 2018). In terms of educational demographics, data from 10,805 Rohingya refugees revealed that just 7.6% of the entire Rohingya refugee community had finished at least primary level formal education with only 0.8% of them who had an educational level of secondary or higher. However, around 37.7% had acquired some form of religious education, while 23.6% hadn't even passed primary school (iccdr,b, 2018). In this study husbands' educational level were found at 75.6% with no formal education, 20.1% with a primary education and only 4.3% with a secondary education level or higher. When the educational features of women of reproductive age (13-49 years) were examined, it was discovered that 31% had no formal education, 45.1% had some type of religious education, and 19.6% had an incomplete primary education. Only 4% had a completed primary education, with 0.3% having a secondary or higher education (iccdr,b, 2018). Another study conducted at 2022 about family planning on women of the Rohingya population stated 51.8% of having no education, 26.8% with incomplete primary education and only 21.6% with a primary education or higher (Azad et al., 2022). A KAP study on Rohingya women about wash & nutrition found 79.6% women as illiterate and 20.4% with an educational level of primary or above (Haque et al., 2020). In this study pregnant women's educational level were found at 90.3% with no formal education, 9.3% with a primary

education and only 4% with a secondary education level which aligns with the existing evidence.

One study assessed the occupational status of the Rohingya women and found 78% as housewife and the rest 22% engaged in some sort of work or family business (Azad et al., 2022). Another study found 96.1% women of the studied population as housewife and 3.9% as employed (small business, daily wager) (Rawal et al., 2021). In this study 95.9% pregnant women were identified as housewife and only 4.1% involved money-earning context which is quite similar to the previous study result. However, a KAP study on family planning of Rohingya women found 62.8% women as housewife, 2.3% as student and 34.9% as worker (Tahir et al., 2022).

In a survey aimed for demographic profiling of Rohingya community found out that, 42.4% of women who had ever been pregnant had 4 or more children, while 57.7% had 3 or less (iccdr,b, 2018). Another study on rohingya female refugees found 80.3% women to have ≤3 child and 19.7% to have ≥4 child (Tahir et al., 2022). The results were quite adjacent with the findings of this study where 69.8% of the studied sample were found to have ≤3 child and 30.2% to have ≥4.

While demographic profiling, (iccdr,b, 2018) also found that among the pregnant women 13.2% were under the age of 18, while more than 80% were under the age of 30. In this study 15.8% of the sample lied within the age of <20 years and 73.7% of them under the age of 30. In most of the studies, the highest population lies with the age range of 20-29 with one study stating a whopiing 63.8% in this category (Rawal et al., 2021) which is similar to the current study where 57.9% of the pregnant women were from this age range.

5.3. Knowledge and practice of antenatal guidelines of the pregnant women

5.3.1 Knowledge & Practice Score

A KAP (Knowledge, Attitude & Practices) study conducted at a district level hospital in North Delhi found antenal care practice score 62% whereas the knowledge score lies at a rather lower side of 17% (Bej, 2020). A similar study done on Pune revealed 58% knowledge score and 70% practice score among the pregnant women attending antenatal clinic (Patel et al., 2016). A Nigerian survey of pregnant women attending hospitals for antenatal care revealed that 76.8% of respondents had an excellent

understanding of healthy nutrition, 13.5% had a fair understanding of healthy nutrition, and 9.7% had a poor understanding of healthy nutrition. Additionally, 39.6% practice healthy nutrition properly, 33.3% practice healthy nutrition adequately, and 27.1% practice healthy nutrition poorly (Ehwarieme et al., 2019). Another KAP study regarding nutrition & diet in the recently delivered syrian refugee woman noticed only 44% to have a good knowledge and 53% to have good dietary practice (Harb et al., 2018). A similar study on refugee context at Kigeme Refugee Camp, Rwanda discovered 53.6% have a high knowledge but with a poor practice of 71.8% (Iradukunda and Ngomi, 2011). In this study 71.5% of the population was found of having good knowledge regarding antenatal care guidelines but only 55.5% of them exhibiting adequate practice.

5.3.2. Level of knowledge

In a refugge camp at Rwanda 100% of the pregnant women knew about the need of a balanced diet in pregnancy and impact of nutrients deficiency on the health status of both the mother the child and 97.3% had adequate knowledge on increased need of iron in pregnancy & the requirement of IFA in antenatal period (Iradukunda and Ngomi, 2011). A study conducted at rural part of India evaluated nutritional literacy where expecting patients were aware of the purpose of food (40.1%), the significance of food (45.5%), and the value of a balanced and healthy diet (43.9%). They had adequate awareness of the nutritional requirements for optimal bodily function (59.9%) and for fighting illnesses (67.2%) (Nagi et al., 2016). A study done on the slum area at Khulna found that 93.75% of mothers had very limited understanding about vitamin and mineral deficient disorders and 80% of them had insufficient knowledge on food-related issues (Sultana and Hasan, 2020). Although in our study participants had satisfactory knowledge in most of the categories of antenatal care guidelines but some prominent knowledge gap were also found. Among the rohingya pregnant women, 76.7% didn’t know the need of consuming more iron and folic acid during pregnancy compared to pre-pregnancy period, 59.4% didn’t know nutrients deficiency during pregnancy can affect the health of both the baby and the mother and 54% were not aware of the benefits of antenatal checkup. Alongside, only 20.5% were familiar with the impact of maternal mental well-being on the fetus.

5.3.3 Association with knowledge

A study on pregnant women attending and not-attending ANC clinics found that higher frequency of ANC clinic visits and maternal education level were strongly associated with maternal health knowledge (Ghimre et al., 2013). An Ethiopian cross-sectional study revealed a strong positive relationship between women's educational status, family income, attitude, number of pregnancies, and dietary awareness during pregnancy. Knowledge, family income, spouse education, and occupation were all associated with appropriate dietary behaviors during pregnancy (Zelalem et al., 2018). A study conducted at rural areas of dhaka city highlighted that level of high nutritional knowledge was substantially correlated with respondent age, family size, and number of pregnancies (Hossain et al., 2020). The current study discovered positive association ($p<0.05$) between knowledge level and no of child, husband's occupational status, source of household income. Besides that the study also portrayes statistically significant relationship ($p<0.001$) between knowledge level and respondent's age & family time in the Rohingya community.

5.3.4. Level of practice

In an Indian study, 20.6% were found who have gone for antenatal checkups 3 times during their pregnancy, 92% knew the requirement & importance of getting TT vaccine while being pregnant (Sitalakshmi et al., 2020). 95% IFA consumption & 5% pregnant women smoking during pregnancy was noticed on a study on humanatarian context based on Syria (Harb et al., 2018). While trying to identify a gap in the antental care of Bangladesh, researcher discovered that only 25% of the pregnant women attended nationally recommended ≥4 antental checkups (Siddique et al., 2018). Another study addressed at host community of Cox's bazar found that 74% of deliveries took place at home, and 71% of deliveries were attended by unlicensed traditional midwives (Hossain et al., 2020).

While assessing health risks in the Rohingya population (Islam and Nuzhath, 2018) found that the majority of women give birth at home, with only 22% of deliveries occurring in health care facilities. Another study on the rohingya refugee stated that although the majority of women (76.6%) adopt ANC checkup, informal services predominate in terms of delivery, with 81% of respondents reporting having experienced a home delivery (Nasar et al., 2019). In the pregnancy period , 53.7% of

women did not see a doctor. The remaining women said they went to the doctor once (11.2%), twice (10.3%), three times (22.9%), and four times (1.9%) while being pregnant (Haque et al., 2020). However, in this study 98.3% of the studied population were identified of having at least one antenatal visit due to strict policy & intervention regarding ANC checkup in recent years. Among those 98.3%, 76% had 1 ANC visit, 16% had 2 ANC visit, 6% had 3 ANC visit and only 2% had 4 ANC study which relates with the previous findings. In this study the result also inidicated that only, 11.4% were willing to deliver their baby at a health post/hospital, 32% was interested to be assisted by a local midwife/healer at childbirth and a vast 57% preferred a home delivery.

One study highlighted that, only 10.8% Rohingya women used folic acid during their pregnancy and over half of the women (49.6%) said they rested during their pregnancy (Haque et al., 2020). Conversely, this study found that around 72.8% women were not having at least 8 hour of sleep daily. Although in this study poor knowledge was identified regarding IFA supplementation but 79.7% women declared that they have taken IFA suuplementation during pregnancy. However, only 60% were identified of having IFA daily and 12% said that they take IFA once every 3days & the remaining 8% told that they take IFA once a week. Another study evaluating health problems faced by Rohingya community revealed that 78.5% pregnant women got TT vaccine during their pregnancy (Rawal et al., 2021) which alligns with the findings of this study where 74.3% pregnant women were identified of having at least one TT vaccine while being pregnant,

5.3.5 Association with practice

According to the findings of a study conducted in Bangladesh, higher education of women and their husbands was related with attending any ANC, early commencement of ANC, ANC in all three trimesters, 4 or more ANC, and adequate coverage of ANC contacts (Siddique et al., 2018). In the current study, no of child, respondent's educational level, husband's education level, husband's occupational status & source of household income was found significantly associated with level of practice regarding antenatal care guidelines.

5.4 Dietary Practice

A KAP study on WASH & nutrition on Rohingya Community revealed that only a frightening 8.6% women ate extra food during their pregnancy (Haque et al., 2020).

Similar shocking result in terms of nutrition was also observed in the current study where only 12.1% were consuming additional food in their pregnancy & only 16.6% were ensuring a variety of food in their daily diet. Around 70% of the pregnant women stated that their food intake decreased during pregnancy, 19% confirmed that there was no change in diet compared to the pre-pregnancy period and only a small number of 12% said that their food intake has increased during pregnancy.

In a refugee context at rwanda, 17.3 % pregnant women were found to have one meal a day, 72.3% were found to have 2 meals a day and only 4.5% to have the suggested 3 meals per day (Iradukunda & Ngomi, 2011). In a previous study on Rohingya population, 62.9 % of Rohingya households reported eating three meals the day before, while 35.8% reported eating two (Mahmud, 2018). The findings have somewhat similarity with the result of this study where 4% of the pregnant women had 1 meal a day, 27% had 1-2 meal a day, 55% had 2-3 meals per day, 11% had 3-4 meals a day and only a scanty 3% had >4 meals per day.

Around 63% syrian refugee mothers were found to have low dietary diversity. Dark green leafy vegetables(11.8%) and vitamin A rich fruits and vegetables(13.8%) were least consumed by them and eggs were only eaten by 29·8 % (Abou-Rizk et al., 2022). In a study done on Saharawi refugees, aroun two-third were identified of having low dietary diversity. It was also noticed that eggs, nuts and seeds, and vitamin-A-rich dark green leafy vegetables were the food groups that were least consumed (Morseth et al., 2017). In this study, among 463 paticipant, 64% had medium dietary diversity, 32% had low dietary diversity and only 4% had high dietary diversity score. The most consumed food group was starchy staples(100%) & dark green leafy vegetables(95%). The least consumed food group was vitamin A rich fruits & vegetables(25%), eggs(25%), milk & milk products(6%) and organ meat(5%) which somewhat alligns with the result of other refugee context.

5.5 Nutritional status:

A study on PLW women under humanitarian setting in Ethiopia found 24% of the surveyed mother as malnourished (Gebre et al., 2018). In a study assesing health problrms in rohingya community revealed that 3.4% of the population had nutrition deficiency (Al Masud et al., 2017). When the rohingyas initially seeked refuge in Bangladesh 2592 lactating mothers and 1145 pregnant women were admitted for

malnutrition therapy at the primary stage. Along with that, 1,20,000 expectant women and breastfeeding mothers required supplemental nutrition to prevent and combat malnutrition (Islam and Nuzhath, 2018). As per a survey on rohingya population, approximately 15% of Rohingya women were malnourished (Joarder et al., 2020). In the current study, around 10.6% of the pregnant women were malnourished based on MUAC assessment. But according to BMI 18.8% were identified as underweight & 63.3.% as normal. The findings had nearby result compared to the previous studies on rohingya women.

Chapter 6: Limitations & Recommendtions

6.1. Limitations:

The adopted study method was cross-sectional, which made it difficult to establish a definite causal association by default. However, the addition of an exploratory investigation to a quantitative study such as focused-group discussion could have provided the extra information that was not uncovered by the quantitative study alone. As constraints, there may be recall bias about dietary intake, as individuals may forget what they had the day before. Additionally, employing a mere 24-hour recall period for assessing dietary diversity did not disclose a person's typical diet or dietary pattern, just gave a peek on what they hconsumed the previous day which might not be their ususal dietary practice. Even though the frequency of food group consumption was taken into account, the amount of food consumed was not recorded, resulting in an inadequate depiction of dietary habits and no information regarding nutrient intake.

6.2. Recommendations:

- For better segregation and accuracy of the extracted data, a likert-scale is advised for future KAP assessment.
- A study design with the provision of accommodating barriers & challenges behind their poor antenatal care practice and limited dietary diversity is advised for further research. Such research can aid in gathering the evidence required to reform existing policy.
- For better inference, a mixed-method study that includes both an qualitative and a quantitative study is also recommended.
- To acquire a complete view of dietary behavior, dietary intake data from the previous 7 days is suggested, coupled with the amount of food consumed to track nutrient consumption and to investigate recommended dietary allowance (RDA) of the pregnant women.
- A future study equipped with pre-pregnancy & pregnancy nutritional status & diet information is also advised for a holistic idea.
- Further research might be conducted on the knowledge-related and behavioral aspects of dietary diversity.

Chapter 7: Conclusion

The current study found suboptimal dietary practice with majority of pregnant women having a dietary diversity ranging from medium to low and almost half of the studied sample were discovered of having a poor practice regarding antenatal care guidelines. Study findings underscore the need to increase awareness among pregnant women regarding the importance of a balanced diet, increased food consumption during pregnancy, adequate sleep, facility-based delivery and last but not the least supplementation of iron and folic acid. This also highlights the demand of feasible solutions for the high prevalence of subpar antenatal care and inadequate nutritional diversification among pregnant women. Actions directed at health-system interventions are recommended, such as comprehensive nutritional and antenatal care education, ANC usage, and quality support through antenatal care. However, boosting maternal knowledge won't be enough to change behaviors and perspectives. Household income, husband's educational level & occupational status also plays a crucial role on the perception & act of pregnant women. Efficient interventions must be devised for overcoming behavioral, perceptional, and socioeconomic constraints. Therefore, all development sectors must come together to improve the practice of antenatal care recommendations for a healthy pregnancy, ensure that pregnant women have a diverse diet, and promote women's level of knowledge by providing them with accurate information and guide them in overcoming obstacles that are impeding their progress towards better health.

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Appendix A: Questionnaire of the survey

Chattogram Veterinary & Animal Sciences University

Dept. of Applied Food Science and Nutrition

"*Assessment of knowledge & practices regarding antenatal care guidelines for a positive pregnancy and impact of dietary practice on the nutritional status of pregnant women in the Rohingya community: A cross sectional study*"

Part A: Participant Consent Form

I am Tajnim-E-Jahan, an M.Sc. student in the Department of Applied Food Science & Nutrition under the Faculty of Food Science & Technology of Chattogram Veterinary & Animal Sciences University. I am conducting a quantitative research study on "*Assessment of knowledge & practices regarding antenatal care guidelines for a positive pregnancy and impact of dietary practice on the nutritional status of pregnant women in the Rohingya community: A cross sectional study*." The purposes of this study are to assess the knowledge and practice regarding antenatal care guidelines for a positive pregnancy, dietary practice and nutritional status of pregnant women in the Rohingya community. Your participation in the study will involve an interview with an estimated length of 15-30 min. This study poses little to no risk to its participants. I will do my best to ensure that confidentiality is maintained by not citing your actual name within the actual study. You may choose to leave the study at any time, and may also request that any data collected from you not be used in the study. By signing below, you agree that you have read and understood the above information, and would be interested in participating in this study.

Date…… Signature……...

Part B: Background information

Date: Sample no:

Respondent's name:	
Husband's name:	
Camp:	
Block:	
FCN no:	
Majhi's name:	

Part C: Demographic & socio-economic information

C1: Respondent's age:	
C2: Respondent's gestation period	
C3: Number of pregnancies	1. Primigravida 2. Multigravida
C4: No of child the respondent has:	
C5: Respondent's level of education:	1. No formal education 2. Primary 3. Secondary 4. Above Secondary
C6: Respondent's occupation:	1. Housewife 2. NGO worker 3. Other's
C7: Family type:	1. Joint 2. Nuclear
C8: Husband's level of education:	1. No formal education 2. Primary 3. Secondary 4. Above Secondary
C9: Husband's occupation:	1. Day laborer 2. NGO worker 3. Small business owner 4. Unemployed 5. Other's
C10: Source of household income	1. Selling relief goods 2. Daily wages 3. NGO work 4. Small Business 5. Other's 6. No extra income

Section D: Knowledge on health guidelines during pregnancy

D1: Does the mother know about the need of additional food intake during pregnancy period (around 300kcal)?	1. Yes 2. No
D2: Does the mother know the importance of consuming a balanced diet during pregnancy?	1. Yes 2. No
D3: Does the mother know that during pregnancy a woman needs more folic acid and iron than a woman who is not pregnant?	1. Yes 2. No
D4: Does the mother know nutrients deficiency during pregnancy could affect health status of both the mother and the infant?	1. Yes 2. No
D5: Does the mother know about the benefits of antenatal visit in health care center during pregnancy?	1. Yes 2. No
D6: Does the mother know the benefits of facility-based delivery during childbirth?	1. Yes 2. No
D7: Does the mother know the potential harmful effects of smoking and/or alcohol consumption during pregnancy?	1. Yes 2. No
D8: Does the mother know to minimize vigorous physical activity and ensure sound rest during pregnancy?	1. Yes 2. No
D9: Does the mother know about the Tetanus Toxoid vaccine required to be given during pregnancy?	1. Yes 2. No
D10: Does the mother know the impact of maternal mental well-being on the fetus during pregnancy	1. Yes 2. No

Section E: Practice of health guidelines during pregnancy

E1: Is the mother consuming additional food in her pregnancy?	1.Yes 2. No
E2: Is the mother ensuring a variety of food in her daily diet?	1.Yes 2. No
E3: Is the mother taking Iron Folic Acid (IFA)?	1.Yes 2. No
E4: Is the mother doing laborious work or physically intensive day to day task?	1.Yes 2. No
E5: Has the mother gone for antenatal check-up at least once in her pregnancy?	1.Yes 2. No
E6: Is the mother willing to deliver her baby in a health post/hospital?	1.Yes 2. No
E7: Is the mother smoking and/or consuming alcohol in her pregnancy period?	1.Yes 2. No
E8: Is the mother having at least 8 hours of sleep in her pregnancy period?	1.Yes 2. No
E9: Has the mother taken at least one tetanus toxoid vaccine in her pregnancy?	1.Yes 2. No
E10: Is the mother emotionally well and stress free?	1.Yes 2. No

Section F: Antenatal care

F1: How many times have you gone for an ANC checkup?

1. 1-time 2. 2 times 3. 3 times 4. 4 times

F2: Where are you planning to give birth?

1. Home 2. Local midwife/ healer 3. Hospital

F3: How frequently do you take IFA?

1. Don't consume 2. Once a day 3. Once every 3 days 4. Once a week

Section G: Anthropometric measurement

MUAC (cm)	
Weight (kg)	
Height (m)	
BMI	
Enrolled in component	1. TSFP 2. BSFP

Section G: Food intake during pregnancy

G1: How has your pregnancy influenced on your food intake?

1. Increased 2. Decreased 3. No Change

G2: How many meals do you usually take per day?

1. 1-time 2. 1-2 times 3. 2-3 times 4. 3-4 times 5. > 4 times

Section H: Dietary diversity (24-hour recall method)

Food type	Consumption	Frequency Per day
Starchy Staples (Rice, Roti, Bread, Noodles, wheat, potato, corn etc.)	1. Yes 2. No	
Dark green leafy vegetables	1. Yes 2. No	
Vitamin A rich fruit and vegetables (Carrot, pumpkin, tomato, mango, watermelon, papaya etc.)	1. Yes 2. No	

Other fruits and vegetables (apple, banana, cauliflower, eggplant, string beans, okra etc.)	1. Yes 2. No	
Organ meat (liver, kidney, heart or any other organ meat)	1. Yes 2. No	
Meat and fish (fresh or dried fish, chicken, beef, mutton, pigeon etc.)	1. Yes 2. No	
Eggs (chicken, duck, pigeon eggs etc.)	1. Yes 2. No	
Legumes, nuts and seeds (dried beans, dried peas, chickpeas, lentils, nuts, seeds etc.)	1. Yes 2. No	
Milk and milk products (milk, cheese, yogurt or other milk Products)	1. Yes 2. No	

Appendix B: Anthropometric measurements of the residents

Figure: MUAC measurement process

Figure: Weight measurement process


Figure: Weight measurement

Appendix C: Interview process & data collection

Figure: Information collection at PLW point of the nutrition center

Figure: Interview process at the home of the participant

Figure: Interview process at the nutrition center

Figure: Inquiry process of dietary practice using a visual aid at participant's house

Figure: Inquiry process of dietary practice using a visual aid at nutrition center

Brief Biography

Tajnim-E-Jahan has completed his B.Sc. (Hon's) in Food Science and Technology from Faculty of Food Science and Technology, Chattogram Veterinary and Animal Sciences University (CVASU), Chattogram, Bangladesh obtaining CGPA 3.75 in the scale of 4.00. For the time being, she admitted herself as an aspirant for the degree of MS in Applied Human Nutrition & Dietetics in the department of Applied Food Science and Nutrition, Chattogram Veterinary and Animal Sciences University (CVASU), Bangladesh. She formerly did four academic internships at Universiti Malaysia Terengganu (UMT), at Institute of Food Science and Technology (IFST), BCSIR, at Training Institute for Chemical Industries (TICI) & at Malaysia and Chattogram Maa-O-Shishu General Hospital (Autism and Child Development Centre). Her research interests are mainly focused on maternal and child health, reproductive health, dietary behavior and public health. She has two published review articles so far. She possesses deep interest and pleasure in imparting knowledge, academic research and would welcome any further opportunities to contribute.