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DEPARTMENT OF NUTRITIONAL SCIENCES

ASSOCIATION BETWEEN DIETARY INTAKE, GESTATIONAL WEIGHT GAIN AND BIRTH WEIGHT AMONG PREGNANT WOMEN IN TAMALE METROPOLIS

BY

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DECLARATION

Candidate's Declaration

I hereby declared that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Name: ZIMPA ABDULAI NIHAD

Signature: …… Date: ……

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

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Signature: …… Date: …….

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ABSTRACT

Dietary intake and Optimal gestational weight gain is an important factor linked with positive outcome for both mothers and their infants. Women who consume inadequate diet and gain inadequate weight during pregnancy are at risk of bearing a baby with low birth weight whereas those who gain excessive weight are at increased risk of preeclampsia, having microsomal babies and gestational diabetes. In developing countries, data on dietary intake gestational weight gain and its determinants are scarce as it is difficult to collect the information throughout the pregnancy period and rather rely on retrospective data. The aim of the study was to assess the association between dietary intake, gestational weight gain and birth weight. The study was a health-facility-based quantitative retrospective cross-sectional study which involved 343 post-natal women. A structured questionnaire guide and checklist was used to collect both Primary and secondary data respectively. Data collected was entered using SPSS version 22 and analysed using STATA version 12. Majority (93.67%) of the respondents reside in urban areas. Greater proportion of the women were within the age range of 20-30 years. The mean age of the respondents was 29.04±5.35. Many respondents (90.51%) were married. 83.86%had some form of education. Most of the respondents (78.8%) were employed. The study showed 17.78%, 55.87% and 26.35% prevalence of inadequate, adequate and excessive gestational weight gain respectively and also 7.59% and 92.41% showed a prevalence of inadequate and adequate dietary intake respectively. Maternal Body mass index and weight gain during pregnancy were strong predictors of low birth weight among pregnant women. The results

showed that pregnant women who were underweight (BMI < 18Kg/m^2) were 99.9% at risk of delivering a low birthweight child. Furthermore, pregnant women who did not gain adequate weight during pregnancy were more at risk of giving birth to low birthweight children. The risk among pregnant women who gained inadequate weight increased by 98% compared to pregnant women with normal gestational weight gain. A strong association was seen between low birthweight and pre-pregnancy BMI and weight - gain but no significant association existed between dietary diversity and low birthweight.

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DEDICATION

I dedicate this dissertation first and foremost to God (Almighty Allah) for making this work a success. I also dedicate this work to my family, especially my loving parents whose words of encouragement and push has brought me this far. Not forgetting my lovely sister and loved ones who have never left me and are special for their advice.

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LIST OF ABBREVIATIONS

APOs	Adverse Pregnancy Outcomes
BMI	Body mass index
GDHS	Ghana Demographic and Health Survey
GDM	Gestational diabetes mellitus
GSS	Ghana Statistical Service
GWG	Gestational weight gain

IGF	Insulin Growth Factors
IOM	Institute of Medicine
IUGR	Intra Uterine Growth Retardation
LBW	Low Birth Weight
LGA	Large Gestational Age
NTD	Neural Tube Defects
RDA	Recommended Dietary Allowance
SGA	Small Gestational Age
UNICEF	United Nations International Children Education Fund
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Malnutrition in pregnancy, especially in developing countries, is at the centre of many women's health issues. During pregnancy Dietary intake is of great significance as far as foetal growth and evelopment is concerned. Consuming a variety of food groups by pregnant women reduces their sk of giving birth to low birthweight babies (Abubakari et al, 2016). Poor nutrition in pregnancy related to poor birth outcomes including low birthweight babies, pre-term delivery and intra-terine growth retardation. In the same way, a healthy birth outcome stems from a good nutritional atus (Wu et al, 2004) therefore the diet should be diverse and balanced for pregnant women Black et al., 2008). In accessing the utilization, access, and quality of diet of households and ndividuals, the key indicator considered to be used is termed as dietary diversity (World Health rganization, 2013). Adequate nutrient intake is determined by Individual dietary diversity. mong pregnant women, a proxy index for measuring nutrient adequacy is the dietary diversity core (Wen et al, 2010) . Even though several nutrition interventions exist for women of eproductive age including pregnant women, they still have a higher burden of certain forms of alnutrition: Anemia is found in about one-third of all women in their reproductive ages; in ddition, the risk of obesity occur more in women compared to men. This notwithstanding, the prevalence of underweight is still high among millions of women (Development Initiatives, 2018). In developing nations, malnutrition in pregnant women is often the result of insufficient dietary intake, poverty, poor healthcare system, heavy work-load, recurrent infection and lack of knowledge about appropriate food to take during pregnancy (Ahmed et al, 2012). Dietary intake in pregnancy is complicated by physiological changes which leads to poor dietary intake with

grave negative consequences on the developing fetus and the mother (Zakaria & Laribick, 2014). Furthermore, in pregnant women, the lack of education, socio-cultural practices and inequalities in family sizes lead to under-nutrition. Inadequate dietary consumption during pregnancy may result in many deficiencies in macronutrients and micronutrients including energy, iron-deficiency anemia, vitamin A, Iodine and other micronutrient deficiencies which could negatively influence pregnancy outcomes (Haider et al, 2011). For example, iron deficiency anemia in pregnant mothers closely linked with low birthweight for newly born infants coupled with a greater risk of remature birth (Wang et al., 2016). Also, Malnutrition is correlated with growth loss and nergence of protein-energy malnutrition due to insufficient dietary intake, especially throughout ildbirth.(Adikari et al, 2016). Women who do not eat fruit, vegetables and meat from animal ources increase the risk of developing micronutrient related deficiencies.

aining a healthy weight appropriate for pregnancy historically was a struggle for women due to sufficient nutrition (Samura et al., 2016). However, over the past few decades, excessive weight ain has become prevalent globally, affecting all age groups, including pregnant women (Yao et , 2017). Obesity is considered to be more sensitive in women and is a worldwide phenomenon, so known as unhealthy weight gain. This is because there are heightened dietary needs during regnancy that are important for the mother and the baby's health (Papazian et al., 2017).

till birth and abnormal birth weights are the poor outcomes of an adverse pregnancy (Lee et al, 013). This is significant in countries; advanced and low-middle-income countries (Beck et al., 2010; Blencowe et al., 2012; Lee et al., 2013). The WHO identify in their guidelines the adverse effects of pregnancy: low birth weight, preterm birth, stillbirth, perinatal death or abortion.(World Health Organization (WHO), 2004). According to WHO, low birth weight (LBW) is birthweight less than 2500g (WHO, 2010). This is determined by considering two key processes: the gestational period and intrauterine growth (Urquia & Ray, 2012; WHO, 1995). Therefore, it can

be said that LBW is a result of a retarded intrauterine growth, incomplete gestation period or a combination of the two. However, it is important to note that, disease process does not necessarily result in small babies/preterm births. In addition, not all children affected by intra uterine growth retardation (IUGR) are little (Urquia & Ray, 2012). A population's health status can be assessed through the number of babies born who are weighing less than 2500g (Manna, 2013). Stunting and non-communicable diseases as well as child survival are important determinants that stem from ɔw birthweight therefore, there is the need for effective public health interventions that address ıis problem (Lawn et al,2005; Lee et al., 2013). With reference to UNICEF (UNICEF, 2015), low irth weight prevalence in Ghana is 14.2%. The prevalence however is higher in some parts of hana. A study by Abubakari and colleagues (2015) in northern parts of the country, low irthweight was reported at 26% whiles Fosu et al (2013) found a prevalence of 21%. Being "too ig" at birth (Macrosomia) is also considered an undesirable pregnancy outcome with associated evated risks to both mother and child (Wendland et al., 2012). However, in developing countries, ıacrosomia is given less consideration. Birthweight more than or equal to 4.0kg is regarded as ıacrosomia birth (Koyanagi et al., 2013; Lu et al, 2011). The prevalence of macrosomia is etween 5% and 20% in developed countries even though a rise of 5 % was detected that is from 5% to 20% in the past decades, which is as a result of maternal diabetes and obesity.(Henriksen, 008). However, the prevalence trend of macrosomia in developing countries appears to be ɔoradic. For instance, In Lu et al., (2011) study, a rise from 6.0 percent in 1994 to 7.8 percent in 2005 was recorded. The overall prevalence of macrosomia births in Ghana could not be found although a current study on macrosomia births amongst women who are obese and overweight indicated a 10.9% prevalence rate (Addo, 2011) among this most vulnerable group and also a study in the northern region based research reported 11.6% prevalence among the group (Abubakari et al,2016). Macrosomia, which is associated with obesity far occurs ahead in adult life (Oken &

Gillman, 2003), It may lead to complex birth outcomes (Koyanagi et al., 2013). Due to the difficulties associated with delivering critical obstetric care facilities, this could lead to additional risks to mothers and new-borns in resource-limited countries such as Ghana.

During pregnancy, weight gained often known as gestational weight has major health implications for both mother and infant (IOM & NRC, 2009). Inadequate weight gain has been related to the mother and foetus' health risks (Rhodes et al, 2013). In spite of this, most developing countries in .frica have overweight and obesity prevalence rates of above 10% (Neupane et al, 2016). ısufficient gestational weight gain is known to be predisposed to low birthweight, preterm ıildbirth and anaemia. Adverse maternal and foetal effects such as large gestational age (LGA) abies, gestational diabetes mellitus (GDM), caesarean delivery, early pregnancy loss, reeclampsia, and post-partum weight retention result from excessive weight gain during regnancy. Optimal gestational weight gain contributes to positive pregnancy outcomes such as rowth and development of the foetus and reduced probability of mortality during pregnancy.

he prevalence and factors influencing dietary intake, gestational weight gain and birth outcome e varied across different regions and settings. These highlight the need for further research to etermine the prevalence and influencing factors that are specific to different settings to inform ecommendations regarding dietary factors and weight gain goals in pregnancy to achieve optimal regnancy outcomes and minimise complications.

.2 Problem statement

ne of the most significant causes of maternal and child morbidity and mortality, especially in developing countries is maternal malnutrition (Horton, 2008). Ghana is facing a double burden of malnutrition among other developing countries (UNSAID, 2018). Under-nutrition among pregnant women in Ghana decreased from 9 per cent in 2003 to 6 per cent in 2014, whereas over nutrition increased from 26 per cent in 2003 to 40 per cent in 2014 (GSS, 2018). Among the factors that

influence the nutritional status of the developing fetus, maternal nutrition is an important one (Bergner & Susser, 1976), because a vital inter-dependence can be found amongst the overall nutritional health of the expectant mother and fetus (Prakasm 1980). Therefore, the diet, nutrition and health of women is of decisive importance during the entire period of pregnancy. Women with weak diets, particularly in pregnancy, not only have significant nutritional significance for the foetus, but may also contribute to maternal depletion, which is also cumulative for any birth.

he prevalence of excessive gestational weight gain is rising and alarming indicating a public ealth concern. (Yao et al, 2017). Numerous studies in developed countries on gestational weight ain indicated that more than 40% of women are gaining weight above the Optional IOM ranges Campbell et al, 2011; Yao et al., 2017). It is further estimated that over 75 % of African American omen of reproductive age are overweight or obese and this increases their already high risk for besity-related adverse pregnancy outcomes (Goodrich et al, 2013).

dequate nutritional status of pregnant women is essential for the health of the mother and the eveloping foetus. This however, is greatly influenced by dietary intake of the mother. Dietary ıtake is usually predicted by culture and by the type of food available for consumption in a articular locality; hence findings in one locality may not be applicable to all localities in Ghana. he prevalence of overweight and obesity among women of childbearing ages were 26% and 14% ı urban women and 14% and 4.2% among rural women respectively according to (Konan al,2010). However, in the Northern part of Ghana, a lower BMI is always observed compared to the Southern part of Ghana, although the trend in overweight and obesity observed in urban areas in the North is almost comparable to the rest of the country (Fidelia etal,2012). This could be the reason for the high rate of low birthweight in the northern part compared to the southern part of the country.

A study by (Abubakari etal,2016) found low birthweight prevalence of 29.6% in the tamale metropolis and a study by (Yakubu, 2018) found a low birthweight prevalence of 21% in the metropolis. Whiles the prevalence of macrosomia births was found to be 10.5% and 10.9% according to (Abubakari etal,2016) and (Addo,2010). Maternal characteristics and child nutritional status with respect to both low birth weight and macrosomia births has not yet been fully explored in Northern Ghana, where the prevalence of stunting is high and overall dietary quality is likely to e poor. Therefore, investigating the association between dietary intake, gestational weight gain nd Birth weight of pregnant women in the study area will lay the foundation for future nterventions to improve maternal nutrition in Tamale Metropolis.

.3 Objectives/hypothesis

.3.1 Hypotheses

$_0$ = There is no association between dietary intake, gestational weight gain and birth weight.

$_1$= There is association between dietary intake, gestational weight gain and birth weight.

.3.2 Main objective

he main objective of the study is to determine the association between dietary intake, gestational eight gain and birth weight among pregnant women in the Tamale Metropolis.

.3.3 Specific objectives

To assess dietary intake and associated factors among pregnant women in the Tamale Metropolis

To assess the prevalence of gestational weight gain and associated factors among pregnant women in Tamale metropolis.

3 To assess the prevalence of birth weight and its associated factors

1.4 Conceptual framework

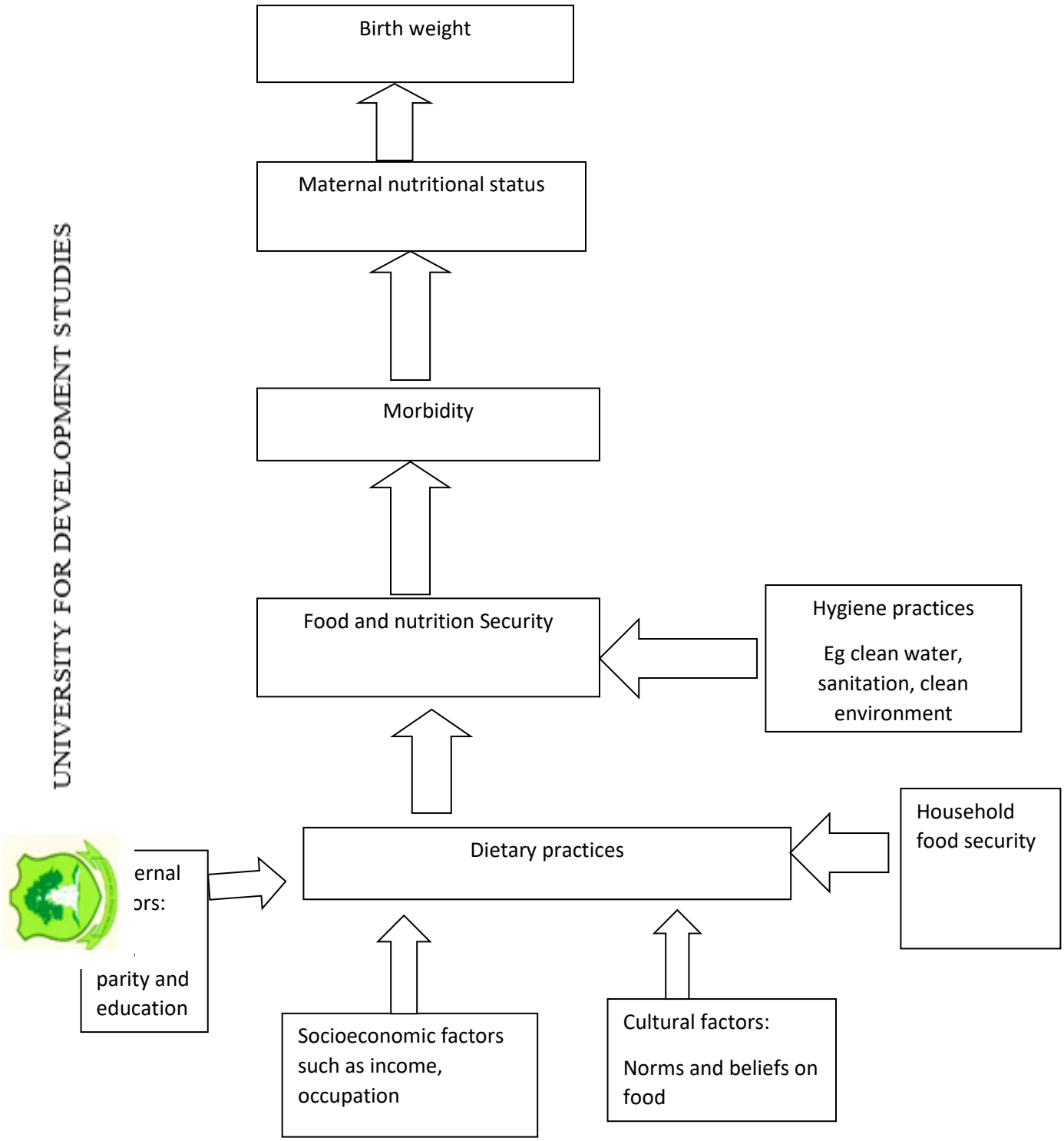


Figure 1.1: conceptual framework

Diet is important to development and growth as well as to the survival of healthy communities. Dietary intake is directly related to immunity, intelligence quotient level, nutritional status and birth outcomes etc. Just as dietary intake affects nutritional status, dietary intake is also determined by diet diversity. A diversified diet is most likely to contain all the recommended food groups, hence would ensure diet adequacy thereby affecting nutritional status via dietary intake. People's diet may or may not be diversified due to a number of underlying factors such as socioeconomic atus (eg. income), demographic factors (household size) and infection patterns. A sick person ıostly does not have appetite for food so eats very little and is not even able to utilize the little he r she eats.

.5 Significance of the study

he findings of this study will be useful to the Ministry of Health (MOH) and other stakeholders y providing important information needed in designing appropriate interventions to improve ıaternal nutrition in the study area. This study also makes an important empirical contribution to ıe growing body of literature on dietary diversity and gestational weight and its influence on irthweight and their associated factors among pregnant women.

CHAPTER TWO
LITERATURE REVIEW

In the nature and result of birth, the nutritional condition of pregnant women plays an important art. A number of factors influence pregnancy outcome and several studies reported in literature rove this.

.1 Nutrition during pregnancy

utrition is the process of providing nutrients to the cells of the human system in the form of food support life. A healthy diet can be used to prevent or alleviate many common health problems. he diet of an organism is dictated by what it consumes, which consists of foods that the body equires to function efficiently in the body system.

Chemical components found in food are what is termed as nutrients. Nutrients are classified into x major classes namely: carbohydrates, fats, minerals, protein, vitamins and water and can be urther categorized as either macronutrients (which means they are needed in relatively large mounts) or micronutrients (which means they are needed in smaller quantities). Macronutrients nclude carbohydrates, fats, fibre, protein, and water and micronutrients are minerals and vitamins (Berg et. al., 2002).

2.2. Dietary habits/practices of pregnant women and associated factors

Nutritional well-being can be a health requirement of a diet-convinced person, the quantity and natural biochemical integrity of the nutrients found within the body. Normal nutritional status is controlled by matching food intake with normal nutrient use. Nutritional status is regularly referred

to as a result of the food acquisition, consumption and utilization process. (Rajapaksa et al., 2011). Eyad et al (2012), in a study, indicate that a diet which is diversified is associated with a good nutritional status. Thus, compelling evidence of the correlation between maternal nutritional status during pregnancy and, therefore, the unborn child's future well-being is now substantial. The growth and development of the foetus depend on the mother's nutritional status before and during pregnancy which exhibits a crucial role. The poor nutritional status of a mother during pregnancy as been known to induce the delivery of babies with low birth weight and may contribute gnificantly to maternal morbidity (Hambidge et al., 2014). In line with Bhutta et al. (2013), it is oted that maternal malnutrition leads annually to 800,000 neonatal deaths worldwide via small or foetal age deliveries. Under-nutrition by pregnant women later in life is linked with an elevated sk of illness in their offspring. (Ahmed & Tseng, 2013). Studies further suggest that pre-regnancy Body Mass Index (BMI) findings on pregnancy results have tended to draw mainstream iterest (Yu et al., 2013).

.2.1 Key nutrient during pregnancy

uring early and late pregnancy, there is a greater distinction in terms of nutrient requirements. everal literature reviews suggest that micronutrients and protein are needed in early pregnancy, hile calories and other nutrients are needed later in pregnancy. The emphasis is also now on a aradigm change from efforts to increase the size at birth to efforts to improve foetal development nd growth. A wide spectrum of food consumption can be tailored for pregnant women in terms of consistency and quantity. An increment in birthweight depends on the comparative input of calories and proteins on the diet taken by pregnant women. Women that have low pre-pregnancy weight, inadequate nutrition, low supplement replacement level of home diet, low pregnancy physical activity and poor health status will see a greater rise in birth weight with supplementation.

Folate is very crucial because of its role in cell division and development. Its deficiency causes megaloblastic anaemia and is linked with spontaneous abortions, IUGR, premature delivery, foetal malformations and antepartum haemorrhage. RDA of folate is 600µg/day that is an extra 200µg/day because 50% of women before 8 weeks of conception, do not schedule pregnancies and do not seek antenatal care either. Folate supplements are important to avoid neural tube defects prior to conception (NTD). Sources of folate are green vegetables, citrus fruits, legumes and holegrain bread and cereals

aramount for the development of the foetal skeleton and teeth is the presence of calcium. This so reduces the rate of developing gestational hypertension, preterm delivery as well as possibly re-eclampsia. The current RDA is 1200mg/day (extra 200mg/day) Good sources are dairy roducts, okro, green vegetables and beans.

itamin D is Very essential to facilitate the absorption and distribution of calcium for the ormation of foetal bones. Extra 5µg/day recommended for people with low intakes 10-20mins aily sunlight exposure is needed.

on is a key ingredient of the body's cells. It is crucial in the production of a variety of critical nzymes in the body. Various body systems may be affected during its deficiency e.g. Brain, erves, muscles, the gut and the skin. Infants are born with an adequate amount of iron contained n the liver to last for 6 months. To do this, during conception, the mother must pass between 200-400 mg of iron to the foetus. Besides, iron is required if placenta formation must occur. Haemoglobin is also required by the expansion of blood volume and to compensate for blood loss emanating from childbirth. The requirement for iron throughout pregnancy amounts to 800-900mg. Each day maternal stores must supply 3mg of iron. The efficiency of iron absorption increases from 10% to 30% in the 2nd trimester. Thus, RDA for pregnant women is 30mg/day.

This amount is not achievable from dietary intake alone. Meat, fish and poultry are strong sources of iron. Legumes are also good sources but the iron in plant foods is better absorbed when consumed with foods high in vitamin C.

Essential long-chain polyunsaturated fatty acids are crucial for cell membranes and brain and as precursors of prostaglandins. Women with multiple foetuses or women at risk of preterm delivery ·e particularly recommended to take increased amounts. These fatty acids are mostly found in uts and seeds (sunflower etc), seed oils, olives and in fish (salmon, mackerel, sardine).

inc is essential for foetal growth because of its role in protein synthesis, cell division, hormone ıetabolism and immuno-competence. The foetal need of zinc is about 100mg; daily accumulation ıcreases from 0.1mg during 1st trim to 0.7mg during 3rd trim. RDA for zinc has been set at 11 – 3mg. Zinc deficiency has a devastating effect on pregnancy outcome including growth ·tardation, teratogenic effects and foetal death Dietary sources are liver, meat, oysters, crab.

itamin E

he RDA for vitamin E is higher during pregnancy because of its important role in foetal growth. ransfer of vitamin E from the mother to the child occurs at the middle point of pregnancy ıerefore children who are born prematurely have inadequate stores. In premature infant's ısufficient vitamin E status leads to bronchopulmonary dysplasia, retinopathy and intraventricular aemorrhage (Latham, 1997).

Vitamin K

During pregnancy, the intake of vitamin K is tremendously vital due to the occurrence of haemorrhagic disease of the new-born, which normally ends up in intracranial haemorrhage and is

deadly. Investigators indicate that administering vitamin k giving to expecting mothers before delivery can avert the occurrence of this condition. Besides, this strategy helps in improving measures of vitamin K and coagulation function (Motohara et. al., 1990, Anai et. al., 1993).

Vitamin A

During pregnancy, the deficiency of Vitamin A weakens the body functionality, raises the chance f infections and has been linked with hypovitaminosis (Katz et. al., 1995), So far this has led to ıcreased rates of intrauterine growth retardation and premature birth (Shah & Rajalakshmi, 1984). eta- carotene from vegetables might not provide the maximum amount of retinol as previously ıought (De Pee et. al., 1995).

Vater

ased on the recommendations of the US National Research Council, men are to drink a total of .7 litres of water while women drink a total of 2.7 litres this includes water from all sources ıcluding food. To keep hydrated, pregnant and breastfeeding women require extra fluids. The ıstitute of Medicine (IOM) advises that women drink 2.2 litres of water on average, and men ɔnsume 3.0 litres of water daily. 2.4 litres (approx. 9 cups) of water is generally prescribed for ɾegnant mothers (National Academy of Sciences – Institute of drugs, 1990).

2.3 Nutrition in the three trimesters of pregnancy.

While being pregnant, nutrition is a very vital element. Additional energy and nutrients are required to enable foetal growth and mother's body changes to achieve a successful pregnancy and a healthy baby

2.3.1 The first trimester

The first trimester of pregnancy is made up of the first three months of pregnancy. At this stage, good nutritional status is very important as the growth of the foetus can be impaired at this stage due to nutritional deficiency which can last a lifetime (Wardlaw, 1999). Foetal formation progresses easily within the first 3 months of pregnancy thus if an essential nutrient is deficient at this stage the foetus can be affected before the mother even starts to show signs and symptoms of ıe deficient nutrient. Therefore, in this period of pregnancy, the quality of the diet is more nportant than the volume. So, therefore, Nutrient-dense food should be eaten by pregnant women. .owever, even though some women experience nausea leading to lack of appetite at this stage of regnancy, they should aspire to get adequate food (National Academy of Sciences- Institute of ıedicine, 1990).

.3.2 The second trimester

utritional deficiencies at the second-trimester stage of pregnancy which is from the 4th –6th ıonth have a stronger influence on the mother compared to the foetus. At this stage, maternal ɔdy components are formed such as the breast tissues for the production and release of breastmilk. herefore, if the woman's nutritional requirements are not met her ability to breastfeed will be ffected (Worthington-Roberts and Williams, 1997).

.3.3 The third trimester

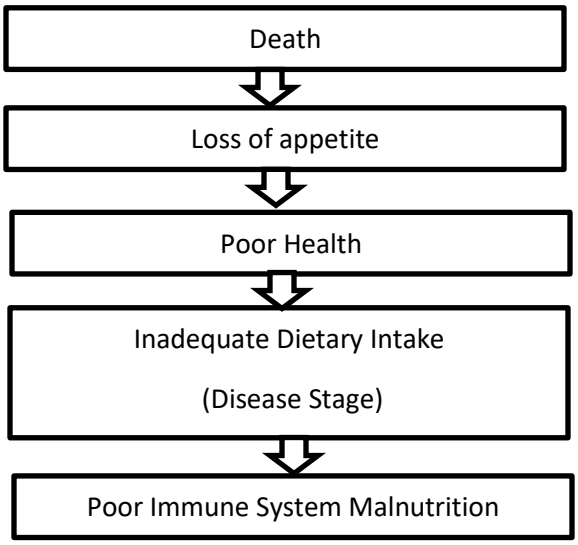
consists of the last 3 months of pregnancy that is from the seventh to the ninth month. This is another crucial stage during pregnancy. At this stage the foetus takes up iron stores from the mother for its own use. Therefore, if at this point, the mother does not fulfil her iron demands, she may not be able to transfer enough to her unborn baby and for her own use leading to anaemia. That is why it is recommended that pregnant should consume green leafy vegetables as they are good sources of iron and also consume fruits to aid in the absorption of iron (Kalosa et. al., 1997).

2.4 Determinants of maternal nutritional status

2.4.1 Health of Mother

The chance of a pregnancy resulting in a full-term, stable delivery is determined by the woman's health status which can be influenced by inadequate dietary practices during pregnancy. There is a mutual connection between a woman's health and the results of her birth, where poor health results in high foetal and early death rates for children.

ıadequate maternal food intake due to food accessibility, availability and affordability affects the nmune system thereby giving rise to so many diseases and infections. Malaria and anaemia are ıe most common diseases. Having a haemoglobin level of less than 11g/dl is an indicator of .naemia (GHS, 2004).



igure 2. 1: The Link between Maternal Health and Malnutrition
2.1.1 Source: Author's own construction

2.4.2 Socio-economic factors

According to Kamau et al, (2007) socioeconomic factors are seen to be very important determinants of nutrient intake and diet quality. It has been noted that nutrient deficiencies are normally found among populations with low socio-economic status involving multiple nutrient deficiencies rather than single nutrient deficiency (Fall et. al., 2003).

2.4.3 Cultural Practices

ulture can be defined as a way of life where a group of persons reside and doing things in common nd are guided by values and norms which in turn influence the food habits of the individuals. Due o this, some foods may be considered as tabooed by some of the groups and hence will not onsume these foods even though they may be nutritionally sufficient, they won't be regarded as ood.

roviding a framework using socio-cultural dimensions to examine cultural issues related to renatal weight gain consist of the following: getting information on structures associated with eight gain, dietary intake, physical and lifestyle activity patterns during pregnancy, as well as the elation of these characteristics to the individual household and society.

.4.4 Birth spacing

fter childbirth, women who do not observe the acceptable birth spacing cycle appear not to be ole to replenish their nutrient stores (ACC/SCN, 1990). Pregnant women who do not practice dequate birth spacing before next pregnancy, usually find themselves more vulnerable and have a higher risk of anaemia (Latham, 1997). According to Marti et. al., (2001) closely spaced pregnancies in pregnant women causes low supply and slow iron absorption which contribute to reduced iron reserves.

2.4.5 Food preparation.

Food preparation by pregnant women for consumption has an effect on their nutritional status. If we look at the cooking process of green leafy vegetables, the prolong cooking lead to the major nutrient which is iron being lost therefore how food is prepared for consumption determines the nutrient retention in the food. Cooking water from rice is discarded in certain community environments. These techniques can minimise the amount of water-soluble, heat-responsible itamins such as ascorbic acid, folic acid, and thiamine (Worthington-Roberts and Williams, 997). The use of contaminated water for food processing can also have an effect on food safety Woods, 2006).

he foetus is completely dependent on maternal stores of nutrient intake in pregnancy, specifically its & protein for energy, Low fat & energy consumption thus means a risk to the foetus of poorly utritional supply. Several evidences found that supplementation of macronutrients (protein, nergy) was correlated with a rise in maternal weight and mean birth weight and a decline in the umber of babies with low birth weight. sIt is proven that an additional 100 kcal/day during regnancy for undernourished women will raise the birth weight by around 100g and halve the sk of IUGR (WHO.1995).

.5 Factors Influencing Dietary intake and diversity

.5.1 Socio-economic Factors

everal studies have found that dietary diversity is actually correlated with a person's socio-economic status (SES) (Sanusi 2010, Savy et al., 2005; Torheim et al., 2004). A study by Rashid et al., (2011) and Thorne-Lyman et al., (2010) found the socio-economic status of a household is associated with how varied the diet of the household is. In the same way, during a study by (Henk-Jan Brinkman et al., 2010), it was indicated that having a more diversified diet was related to families who had more resources and earnings. Also having a better education and wealth was

seen to be an influencing factor on women dietary diversity score (Savy et al., 2008). However further research indicates that poorer diet is more common among individuals with less income and low educational status than individuals with more income and education this might be as a result of a diversified diet which is health and claimed to be less healthy and more expensive. (Morris et al., 2014). An outcome measure of dietary diversity is food security which is known to be related to low purchasing power which is further related to low or inadequate dietary intake. hab et al., 2012).

is evident that the consumption of little and no quality animal source foods as well as fruit and egetables is much associated with persons with lower economic status due to their expensive ature (Dachner et al., 2010). In Kenya, Kimiywe et al. (2007) reported that occupation and income vels impacted the intake of various vegetable levels, which is also evident in Ihab et al. (2012) udy where high food costs and insufficient resources resulted in limited access to food as well as mited quantities and low-quality foods within the household. However, knowledge of the elationship between socioeconomic factors and dietary diversity among pregnant women living ı ASAL is scarce.

.5.2 Demographic Factors

arity, socio-economic status, age, sex, parity and household size are found to have an influencing ıctor on dietary diversity. A diet low in variety with insufficient fruits and vegetables and animal roducts was shown to be consumed by older women in Botswana (Clausen et al., 2005). Thus, age might be an influential factor in nutrient consumption. In line with Taruvinga et al. (2013), it was noted that households headed by females were seen to have a higher or better probability chance of attaining a higher dietary diversity compared to the male-headed households and also households headed by females are seen to spend more on more quality foods according to Rogers, 1996. In Germany Thiele reported that the strongest determinant of dietary diversity was: age, sex,

household size, employment status, and level of education. The relationship between dietary variation and demographic features remains less known.

2.5.3 Morbidity Patterns

Dietary diversity and nutritional intake are impaired by morbidity trends because they cause decreased food consumption due to lack of appetite associated with the disease (Scrimshaw, 2003). Morbidity was identified by UNICEF (1998) as one of the direct causes of malnutrition in people. oor nutritional status is as a result of poor food intake, absorption, and utilization of nutrients. ccording to Pieters et al. (2013), an individual's health status influences their ability to take in utritious foods. Antenatal care (ANC) has been identified collectively as the only strategies within ıe first detection of complications which can affect pregnancy.

.6 Diet and associated factors

esta et al (2019) conducted a study that revealed factors associated with dietary diversity. indings from the study indicated that few (25.4%) of the women consumed adequate dietary iversity. Mother's secondary and tertiary education, household monthly income, livestock wnership and mothers who got emotional support from partners were seen to be more likely to tain adequate dietary diversity.

ı their report, Demilew et al (2020) reported that 19.9% of respondents had gained acceptable ietary habits. Food security, high edible crop productivity and a favorable mindset were gnificantly correlated with acceptable pregnant women's dietary practices, while the lack of dietary knowledge, cultural factors/taboos, and expert evidence discrepancies were obstacles that hindered dietary practices during pregnancy.

In Ethiopia, Tefara et al (2020) conducted a study and found a mean dietary diversity score of 5.45± 1.83. Over half (60.9%) of the study participants had optimal dietary diversity. Factors that

were seen to influence optimal dietary diversity were: having a college education and above, monthly income more than 5,000 ETB, Pregnant women at second ANC visit and having nutrition information during pregnancy.

Another study conducted by Olajide et al (2018) revealed that a high percentage (75%) of women who were pregnant had modest knowledge as far as their dietary habits were concerned. Also, 78.2% agreed to the fact that their dietary habits are influenced by their cultural heritages whiles 70.8% also established the fact that religion and its teachings have an impact on their dietary practice/habits.

Also, Nana et al, (2018) also observed that 39.3% had good dietary habits, while the remaining 60.7% had bad dietary practices for pregnant women. In terms of dietary knowledge, (61.4 per cent) of respondents had strong nutritional knowledge, while the rest (38.6 per cent) had poor nutritional knowledge. Also, ownership of radio, dietary knowledge, previous disease history and husband income were found to be significantly associated ($P < 0.05$) with the dietary practices of study participants. Besides, it is observed that in Northern region of Ghana that women who had health-conscious diet were at lower risk of having low birth weight infants compared to expectant mothers that were not health-conscious in their diet (Abubakari et al., 2016).

Aberfu et al, (2016) reported that pregnant women dietary intake was still the same no change was detected in the type of food and amount as the consumption pattern of fish, meat, vegetables, and some fruits during pregnancy continued to be the same before the onset of pregnancy which is low regardless of financial and educational status of these pregnant women. Several taboos were also identified and the most common taboos identified in their study were connected to the consumption of cheese, green pepper, green leafy vegetables and yoghurt. Weight gain was seen to be disfavored due to the fear of obstetric complication that comes with delivering a bigger baby. The study

concluded its finding by saying that, food taboos and weight gain during the period of pregnancy were widespread misconceptions especially among the illiterate rural communities and the elderly.

A study conducted by Jamila (2015) found that Married women, those with bachelor's degree, have private medical insurance and those with average family income were seen to have the highest diet quality. Source of nutrition information from family and high pre-pregnancy body mass index (BMI) were seen to be associated with high Diet Quality Index-P scores. However, a significant negative correlation between diet quality and pre-pregnancy BMI was observed (p=0.05). It was concluded from this study that women with Low Socio-Economic Status are at-risk for low diet quality during pregnancy therefore the need for effective nutrition intervention target at women with low Socio-Economic Status.

Fatima et al., (2014) conducted a study and the findings revealed that (47%) of the respondents had pre-gestational body mass index to be normal, (12%) were underweight, (22%) were overweight, and (17%) were obese. Out of the total number, 89% of the pregnant women met the minimum dietary diversity and 5% were seen to have low and high Minimum dietary diversity. No correlation has been identified between dietary diversity and socio-economic. It was observed from the study that (74%) of the pregnant women were seen to have gained lower than the recommended level of weight gain. Although a positive relationship was seen between dietary diversity and weight gain during second and third trimesters. The study concluded that having a good diversified diet proves a good proxy indicator for achieving adequacy of micronutrient during pregnancy.

According to Krishna et al, (2014) study findings, the mean iron, protein, energy, and calcium intake during pregnancy were 30.15±5.5 mg/day,57.8±11.4gm/day,2013.3 ±327.6 kcal/day, and 910.7±210.4 mg/day respectively whiles the mean intake of folic acid, niacin, thiamine, riboflavin,

vitamins C and vitamin A were 196.2±38.4µg, 11.9±2.1 mg, 1.2±0.2 mg, 1.6 ±0.2 mg, 113.3 ±2.1 mg and 608.4±161.2µg respectively. From the study conducted a positive relationship was seen between low birth weight and nutritional deficiencies.

Also, a study conducted by Mahama et al, (2014) revealed maternal dietary diversity was an independent predictor for low birth weight and mean birth weight. Among women on low and highly diversified diets, a positive difference in adjusted mean birth weight was observed. A negative relationship was found between individual dietary diversity score and low birth weight. The study concluded that maternal diet seems to be a major determinant of low birth weight in poor populations in the third trimester of pregnancy and that the dietary diversity score can be used as a measure of maternal nutrition during pregnancy.

A study by Loy et al., (2013) found before pregnancy, 6.5% of women were underweight, 53.7% of women were normal weight while 25.9% and 13.9% of women were overweight and obese. It was observed that fruit intake was associated with having a high birth weight after delivery compared to all the food groups (p=0.018). Length at birth was not associated with any of the food groups whereas fruits intake was positively associated with head circumference (p=0.019). In disparity, condiments and confectioneries were seen to be positively associated with lower birth weight. The results indicate that dietary consumption during pregnancy can impact fetal growth and determine the size of full-term infants born at birth. Consumption of rich food in micronutrients has a beneficial effect on the development of a child.

A study conducted by Gala et al, (2016), revealed that Birth outcome was influenced by factors such as maternal postpartum BMI, gestational age, weight, haemoglobin levels before delivery, height, and nutrient intake mostly energy, protein, vitamin C and calcium. before pregnancy and during pregnancy maternal diet with haemoglobin concentration and maternal anthropometry,

before delivery and gestational age greatly influences the birth outcome. Adolescent girls require more attention especially in the area of nutrition which can be achieved by giving proper pre-pregnancy counselling and nutrition education which will in turn help to better pregnancy outcomes.

Furthermore, another study by Geta et al (2019) found that the mean birth weight of the new-borns was 3.14 ± 0.46 kg. maternal factors such as parity (p = 0.013), hemoglobin level (p = 0.046), pre-pregnancy body mass index (p < 0.001) and weight gain during pregnancy (p < 0.001) were positively associated with birth weight of the new-borns after adjusting while the associations with total protein (p = 0.822) and total cholesterol (p = 0.423) were not significant. As indicated by haemoglobin level and maternal anthropometry, maternal nutritional status during pregnancy was correlated with baby weight at birth. Thus, to reduce the risk associated with low birth weight, nutritional status should be improved during pregnancy.

Lastly, a research was done by Sharma et al (2014), showing that out of the total number of children delivered 63.3% were born with a weight <2.5kg and rests remained normal. 68% of the low birthweight babies accounted for preterm labour and 32% accounted for intrauterine growth retardation (IUGR). It was found that the low body mass index of mothers beforehand and later pregnancy was correlated with the birth of babies weighing <2.5kg, reflecting about half of the mothers. Mean birth weight was about 2.463gms. Dependent on each other was maternal haemoglobin status and low birth weight.

Birthweight and BMI were seen also to be significantly associated. Their study determined that undernourished women who were pregnant delivered low birth weight babies whereas those with low haemoglobin levels were at increased risk of delivering babies weighing <2.5kg.

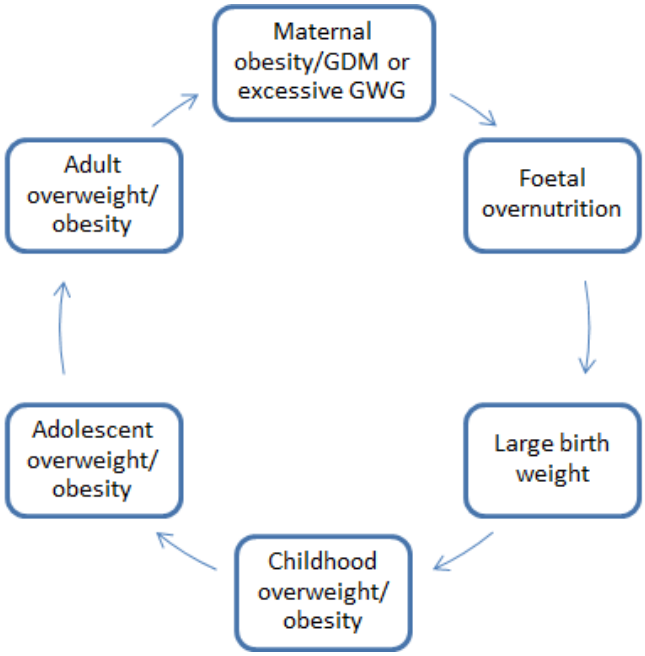
2.7 Gestational weight gain and associated factors

The concept of foetal and infant growth is considered as a sensitive period for the adult disease development later in life, as a result of undernutrition during pregnancy and early post-natal life. This was first introduced by David Barker and hales in the early 1990s.They then proposed a hypothesis known as the "thrifty phenotype hypothesis" or the "foetal origins hypothesis (Barker :al, 2002). They believed that decreased foetal or infant growth was related to type 2 diabetes and dult cardiovascular diseases which are all due to the programming effect of undernutrition on the)etus.

tudies were carried out to establish a link between adult obesity and foetal undernutrition. The rst to be conducted was among women who were exposed to famine during the Dutch hunger 'inter period (Ravelli et al, 1999). The results from the study indicated that male offspring of 'omen who were severely malnourished during the first period of gestation and later had adequate utrition throughout the remaining course of pregnancy were seen to be more likely to develop)esity in young adulthood. (Ravelli et al,1976).

'ver nutrition is the main focus of attention now in most high- and middle-income countries rather ıan undernutrition due to the global obesity epidemic burden which is now the current trend in ealth. Therefore, much attention needs to be given in understanding the phenomena behind)esity and its origins in foetal life in- order to prevent obesity and its related co-morbidities.

he "developmental over nutrition hypothesis" or "foetalovernutrition hypothesis", proposes that, during pregnancy a higher supply of macronutrients can lead to the development of obesity later in life (Lawlor et al,2007). This was originally developed in the 1950's by a researcher named Jorgen Pedersen. The diagram below depicts the above.



igure 2.2: Foetal Over nutrition Hypotheses

efore becoming pregnant, a woman with an average weight should gain around 11 to 15 ilograms after being pregnant. Underweight women are expected to gain 28 to 40 pounds during regnancy, and overweight women will only have to gain 15 to 25 pounds during pregnancy.

chieving optimal nutritional status before and during pregnancy has a positive effect on high diet uality and pregnancy outcomes. According to Widen et al, (2010) obtaining a nutritional history, etermining weight status before and during pregnancy, assessing and monitoring current dietary ıtake are well accepted obstetric protocols. Women who become Pregnant with a body mass index 3MI) of < 18.5, 18.5 - 24.9, 25 - 29.9 and ≥ 30 kg/m are instructed to gain total weight of 12.5 - 18, 11.5 - 16, 7 - 11.5 and 5 - 7kgs, respectively (IOM 2009). The above ranges of weight gain are shown to be associated with the lowest prevalence of outcomes such as: preterm birth, childhood obesity, caesarean delivery and small or large for gestational age. During pregnancy the major constituents of weight gain are the placenta, foetus, maternal body water and amniotic fluid (Rasmussen et al. 2009)

2.7.1 Physiology of Gestational Weight Gain

The word Pregnancy is a dynamic process, which affects the physiology and metabolism of a woman in order to facilitate foetal growth and development. The cycle of pregnancy involves plasma volume development and total body water as well as adiposity changes, and these developments lead to the acquisition of bodily weight (Yao et al., 2017). Weight increase is generally a significance of a discrepancy between energy expenditure and intake (Greenway, 015). Other scientists have also suggested the role of both environmental as well as genetic factors ı influencing weight gain in pregnancy (Choquet & Meyre, 2011). Manifestly, there is a close ilateral relationship between mother and foetus. According to (Kominiarek & Peaceman, 2017), ıe foetus itself possesses dynamic endocrinal and homeostatic changes in its mother, the contrary as an overwhelming control of the foetus' circulation, growth, and metabolism. Weight gain uring pregnancy is naturally projected, as it relates with increased nutrients for use by the foetus. lacenta, foetus and amniotic fluid are the outcomes of pregnancy, representing about 35% of the verall gestational weight gain (Michelle et al, 2017). It has however been recommended that gnificant weight changes could affect many biochemical and physiological processes across ifferent systems in the body. It may also modify metabolism, blood chemistry, nervous ansmission, circulation, among others (Bhaskaran et al., 2014) which in actual sense have a role) play in the overall health of the unborn child.

.7.2 Effects of Hyperemesis and Hypersensitivity

)uring pregnancy, having excessive vomiting before week 3 of gestation is what is termed as hyperemesis gravid arum (hyperemesis). Weight loss, electrolyte imbalance and nutritional deficiencies are the results of the severe forms of this condition which consequently result in low birth weight and preterm deliveries. (Van et al, 2009). During the first trimester of gestation, hyperemesis is the most prevalent cause of hospitalization and the prevalence ranges from 0.5%

to 3.2%. (Vikanes et al., 2008). Though several extensive researches have been conducted to determine the aetiology of this condition, it still remains unknown. However various mechanisms have been proposed to be the likely causes for the development of this condition by earlier research. These mechanisms identified include severe hormone irregularities and over-activation of the immune response in early pregnancy (Verbeg et al., 2005). A Factor identified to be associated with hyperemesis is high pre-pregnancy BMI or eating disorders. Also, the aetiological ıctors between dietary intake, pre-pregnancy BMI and hyperemesis have been barely investigated ı establish. (Cedergen et al., 2008).

regnancy is a physiological condition that, due to high mitochondrial turnover and high tissue xygen needs, has increased oxidative stress. Patients with hyperaemia were shown to have lower verall antioxidant production and higher levels of malondialdehyde than pregnant patients who id not experience hyperemesis. (Askov et al., 2009). Studies have also documented that woman ith hyperemesis have higher oxidative stress (including lowered glutathione antioxidant levels) ıd higher activity of reactive oxygen species, and have poorer antioxidant status than women ithout hyperemesis who are pregnant. Because of the increased need for antioxidants during regnancy, low antioxidant status before pregnancy can therefore lead to the production of yperemesis.

.7.3 Effects of Suboptimal Weight Gain During Pregnancy

uring breastfeeding, inadequate maternal weight gain raises the likelihood of preterm delivery, LBW, SGA (Han et al., 2010; Margerison et al., 2010; Ricci et al., 2010; Wolfe et al., 1991), and infant mortality (Davis et al., 2014). The chance of getting an SGA child is doubled for women who had normal pre-pregnancy weight if the maternal weight gain during the second trimester is below 0.25 kg per week (Carmichael & Abrams, 1997).

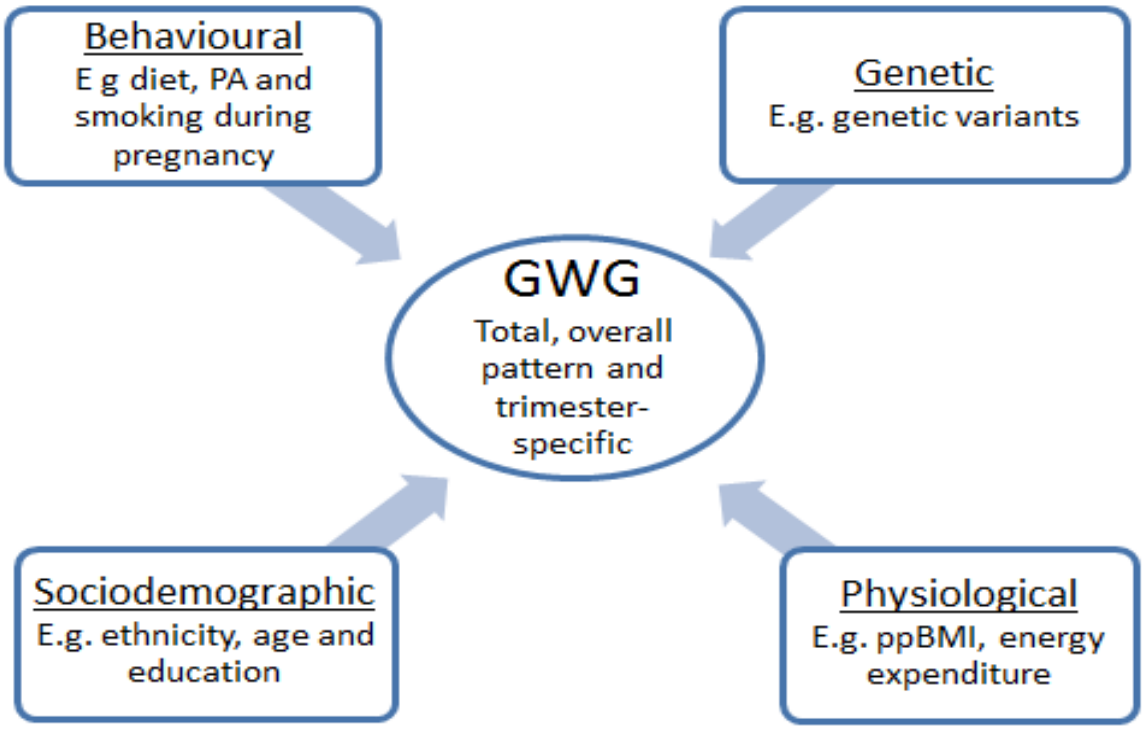
Under-nutrition during breastfeeding, along with insufficient weight gain, is associated with a lower concentration of insulin-like growth factor-1 (IGF-1). IGF-1 plays an essential role in placental and foetal growth by promoting foetal nutrient uptake and inhibiting foetal tissue breakdown. Therefore, lower levels of IGF-1 may cause SGA and low birth weight because of depleted foetal muscle and skeletal mass (Iniguez et al., 2006; Ohkawa et al., 2010).

Excessive weight gain (>0.7kg/week in third trimester) during pregnancy could lead to a large-for-estational-age (LGA) baby. Infants born LGA are at a greater risk of being overweight at age ıree and beyond (Mamun et al., 2014; Crozier et al., 2010; Olson et al., 2009; Moreira et al., 007), and of developing childhood asthma (Forno et al., 2014). An LGA birth also increases the sk of labour difficulties (Mamun et al., 2010). For the mother, excessive weight gain can cause ı increase in weight retention after delivery and increases maternal risk of type II diabetes Margerison et al., 2010; Mamun et al., 2010; Olson et al., 2009; IOM, 2009). Pregnancy obesity ıises the risk of gestational diabetes, PIH, need for caesarean section, late-pregnancy (>42 weeks' estation) and miscarriage (Artal et al., 2010; Mamun et al., 2010; Callaway et al., 2009; ACOG, 005).

.7.4 Determinants of Gestational Weight Gain During Pregnancy

hey are several complex factors that influence weight gain which are physiological, socio-emographic, genetic and maternal behavioural factors which later have an influence of the ıvironment of the foetus (Rasmussen et al, 2009). Important factors that determine gestational weight gain is depicted in the diagram below and can be also considered as potential confounding factors. Reasons explaining paternal influence on weight gain is difficult, thus research in this area is scarce. Nevertheless, in relations to growth of the foetus characteristics such as fatherly size at

birth and adult Body Mass Index have been shown to have an impact however not as great as maternal factors (Klebanoff, 1998). Thus, the focus on maternal factors.



igure 2.3: Determinants of Gestational Weight Gain

esearch conducted by Suliga et al, 2018 found three pregnant women's eating habits which are aried, prudent and unhealthy. Being underweight before birth was a major indicator of insufficient eight gain whiles factors such as being overweight or obese prior to pregnancy and stopping noking are associated with increased risk of premature gestational weight gain. The risk of nnecessary weight gain was minimized by being underweight before birth, adhering to a prudent diet and being in the third or subsequent pregnancy, not the first.

In Ghana Agbayizah 2017 conducted a study and the prevalence of inadequate, adequate and excessive gestational weight gain were 22.7%, 29.2% and 48.1% respectively. Patterns of diet precisely starchy staples and legumes, nuts and seeds and Preliminary pregnancy BMI,

employment status (p=0.009), marital status (p=0.014)) were factors that were substantially related to gestational weight gain

A research by Pal et al. (2017) showed that two of the strongest determinants of birth weight and perinatal outcome are the maternal body mass index (BMI) and the weight that a woman absorbs during pregnancy. Pal et al. (2017) has discovered that a baby's birth weight has a substantial ssociation with overall antenatal weight gain. They concluded that lifestyle intervention enhances festyle patterns during pregnancy and raises the required pre-pregnancy body mass index (BMI) WG, but in terms of changing dietary practices, it has a minimal impact.

ı Malawi Shyreen 2017, conducted a study to identify factors associated with the rate of estational weight gain. It was revealed from the study that 19.8% of the pregnant women gained dequate weight. The mean gestational weight gain per week was 0.26 SD ± 0.2 kg. Inadequate estational weight gain was significantly associated with being pregnant before harvest season. Ialaria and having a high gestational age were factors associated with low Hb status. Poor socio-conomic status and large households decreased the size of MUAC significantly whereas maternal ge was significantly associated with having a large MUAC.

apazian et al 2017 conducted a study which showed that macrosomia and non-fat body weight ere significantly associated among women who were above or below the IOMs recommendations f which are the negative outcomes of new-borns. In both the underweight and obese categories, pre - pregnancy body mass index influenced the infant's birthweight significantly. Head circumference, Apgar score and birth height were not influenced by gestational weight gain or pre - pregnancy body mass index. Furthermore, a negative correlation was found between pre-pregnancy Body Mass Index and maternal age and gestational weight gain.

Furthermore, a study done by Lima et al, (2017) determined that marital status, age, smoking habit, socio-economic status, pre-pregnancy body mass index, and alcohol consumption during pregnancy, hypertension and gestational diabetes, gestational weight gain, and type of delivery were seen to be determinants of birth weight.

A study conducted by Asefa et al (2016) indicated that 69.3 % gained inadequate weight, 28 % ained adequate weight, and 2.7 % gained excess weight. The study observed a mean gestational eight gain of 8.96 ±3.27 kg. Having a Body Mass Index ≥ 25kg /m^2, engaging in regular physical xercise, attending antenatal care visits of more than 4 times, consuming vegetables and fruits and eat were factors associated with adequate gestational weight gain.

. study conducted by Asci et al (2016) showed that lifestyle interventions had a significant effect n improving lifestyle behaviours, protein intake, percentage of energy from protein, calcium, agnesium, iron, zinc, and vegetable intakes when adjusted for confounders ($p < 0.05$). The roportion of women who were within the IOM recommendations was higher in the intervention roup than in the control group.

nother study conducted by Muhammad et al., (2015) considered nutritional status before regnancy and observed that, more than half of subjects failed to gain the recommended weight 5.5%) and that underweight and normal weight women tend to have poor weight gain during regnancy compared to overweight and obese women. They observed that an increase in weight was associated with body mass index before pregnancy and factors such as level of education, age at higher risk, anaemic status, and frequency of ANC visit did not have any association with weight gain.

Again, a study on maternal weight gain and various factors associated with it was discovered. It was observed that, an increase in mean birth weight correlates with an increase in maternal weight gain (Kulkarni 2015). The total mean birth weight recorded from the study was 2728.9 grams. A difference in mean birth weight of 335.1 grams was seen in the birth weight between the two extremes of maternal weight gain. The study also revealed that babies of women who had weight gain of 5-7 kg had mean Birth Weight of 2628.9 grams compared to those of mothers with weight gain of 8-9 kg (Mean Birth Weight 2704.8 grams).

Lastly a study by Krishna et al., (2013), recorded a 72.4% anaemia prevalence during third trimester and moderate and severe degree of anaemia was present in about 16.1 of the study population. They also observed that prevalence of low birthweight and small for gestational age among new-born babies was 11.8 percent and 28.6 per cent respectively and mothers who had severe degree of anaemia 20 in the third trimester of pregnancy delivered 62.5 per cent small gestational age babies while in non-anaemic pregnant women prevalence of small gestational age was 3.6 per cent. In severe anaemic pregnant women low birth weight was 75.0 per cent. They established a positive correlation between anaemia during third trimester and birth weight and gestational size of the new-born.

The evidence above showed that, gestational weight gain had an effect on birth weight however, that of pre-pregnancy body mass index was not seen to have much significant effect on birth weight.

2.8 Birth Weight and Associated Factors

During delivery the weight of a baby can be kept into 3 classifications which are, normal, that is having a birth weight of =2.5kg to <4.0kg, low birth weight weighting <2.5kg and macrosomia weighting =4.0kg. It is noted that macrosomia and low birthweight have serious consequences on

the life of the infant. Apart from infant mortality and childhood growth failures which are short term consequences there exist long term consequences which are adult coronary heart diseases and type 2 (Barker et al., 2002). What may result in low birth weight is a short gestation period (<37 weeks) or delayed intrauterine development (or a mixture of both) (Kramer et al., 1987).

Every year, almost twenty million children are delivered worldwide with less than 2.5kg weights. The low birthweight prevalence is 13.7% in Africa. Considering sub-Saharan Africa countries, ıe prevalence of LBW is around 14% and in West Africa, the prevalence is 15.2 % (WHO, NICEF 2015). The Ghana Demographic and Health Survey Report 2014 indicated that of those ew-borns weighed at birth, 10% had a LBW (GDHS, 2014) and in 2015 WHO and UNICEF ecorded a prevalence of 14.2% indicating an increase.

.8.1 Socioeconomic and demographic factors affecting low birth weight

ge

he risk of delivering a low birthweight infant is high among women within the age group 35 and ɔove (Chiavarini et al 2012). The differences in low birth weight due to ages of mothers are ıultifaceted and associated with social and behavioural factors and socioeconomic drawbacks. It as been proven that maternal age and low birth weight risk does not operate homogeneously Dennis & Mollborn, 2013). Obstetric and medical complications are observed to be more common ımong older women than the younger ones of which include diabetes mellitus, chronic hypertension, malpresentation, pregnancy-induced hypertension, pre-term labour, and postpartum haemorrhage which eventually might lead to adverse foetal results such as congenital abnormalities, low birth weight and low Apgar scores (Tabcharoen et al., 2009).

It is known that worse socio-economic status, reproductive conditions and the pre-natal outcome are observed among teenage mothers (age <20) rather than to other age group categories such as between 20-29 years.

Educational level

The quality of education of people in a household has a significant effect on the health of the ımily, so it is possible to gain more and more advantages from pursuing higher education Rolleston, 2011). Literature indicates that mothers with less education or no level of education : all are more likely to deliver infants with low birth weight as compared to those with higher ducation (Chiavarini et al, 2012).

)ccupation

has been shown that some occupations of women show a negative effect on birthweight. A oman affiliated to a particular occupational group could increase her chances of delivering a low irthweight infant. (Ronda et al, 2009). Countries within sub-Saharan African are called low-ıcome countries, with Ghana being no exception. The lowest income of every Ghanaian in 2015 as $2.2 (GSS, 2015) of which the majority of the Ghanaian population lived below. The ccupational status which determines the financial status of a family was identified as a very good ıdicator of low birthweight delivery as the financial status of the family determines what they ıould eat. The effect of depression was also found to intercede with the effect of poverty on deliveries of low birthweight babies (Lee & Lim, 2010).

Maternal anthropometry

Women with weight 45kg, height 152cm, mid-upper arm circumference of 22.5cm and a Body Mass Index of 20kg/m2 have been shown to have a high risk of delivering low birth weight babies. (Mohanty et al., 2006). A correlation between anthropometric parameters and low birth weight has been identified by several studies.

Marital Status

esearch works have consistently shown that women who are not married have poorer health and igh mortality compared to those who are married (Robards et al 2012). However, this may result a woman giving birth to a child with low birth weight. Unmarried women have higher rates of elivery of babies with a low birth weight than married women because they many lack financial nd emotional support arising from pregnancy stress. Meanwhile, the other partner could help in educing the pressure. The characteristics of the relationship with a woman may be more important the infant's welfare rather than the marital status (Bird et al, 2000).

esidential status

Majority of people in Ghana live in rural areas. The location or residence of a person determines ne accessibility and availability of social amenities such as education, housing units and ealthcare and the rural-urban differences pose these inequalities. (Sahn& Stifel, 2003). In rural ub-Saharan African countries, living in a disadvantaged society means living in a deprived ommunity with an elevated risk of women having low birth weight babies due to poor social services and infrastructure and work opportunities.

A study on maternal obstetric and socio-demographic determinant of low birth weight in Ghana by Shamsudeen et al (2019) also found that maternal educational level, residence, haemoglobin level, parity, and number of ANC visits are independent predictors of low birth weight.

Research on factors correlated with low birth weight among new-borns delivered at public health facilities in Ethiopia, conducted by Girma et al (2019), revealed that low birth weight deliveries were individually correlated with the lack of nutrition therapy during pregnancy, maternal under-nutrition, not taking snacks during pregnancy, maternal anaemia and insufficient minimum dietary diversity score for mothers.

Research by Jennifer et al (2017) provided an insight into the impact of obesity on maternal and foetal results in obese pregnant women relative to average weight pregnant women. During their pregnancy time, (32 per cent) of cases developed gestational diabetes mellitus and (38 per cent) developed gestational hypertension. (10 %) underwent emergency caesarean section and elective caesarean section was performed for (28 %) of cases. The percentage of patients who experienced antepartum symptoms that were also found to be higher than in control groups were gestational diabetes mellitus, gestational hypertension and preeclampsia. Also, the requirement for labour and caesarean section induction has been shown to be greater in cases than in controls. An increased neonatal intensive care unit admission for stabilizing the new-born among the case groups was greater than the control group. From the study reviewed, Maternal obesity has obviously been known to have adverse effects on both maternal and foetal outcomes.

A study by Manyeh et al (2016) to determine birth weight using demographic and socio-economic determinants in southern rural Ghana revealed in their study that women's household socio-economic status, child sex, parity, occupation, and maternal age were highly associated with having a birth weight of =2.5.

A study conducted by Fosu et al (2016) in Ghana found a significant influence of mother's location (Urban/Rural) and socio-economic status on low birth weight (p= <0.0001). However significant relationship could not be established between marital status and ethnicity and low birth weight.

Another study conducted by Eyad et al., (2015) on the determinants of pregnancy outcome showed a significant association between socio-economic status and birth weight ($p<0.05$) with high birth weight group babies belonging to a high-income group and low birth weight babies from lower-income groups only. Factors such as weight and BMI of the mothers before pregnancy, total weight gain during pregnancy and haemoglobin levels were found to be significantly correlated with birth weight in the said study.

. study by Gizaw et al, (2018) on factors associated with low birthweight in North Shewa Ethiopia, ıdicated that mother with no formal education were two times more likely to deliver low birth 'eight babies compared to women with formal education. [AOR = 2.20 (95% CI: 1.11, 4.38)]. he study also indicated that women with no history of nutrition counselling during pregnancy 'ere 3 times more likely to deliver low birth weight babies compared to those who had nutrition ɔunselling. [AOR = 3.35 (95% CI: 1.19, 9.43)]. Mothers who were not married had more odds of iving birth to low-birth-weight babies than those who were married. [AOR = 3.54 (95% CI: 1.83, .83)]. In disparity to women who had more than four antenatal care visits, those who had no visits ad three times more odds of delivering low birth weight babies. [AOR = 3.03 (95% CI: 1.19, .69)].

According to Atuahene et al (2015), their study found that factors that were significantly ssociated with low birth weight were low gestation at birth, lower body mass index Gestation at ɔirth and diastolic blood pressure. Their research also found that a rise in diastolic blood pressure is more likely to lead to neonates with low birth weight, whereas an increase in gestation by 1 week at birth is more likely to yield a normal birth weight.

In Pakistan Habib et al, (2017) conducted a study and found that the following factors were significantly associated with having an increased odd of having a low birthweight baby which

included: illiteracy, nulliparity, having a previous miscarriage/abortion, having < 2 antenatal care (ANC) visits during last pregnancy, seeking ANC in the third trimester, non-use of iron-folic acid during last pregnancy, having hypertension during last pregnancy, being anaemic and having a postpartum weight of <45.

According to a study conducted by Agonyira et al 2018 in Ghana, the low birthweight prevalence was 13.8% and it was found more in females (15.5%) compared to males (12.2%). They also sought to determine low birth weight determinants which were, sex of neonate, maternal age and mothers who are not married, after controlling for confounders.

Another research conducted by Tampah-Naah et al (2016), showed that educational status of women especially those who had never been to school had less likelihood of delivering a low birthweight baby (OR = 0.566, 95% C.I. = 0.349 – 0.919) as compared to the other levels of education of women. Also, women who were not married were seen to have a higher likelihood of giving birth to a baby with low birth weight (OR = 1.698, 95% C.I. = 0.993 – 2.905) compared to those who were married. Therefore, factors such as educational status and marital status of women/mothers can influence the birth weight of an offspring.

Another research conducted by Taabia (2018) indicated that the prevalence of moderate asphyxia, low birth weight and postpartum haemorrhage were 9.3%.8.2% and 7.1% respectively. Significant factors that were associated with low birth weight included intake of alcohol (P<0.034), Gestational weight gain (p<0.036), maternal height (p<0.028), food taboos (p<0.017), religion (p<0.037), transportation (p<0.001), gravidity (p<0.013) and parity (p<0.008)

Prasad et al (2017) conducted a study and in their study, it was found that 9.4% of babies were born low birth weight and 90.6% were born with normal weight at birth. The mean birth weight

observed was 2.96kg of which 9.4% were weighing less than 2.5kg. Factors such as the age of mother, weight gain, Height, low body mass index and hyperemesis gravidarum were seen to be the strongest predictors of low birth weight in this study.

A study conducted by Zakaria (2016) in Ghana indicated that low birth weight is influenced by several factors of which include first-trimester haemoglobin <11g/dl, delivery at 32-36weeks estation, delivery below 32weeks gestation, Secondary Education of mothers, living with xtended family, living alone during pregnancy, and not complying with the iron supplements ecommended for pregnancy were found to be the determinant factors of Low birthweight in this udy.

. study conducted by Gebremedhin et al (2015) in Tigray indicated that the prevalence of low irth weight was 14.6% with a mean and standard deviation of 3094.9 ± 587.6 grams. The revalence of low birth weight was consistent with the rural place of residence, preterm irth/gestational age of less than 37 weeks, the existence of some underlying medical disorder and aternal weight of less than 50 kilograms. It was also found that the culture was inherent in its ractice of choice and collection of nutritionally deficient food products during pregnancy.

nother research conducted by Osman et al (2014) showed that the mean gestational weight gain as 1.63 ± 0.48 kg/month. They observed that birth weight and maternal height, maternal weight, id-upper arm circumference and skin-fold thickness of triceps were linked. Others (Solanki et al., 2012) found an association between birth weight and education, maternal age less than 20 years, and socioeconomic status. Furthermore, infants of mother's age less than 20 years and the number of years of education less than 7 were found to have an increased risk of LBW.

In Brazil, a study conducted by Silvestrin et al. (2013) found that maternal age was significantly associated with adverse birth outcomes. The results indicated that the prevalence of low birth weight was higher in the extremes of reproductive life. Low birth weight deliveries rate increased consistently with younger maternal age, with that of mothers 15 years and younger recording high percentages of low birthweight deliveries.

Moreover, Deshpande et al., (2011) reported that women with low income, farm labourer mothers, literate or primary educated primiparas and with spacing less than 2 years had higher deliveries of low birthweight infants. Their study established an association between low birth weight and anaemia. Pregnancy-induced hypertension, maternal weight <45kg, maternal height <145cm, and insufficient prenatal treatment were identified as important determinants of low birth weight. They further showed that health education, socio-economic development, maternal nutrition, and increasing use of health services during pregnancy could be protective against low birth weight (Depshpande et al., 2011).

Nigerian research by Isiugo-abanihe et al (2011) on maternal and environmental factors influencing infant birth weight in Ibadan showed that mothers with gestational age less than 37 weeks were shown to deliver low birth babies as it was the strongest factor associated with low birth weight. Thus, the study emphasized the impact of intrauterine growth restriction as an indicator of low birth weight. They also reported of other significant risk factors for low birthweight deliveries to be maternal age less than 25years, first parity, maternal weight and height, late initiation of ANC, pre-term delivery, and the presence of illness.

A population-based study of ethnic differences in birth weight conducted by Shiono et al., (1997) found that maternal ethnic group was a strong significant factor for birth weight. In their report, they also demonstrated that socio-economic background, unplanned pregnancies, nutrient

deprivation, risky behaviours, and post-natal wellbeing were the main factors correlated with racial disparities.

CHAPTER THREE
METHODOLOGY

3.1 Study Area

The study was carried out in the Tamale Metropolis of the Northern region, which is ecologically situated in the guinea savannah zone. The area is characterized by drought-resistant trees such as baobab, dawadawa, shea, mango and neem. It lies between longitudes 1ºE and 3ºW and latitudes 9ºS and 11ºN of the equator. Tamale Metropolis share boundries with Savelugu/Nantong to the North, Tolon and Kumbungu to the North West, East Gonja to the South and Yendi district to the East.

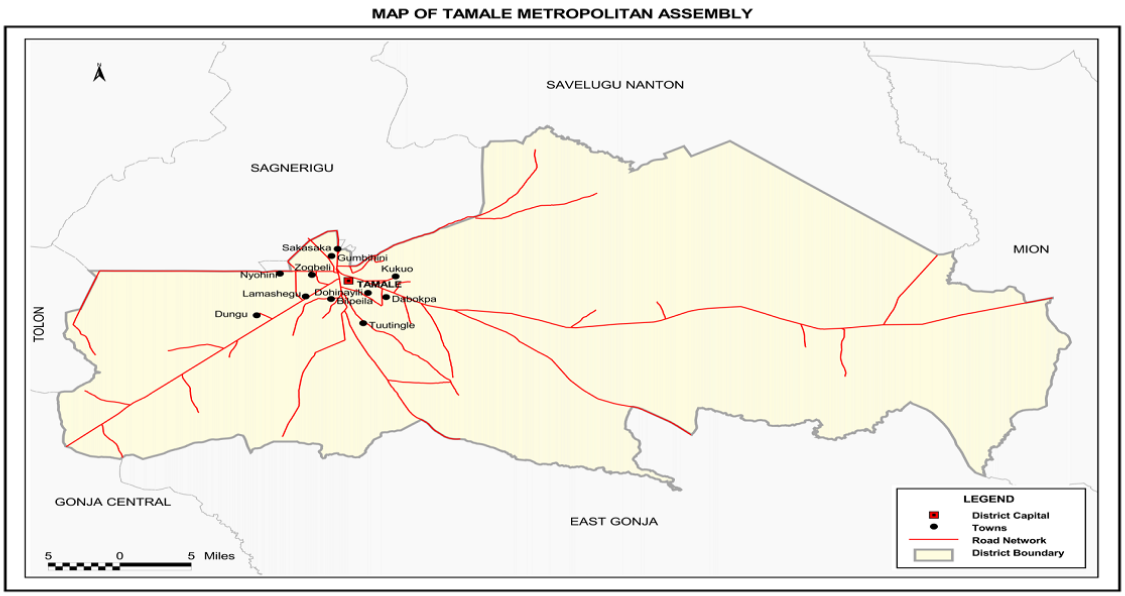
The major occupation of the people is farming. Rice and maize are the main cereal crops cultivated in the area. Few farmers also cultivate yam, cassava, pepper and some other crops. Most farmers keep small ruminants as well as poultry at the backyard to supplement their crops. The area has a population of about 223,252 (Ghana statistical service, 2014).

The metropolis is made up of One hundred and fifteen communities (115), with Females constituting 50.2% and Males representing 49.7%. of the population. The number of people living in the urban areas of the Metropolis is 80.9% compared to 19.1% living in the rural areas. Generally, Fertility Rate is 79.9 births per 1000 women aged between 14 – 49 years and the Crude Birth Rate is 21.2 per 1000 population. Most of all the large landscape of land in the metropolis used for agricultural production which serves as the food basket for the metropolis is found in the rural communities. However, basic social and economic infrastructure such as school blocks, good roads, health centers and markets are still lacking in the rural communities of the metropolis

thereby deterring socio-economic development, poverty reduction and reducing the general phenomenon of rural-urban migration.

Agriculture is an important component of the economy of Ghana and employs about 60.0% of the nation's economically active population (GSS, 2010). The sector is important to the national economy, which in 2013 added 21.3% to the Gross Domestic Product (GDP) (MOFEP, 2013).

he main types of farming activities considered in the 2010 Population and Housing Census in hana are crop farming (excluding gardening), tree growing, livestock rearing, and fishing. Crop rming is most dominant in the Metropolis, accounting for more than half (52.9%) of the opulation in the urban areas and less than half (47.1%) in the rural areas.



Source: Ghana Statistical Service, GIS

Figure 3.1 Map of Tamale Metropolis

3.2 Study Design

This study used a retrospective cross-sectional analytical design. The design aided collecting of data at a point and identification of relations concerning the different variables.

3.3 Study variables

The study considered gestational weight gain, Birthweight and Dietary habits as dependent variables and all other factors as independent.

Variable	Type of variable	Definition of the variable
Birth weight	Dependent	Baby weight at birth
Gestational weight gain	Dependent	Weight gain during the period pregnancy
Dietary habits	Dependent	Food intake of pregnant women
Age	Independent	Maternal age in completed years
Marita status	Independent	The relation between participant and male participant
Religion	Independent	Belief/religion of the pregnant woman
Educational level	Independent	Level of formal education
Occupation	Independent	Means of income
Place of residence	Independent	Participant's place of residence
Parity	Independent	Number of children participant has
Food taboos	Independent	The beliefs and practices of pregnant woman in relation to food
Malaria	Independent	Whether participant was treated for malaria in current pregnancy
Maternal dietary diversity score	Independent	The number of food groups mothers consumed the previous day using Minimum Dietary Diversity for Women (10-items)

3.4 Study Population

The source population was postnatal mothers who are permanently residing in Tamale Metropolis of the Northern Region. The study sample was postnatal mothers who were randomly selected to participate in the study in Tamale Metropolis.

3.4.1 Inclusion Criteria

ostnatal mothers who were willing to participate in the study and are permanent residents of amale Metropolis and of sound mind and health were included in the study.

.4.2 Exclusion Criteria

xcluded from the study were postnatal mothers with chronic conditions such as cancer and iabetes. This is because these factors are believed to influence an individual's nutritional status. he respondents, clinical reports in the mother child's booklet and from the medical documents ere used to collect this health information.

.5 Sample Size Determination

he sample size was determined by a single population formula using

$$= \frac{z^2 \acute{p}(1-\acute{p})}{ME^2}$$

vith a 95% confidence interval, 5% margin error and a low birth weight prevalence of 29%.

(Where n is the sample size, Z2 (statistic) = 1.96, p (prevalence) = 0.29 d (margin of error) = 0.05

.

$$N= \frac{(1.96)^2 (0.29) (1-0.29)}{(0.05)^2} = 313$$

The calculated sample size will therefore be 313. After adding 10% non-response rate, the final sample size obtained will be 343 research participants.

3.6 Sampling Method

The study used a multistage sampling approach. The first stage used random sampling to select the health facilities in the Metropolis. The second used consecutive sampling to select the study participants. On each day of sampling, all women in attendance at the various postnatal points of the selected hospitals were approached and eligible candidates were selected and interviewed. This procedure was done on each day of the sampling until the required sample size was obtained. The election of the number of people from each facility was based on the number of people that visit ıe various facilities for post- natal services

.7 Data collection and instruments

he data collection spanned for two months (March 2020 to May 2020) with the use of a semi-ructured questionnaire. Interviewer assisted questionnaire administration was employed for the rimary data collection. The questionnaire was administered in the local language (Dabganli) of ıy respondent who does not understand English or chooses to communicate in the local language. he questionnaire used both open and close-ended questions. It was divided into sections: Section . covered socio-demographic characteristics, Section B covered household assets and wealth and ection C covered dietary pattern using food frequency questionnaire adapted from the Ghana)emographic and Health Survey Report and modified to suit the purpose of the research.

he socio-demographic information prerequisites were: - age, parity, marital status, educational ıevel and core livelihood of the respondent and the husband if married/ socio-segment data essentials were: - age, equality, marital status, literacy level and centre business of the respondent and the spouse whenever wedded. In assessing pregnant women's nutritional status, methods such as the use of anthropometrics, biochemical methods, clinical methods and dietary intake assessments were used (Gibson, 2005). According to De et al (2009), anthropometric

measurements are the most frequently used methods. The methods are considered effective and most appropriate in the promotion of women's health. In developing countries, the use of BMI in assessing nutritional status among pregnant women has been restrained since most women show up for their prenatal hospital late and so their pre-pregnancy BMI might stay unidentified (Kruger, 2005).

2.7.1 Ideal Weight Gain

Increasing weight gain in pregnancy is the result of the expansion of organs for lactation, growth of fetus and body fluid increment in volume. During pregnancy, an increment of 25% initial body weight is considered normal. Therefore, for an average pregnant woman to reach this 25 percent initial body weight, she should gain weight of 10 kg during pregnancy. An ideal weight gain is 5% of the initial body weight (approximately 10kg) and a lower body weight gain could be as a result of greater loss of body fat due to inadequate intake of food or a smaller gain in cells mass and extracellular fluid.

2.7.2 Guidelines for determining gestational weight gain

The guideline for weight gain in pregnancy was proposed by the Institute of Medicine (IOM) in the year 1990. This enabled the promotion of adequate weight gain in gestation to avert premature births. Whiles the objectives were not being entirely achieved, the Institute of Medicine's guidelines for pregnancy weight gain was reorganized in 2009 to make use of standard body mass index (BMI) groupings which was developed by the World Health Organization with a shift towards better maternal health outcomes (Restall et al., 2014). The guidelines set out had three categories of gestational weight gain specifically; low or inadequate, normal, or adequate and excessive gestational weight gain with corresponding body mass indexes as demonstrated in (Appendix 2).

In all antenatal care visits, weight of expectant mothers is recorded, which is used as a significant clinical test in antenatal care. Weight gain of mothers is also a measurement often discussed by the pregnant woman in sessions with her doctor or midwife. When the pregnant woman does not gain weight as the pregnancy progresses there is the need the raise a concern. The WHO developed and instituted recommended weight gain during pregnancy, which was based on pre-pregnancy weights. Obesity is defined by many reports as the increment of body mass index > or =30kg/m2 hiles others define it as the increment in the waist-hip ratio of more than 90kg. This makes the omparison of studies difficult and may have implications in the management of normal regnancy.

Veight gained during pregnancy was determined by subtracting the weight at first ANC from the eight at last ANC and categorized according to IOM (2009) recommendation (appendix2). This iformation was obtained from the checklist which was used to collect secondary data from the iaternal health record book

.7.3 Measurement of birth weight and pre-pregnancy BMI

ccording to the world health organization low birth weight infant is one born with a birth weight f <2.5 while macrosomia is defined as birth weight >2.5 (Ramussen,1992). Therefore, this study onsidered 3 categories of birth weight established by the World Health Organization which are a irth weight <2.5 indicating low birth weight babies, a birth weight of ≥2.5 indicating ormal/optimal weight babies and a birth weight >4.0 representing macrocosmic babies.

Pre-pregnancy BMI was determined by using the weight at the first visit to the antenatal facility and the height to calculate the body mass index using the formula weight /height2. The weight in kilograms and the height in meters and the BMI was classified into four categories which are Underweight: BMI < 18.5, Normal weight: 18.5< -<25, Overweight: 25< - <30 Obese: BMI>30.

3.7.4 Measurement of Individual Dietary Diversity Score and socio-economic status

The measure of Dietary diversity of a household reflects the qualitative process of determining their food consumption and their access to food variety. This serves as a benchmark to determine the nutritional adequacy of the diet of individuals. The dietary diversity scores consisted of a simple count of food groups that a household or an individual has consumed during the period of pregnancy prior to the study.

he study aim was to assess the nutrient adequacy of the diet; therefore, data were collected at the ıdividual level. Respondent reported the frequency of consumption of each food using weekly ıd monthly basis and received 1 point if they consumed any food within the food group at least ıce during the period of pregnancy prior to the study and 0 point if they never consumed the food ɔoth in and out of home).

he frequency of consumption of various food groups was analyzed by adapting the guidelines of ıe Food and Agricultural Organization of the United Nations for measuring household or ıdividual dietary diversity (FAO,2014). The dietary diversity score which was used in this study ·as that of women dietary diversity score. Foods eaten by the respondents were classified into 9 ɔod groups: Starchy Staples (Cereals &White roots and tubers); Dark Green Leafy Vegetables; ıther Vitamin A-rich fruits and vegetables; oils/fats; legumes, Nuts and seeds; other fruits & ɐgetables; Organ meat; milk and milk products; Eggs; Meat & fish, seafood. The Individual Dietary Diversity Score was calculated as the sum of food groups consumed. The total individual food scores were first categorized into terciles namely, Low IDDS is equivalent to low dietary diversity (1–3 food groups); Medium IDDS is equivalent to 4–5 food groups, and High IDDS means 6 or more food groups. For further analysis, these groups were then dichotomized into two categories where 0–4 was considered low dietary diversity scores and greater than or equal to 5

food groups was considered high dietary diversity scores. The final frequency of consumption of each food group was determined on a daily and occasional basis from all food groups consumed by the women during pregnancy.

The socio-economic status was determined by summing up all the household assets totaling to 14 household assets used in the questionnaire. Then based on the number of household assets owned, n individual was classified as either low or high depending on the number of assets owned those ho owned less than 7 assets were classified as having low socioeconomic status and those having ore than 7 were classified as having high socioeconomic status.

.8 Data/Statistical Analysis

uring delivery an infant weighing <2.5 kg is known as a low birthweight infant and one weighing 4.0kg is termed macrosomia. this is according to the World Health Organization amussen,1992). Thus, in this study all birth weights =4.0 kg was considered as macrosomia irths, birth weight of >2.5 kg to < 4.0 kg as normal and <2.5 kg as low birth weight. Data entry as done using Statistical Package for the Social Sciences (SPSS version 21) and transferred to TATA 12.1 for further analysis. Uniformity and plausibility checks were done after the data entry ensure that errors were reduced. Descriptive statistics including means and standard deviations SD) were used for continuous variables and frequency distributions were used for categorical ariables. One-way ANOVA was used to compare means, where more than two categories were ormed. Explanatory variables under investigation were maternal age, education, occupation, parity, religion, ethnicity, husband's occupation and education, Body Mass Index, and weight gain. The outcome variables were new-born birth weight (low birth weight, normal, macrosomia). Bivariate analyses were done using chi-square statistics to determine the associations between categorical variables with statistical significance set at $p < 0.05$. Multivariate logistic regression

models were used to determine the predictors of birth weight. All explanatory variables that were significantly associated with the outcome variable in the bivariate analyses ($P< 0.05$) were entered into a multivariate logistic regression model. Both crude and adjusted odds ratios with their 95% confidence interval (CI) were determined and statistically, a significant association was asserted based on *P* value less than 0.05. Multiple testing was controlled using Bonferroni analysis.

.9 Study Period

he study spanned from October 2019 to September 2020 of which all the due processes ranging om proposal defense, ethical clearance to data collection, analysis and writing of the final thesis as done. Live data collection took place from April 2020 to June 2020.

.10 Ethical consideration

ll relevant authorities including the Head of Department, the Regional Health Directorate, and e District Health Administration among others were involved to ensure that all the appropriate olicies and regulatory measures were taken to protect respondents. Respondents' consent form as issued to the individual respondents to seek their voluntary participation in the study before e conducted the interviews with the respondents. The confidentiality of the information obtained om respondents was assured because respondents' privacy was protected through anonymity and oluntary participation. Importantly, ethical clearance was obtained from the Research Committee tor Human Publications and Ethics (CHRPE) Kwame Nkrumah University of Science and Technology, School of Medical Sciences and Komfo Anokye Teaching Hospital, Kumasi to guarantee all the protocol used in the research procedure. The respondents were given explanations on the purpose of the interview after a formal introduction by the investigator. The

respondents were informed of the amount of time it would take to complete the prepared questionnaire.

3.11 Data Quality Control

Adequate training of the data collectors was the first measure that was taken to ensure data quality. Due to the widespread nature of the data collection points across the District; the filled uestionnaire was collated at the close of each week for safekeeping. This ensured that the data athered are checked for possible corrections that are if any before the subsequent week. This also nsured that information obtained from respondents were kept confidential from any third parties. inally, all completed questionnaires were edited before the data was entered for analysis.

.12 Training and pretesting

wo (2) Data Collection Assistants were trained on how to effectively administer Questionnaires nd obtain secondary data from maternal health record books. Training was conducted for the data ollectors before the study. Data collectors were also taken through how to administer a uestionnaire using the appropriate interviewing skills. The questionnaires were written in the nglish language and were translated orally into any of the locally spoken languages (mainly agbanli).

Measures were taken to ensure that the keywords or main concepts in the questionnaire were not ost when the questionnaire was being translated to a respondent. The questionnaire was first pre-tested among 10 women at a selected Hospital. This was done to determine those who will meet the criteria before the commencement of the main research study. This was to ensure that the questionnaire was able to communicate the right information and solicit the right responses needed for the purpose of the study. The necessary corrections identified during the pre-testing were corrected before the final administration of the questionnaire.

CHAPTER FOUR
RESULTS

INTRODUCTION

This chapter presents the data analysis and interpretation of the 343 post-natal mothers sampled for the study.

4.1 Socio-Demographic Characteristics of Respondents

. total sample of 343 women was used in all analyses. The Majority (93.67%) of the respondents ɛside in urban areas whiles the remaining (6.33%) were from the rural areas. Greater proportion f the women were within the age range of 20-30 years (49.37%) and the remaining (8.23%), 39.56%) and (2.85%) were within the age groups of<20, 30-40 and >40 years respectively. The ıean age of the respondents was 29.04±5.35. Many respondents (90.51%) were married whiles ıe remaining (9.49%) were either cohabiting/divorced/widowed. Only 16.14% women had no ɔrmal education, the remaining 83.86%) had some form of education. Most of the respondents 78.8%) were employed with 35.03% being traders whiles the remaining (21.20%) were ɔusewives. The most dominant religion of the respondents was Islam (75.32%) whiles the ɛmaining 24.68% belonged to other religious affiliations. Most (73.73%) of the women had 1-3 ıildren whiles (14.24) had 4-6 children and the remaining 12.03% were primaries. Most (46.20%) f the women were Dagombas by tribe and the rest were Gonjas (17.72%), Mamprusis (13.29%), .kan (8.22%), and other ethnic groups (14.55%). Most respondent's husbands (94.3%) had some form of education and only 5.70% had no formal education. Most of the husbands were employed (97.8%) and only (2.22%) were unemployed. More than half (52.53%) of the women had normal pre-pregnancy weight, 7.28% were obese, 28.80% were overweight and11.39% were underweight. About 90.51% of the respondents had high socio-economic status and only (9.49%) had low socioeconomic status. majority of the respondents were living in block houses (94.62%), 4.75%

lived in mud houses while the remaining 0.63% occupied brick houses. Charcoal (76.58%) was the main cooking fuel among respondents, followed by LPG (19.3%). Majority of the respondents had their own toilet facilities (69.62%), while 28.48% shared toilet facilities publicly. Meanwhile 1.9% of them practiced open defecation as shown in table.

More than half of the study participants (98.10%) had their main source of drinking water from pipe water. 1.88% drink bore hole water and 0.32% drinks from protected well (TABLE 4.1).

Table 4.1 socio-demographic characteristics of respondents

Variables	Categories	Frequency(N)	Percentage (%)
Residence	Rural	20	(6.33%)
	Urban	296	(93.67%)
Age	<20	26	(8.23%)
	20-30	156	(49.37%)
	30-40	125	(39.56%)
	>40	9	(2.85%)
Marital status	Married	286	(90.51%)
	Cohabiting	12	(3.80%)
	Divorce/separated	6	(1.90%)
	Widowed	12	(3.80%)
Education	No formal education	51	(16.14%)
	Primary	41	(12.97%)
	JHS	66	(20.89%)
	SHS/vocational	98	(31.01%)
	Tertiary	60	(18.99%)
Occupation	Housewife	67	(21.20%)
	Food seller	34	(10.76%)
	Petty trading	77	(24.37%)
	Seamstress/hairdresser	62	(19.62%)
	Salaried worker	76	(24.05%)
Parity	No child	38	(12.03%)
	1-3	233	(73.73%)
	4-6	45	(14.24%)
Ethnicity	Dagomba	146	(46.20%)
	Gonja	56	(17.72%)
	Mamprusi	42	(13.29%)

	Ashanti/ewe	26	(8.22%)
	Others	46	(14.55%)
Religion	Christian	66	(20.89%)
	Muslim	238	(75.32%)
	Traditionalist	12	(3.8%)
Husbands' education			
	Primary	8	(2.53%)
	JHS/middle school	18	(5.70%)
	SHS	117	(37.03%)
	Tertiary	155	(49.05%)
	None	18	(5.70%)
Husbands' occupation			
	Trader	50	(15.8%)
	Employed	210	(66.5%)
	Unemployed	7	(2.2%)
	Farmer	37	(11.7%)
	Others	12	(3.8%)
BMI			
	Underweight	36	(11.39%)
	Normal	166	(52.53%)
	Overweight	91	(28.80%)
	Obese	23	(7.28%)
Socio economic status	Low	30	(9.49%)
	High	286	(90.51%)
Type of house	Block house	299	(94.62%)
	Brick House	2	(0.63%)
	Mud House	15	(4.75%)
Type of cooking fuel	Electricity	2	(0.63%)
	LPG	61	(19.30%)
			(76.58%)

	Charcoal Kerosene Firewood	242 0 11	(0%) (3.48%)
Toilet facility	Own Flash toilet Public Flush toilet Own pit toilet Public or shared pit Toilet/open defecation	92 17 128 73 6	(29.11%) (5.38%) (40.51%) (23.10%) (1.90%)
Source of drinking water	Pipe Water Borehole Protected well	310 5 1	(98.10%) (1.88%) (0.32%)

ource: Field Data 2020

.2 Maternal past obstetric history

rom the study majority (85.76%) of the women did not have any problems during pregnancy and ıe remaining 14.24% had problems during pregnancy (nausea, vomiting, and diarrhoea). Most)5.57%) of the women had tetanus injection during pregnancy and about 60.44% received only ne injection, 35.44% received tetanus injection twice, 4.11% did not receive tetanus injection. Iost (98.73%) of the women took iron tablets during their pregnancy whiles the remaining (1.27%) did not receive iron tablets. More than half (61.39%) of the respondents received de-wormer during pregnancy and the remaining (38.61%) did not receive. Almost 87.0% of all the respondents received malaria treatments while 12.97% did not receive malaria treatment. When mothers were asked about their opinion on their baby's size, most of them (43.99%) considered

their baby's size to be average whiles the remaining chose very large (3.80%), larger than average (28.80%), smaller than average (2.53%) and don't know (20.89%). The majority (82.59%) of the women underwent vaginal delivery and the remaining (17.41%) underwent caesarean section Most (86.39%) of them slept under treated bed nets and the remaining (13.61%) did not (table 4.2).

Table 4.2: Maternal past obstetric history

Variable	Frequency (N)	Percentage (%)
Problems during pregnancy		
Yes	45	(14.24%)
No	271	(85.76%)
Tetanus injection		
Yes	302	(95.57%)
No	14	(4.43%)
Number of times received tetanus injection		
zero	13	(4.11%)
once	191	(60.44%)
twice	112	(35.44%)
Iron tablets		
Yes	312	(98.73%)
No	4	(1.27%)
Dewormer		
Yes	194	(61.39%)
No	122	(38.61%)

Malaria drugs		
Yes	275	(87.03%)
No	41	(12.97%)
Opinion of baby size		
Very large	12	(3.80%)
Larger than average	91	(28.80%)
Average	139	(43.99%)
Smaller than average	8	(2.53%)
Don't know	66	(20.89%)
Mode of delivery		
Vaginal	261	(82.59%)
Caesarean	55	(17.41%)
Treated net		
Yes	273	(86.39%)
No	43	(13.61%)
Pica practices		
Yes	115	(36.4%)
No	201	(63.6%)
Pre-pregnancy BMI		
Underweight	36	(11.39%)
Normal	166	(52.53%)
Overweight	91	(28.80%)

Obese	23	(7.28%)
Number of ANC visits		
Less than 4	5	(1.58%)
At least 4	311	(98.42%)

Source: Field data, 2020

.2 Dietary Habits

.2.1 Meal pattern and food frequency of respondents

rom the analysis done 97.46% of the respondents consumed breakfast on daily basis and the emaining occasionally. Almost all the respondents 98.74% consumed lunch on daily basis whiles few did not consume. More than half of respondents take snacks in addition to their 3 square ıeals and 40% were not consuming snacks however all the respondents indicated ‘taken supper l days of the week.

nalysis done on frequency of food consumption indicated that frequency of consuming food was bserved more in the second and third trimester as compared to first trimester with the following 2.66, 2.22 and 0.32 showing the consumptions of food once in a day for first, second and third imester respectively. For twice a day it was 48.84, 11.08, and 1.90 respectively for first, second ıd third trimester respectively. Also, for consuming food thrice a day it showed that 37.34, 51.9 and 65.04 respectively for the various trimesters and lastly 3.16, 34.81 and 65.04 indicated consuming more than 3 times respectively for first, second and third trimester respectively

Table 4. 3: Meal pattern and food frequency of respondents

Variable	Variable category	Frequency	Percentage
Meal pattern	Breakfast	308	97.46%
	Lunch	312	98.74%
	Snack	218	60.0%
	Supper	316	100%
Frequency of meals consumed/day			
First trim	Once	40	12.66%
	Twice	148	48.84%
	Trice	118	37.34%
	More	10	3.16%
Second trim	Once	7	2.22%
	Twice	35	11.08%
	Trice	164	51.9%
	More	110	34.81%
Third trim	Once	1	0.32%

	Twice	6	1.90%
	Trice	94	29.75%
	More	215	65.04%

Source: Field data, 2020

.3.1 Dietary patterns of pregnant women

rom the table 4.4 below it was revealed that majority (58.23%) of the women consumed starchy oots and tubers on daily basis as compared to occasionally (41.77%). Almost (97.47%) all the omen consumed dark green leafy vegetables on a daily basis and only a few (2.53%) consumed occasionally. Most (81.65%) of the women consumed meat and meat products daily whiles only 8.35%) consumed it occasionally. More than half (65.51%) of the women consumed milk and ilk products occasionally but 34.49% of the study participants consumed milk and milk products n daily basis. Women who consumed cereals daily were more (59.81%) than those who consumed occasionally (40.19%). Majority (85.76%) of the respondents consumed legumes daily while a w (14.24%) consumed it occasionally. More than half (68.67) of the respondents consumed other itamin A rich fruits and vegetables occasionally as compared to those who consumed it daily 31.33%). Most (87.03%) of the respondents consumed grains on daily basis whiles (12.97%) onsumed it occasionally. with regards to eggs consumption majority (87.97%) of the women consumed eggs on daily basis as compared to occasionally (12.03%).

Table 4.4: Dietary patterns of pregnant women

Food group category	Frequency of consumption

	Daily	Occasionally
Starchy staples	184 (58.23%)	132 (41.77%)
Dark green leafy vegetables	308 (97.47%)	8 (2.53%)
Organ meat	258 (81.65%)	58 (18.35%)
Milk and milk products	109 (34.49%)	207 (65.51%)
Cereals	189 (59.81%)	127 (40.19%)
Legumes and pulses	271 (85.76%)	45 (14.24%)
Fruits Other vitamin A fruits and vegetables	99 (31.33%)	217 (68.67%)
Grains	275 (87.03%)	41 (12.97%)
Eggs	278 (87.97%)	38 (12.03%)
Dietary diversity Acceptable Not acceptable	 292(92.4%) 24 (7.59%)	

ource: Field data, 2020

4.4 Maternal characteristics and women dietary diversity scores (DDS)

The mean women dietary diversity score among the respondents was (6.2±0.2), with 92.4% of them having a low dietary diversity and 7.6% having high dietary diversity. Significant mean difference was observed between birth weight, gestational weight gain, husband's education and women dietary diversity score. Mothers who gained optimal weight during the period of pregnancy ere seen to have higher mean 6.4±1.5 dietary diversity score compared to those who gained xcessive weight, mean=6.3±1.85 and inadequate mean=5.6±1.7 (p=0.021). Furthermore, mothers ho delivered microsomal babies had higher mean dietary diversity score (6.9±0.7) compared to ıose who had normal weight babies (6.4±1.5) and low weight babies mean=5±1.8 (p=0.006). A atistically significant mean difference between mothers with low birthweight infants and mothers ith normal and microsomal birth weight infants was found.

Iothers living in rural areas have been shown to have a significantly higher mean score for dietary iversity (6.3±1.6) than those living in rural areas (5.25±1.3). Mothers within the age brackets 30-0 had slightly higher mean dietary diversity score (6.5±1.4) as compared to those within the age roup 20-30 (6.2±1.6),>40 (6.2±1.5) and <20 (5.1±1.8).

Iothers who attained primary education had higher diversified diets (7.0±1.7) compared to senior igh school (6.2±1.3), junior high school (5.7±1.6), university (6.6±1.6) and those without formal ducation (6.1±1.5).

Also, mothers who were housewives had higher mean dietary diversity score (6.5±1.4) than those who are food sellers (6.3±1.2), petty traders (6.3±1.6), seamstress/hairdresser (6.26±1.7) and salaried workers (6.28±1.5).

Mothers who were Mamprusis had slightly higher dietary diversity score (6.4±1.3) than those who are Gonjas (6.1 ±1.4), Dagomba (6.3±1.7), Ashanti (6.1±1.5) and those who belonged to other ethnic groups (6.3±1.6). Mothers of Christian religious affiliation had slightly higher mean dietary diversity score (6.5±1.4) compared to those who are Muslims (6.2±1.6) and traditionalist (5.6±1.9). Mothers who did not practice pica had higher dietary diversity score (6.4±1.5) compared to those who practiced pica (5.9±1.6).

Table 4. 5: Maternal characteristics and women dietary diversity scores (DDS).

Variables	Categories	Mean ± SD (DDS)	p-value
Town	Urban	6.3±1.6	
	Rural	5.25±1.3	0.206
Age	<20	5.1±1.8	
	20-30	6.2±1.6	0.171
	30-40	6.5±1.4	
	>40	6.2±1.5	
Marital status	Married	6.3±1.5	0.759
	Cohabiting	3.7±1.2	
	Divorce/separated	5.2±1.2	
	Widowed	6.9±1.4	

Education	No formal education	6.1±1.5	0.163
	Primary	7.0±1.7	
	JHS	5.7±1.6	
	SHS/vocational	6.2±1.3	
	University/polytechnic	6.6±1.6	
Occupation	Housewife	6.5±1.4	0.45
	Food seller	6.3±1.2	
	Petty trading	6.3±1.6	
	Seamstress/hairdresser	6.26±1.7	
	Salaried worker	6.28±1.5	
Religion	Christian	6.5±1.4	0.343
	Muslim	6.2±1.6	
	Traditionalist	5.6±1.9	
Ethnicity	Dagomba	6.3±1.7	0.128
	Gonja	6.1±1.4	
	Mamprusi	6.4±1.3	

	Ashanti	6.1±1.5	
	Others	6.3±1.6	
Husband education	Primary	6±0.9	**0.038**
	JHS/middle	4.4±1.5	
	SHS	6.2±1.68	
	Tertiary	6.5±1.3	
	None	5.6±1.7	
Husband's occupation	Trader	6.2±1.4	0.27
	Employed	6.4±1.6	
	Unemployed	5±0	
	Farmer	5.9±1.4	
	Others	4.7±1.9	
Pica practices	Yes	5.9±1.6	
	No	6.4±1.5	0.342
Birth weight	Low birth weight	5±1.8	**0.006**
	Normal	6.4±1.5	
	Macrosomial	6.9±0.7	
Weight gain	Inadequate	5.6±1.7	**0.021**
	Normal	6.4±1.5	

	Excessive	6.3±1.85	

Source: Field data, 2020

4.5 Association between dietary diversity and maternal factors

In univariate analysis an association between respondents age and diet diversity was established where respondents 30-40 (98.8%) had adequate diet diversity and those <20 (23%) had inadequate iet diversity (**p=0.010**). Respondents who were widowed (100%) had adequate diet diversity but mong those were cohabiting (58.3%) had inadequate diet diversity (**p=0.001**). Also, the ducational level of respondents was seen to be associated with dietary diversity where those of rimary education had adequate diet and those of junior high school education had inadequate diet **=0.009**). Furthermore, religion of the respondent was associated with the dietary diversity of the spondents as 59.5% of those who were Christians had diversified diet and 95% of those who ere traditionalist had diversified diet (**p=0.048**). Lastly it was observed that husbands' education nd occupation had an impact on dietary diversity with (**p= 0.015 and 0.001**).

able 4.6: Association between dietary diversity and maternal factors

Variable	Category	Adequate	Inadequate	p-value
Location	Rural	273(92.2%)	23(7.8%)	0.651
	Urban	19(95%)	1(5%)	
Age	<20	20(77%)	6(23)	**0.010**
	20-30	144(92.3)	12(7.7%)	
	30-40	120(96.8%)	4(3.2%)	

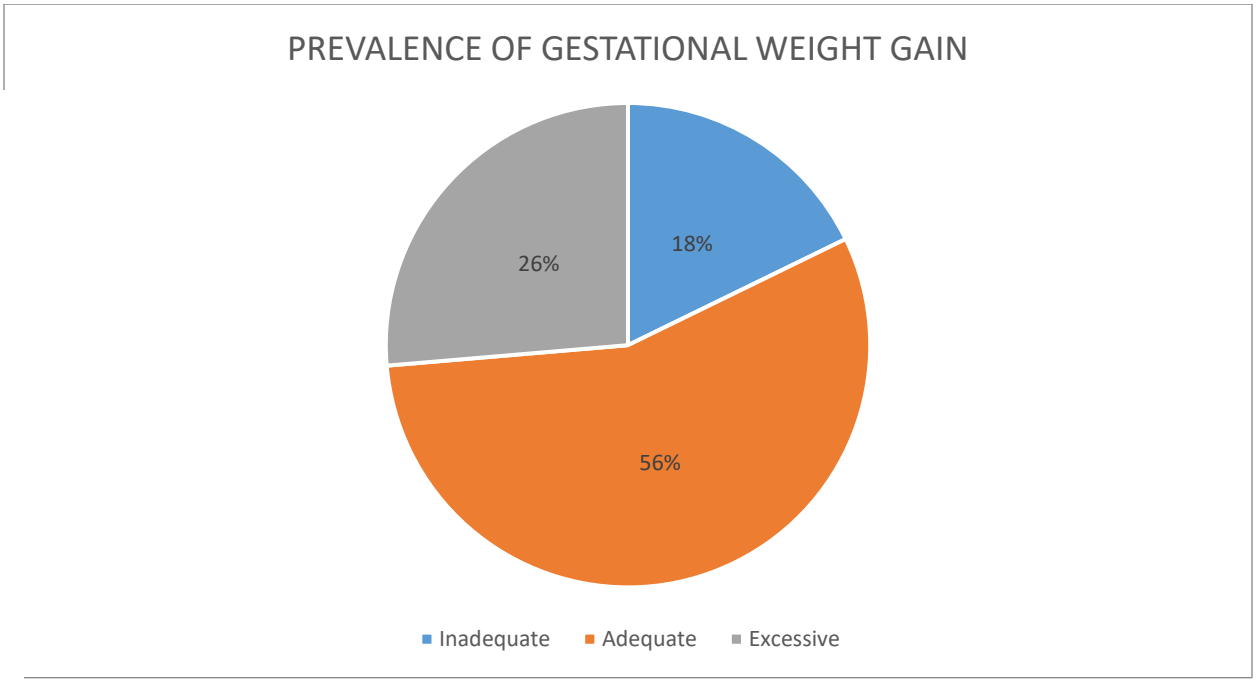
	>40	8(88.9%)	1(11.1%)	
Marital status	Married	270(94.4%)	16(5.6%)	**0.001**
	Cohabiting	5(41.7%)	7(58.3%)	
	Divorce/separated	5(83.3%)	1(16.7%)	
	Widowed	12(100%)	0	
Education	No formal education	41(93.2%)	3(6.8%)	**0.009**
	Primary	48(100%)	0	
	JHS	55(83.3%)	11(16.7%)	
	SHS/vocational	94(96%)	4(4%)	
	University/polytechnic	54(90%)	6(10%)	
Occupation	Housewife	50(98%)	1(2%)	0.358
	Food seller	22(100%)	0	
	Petty trading	55(91.7%)	5(8.3%)	
	Seamstress/hairdresser	41(91.1%)	4(8.9%)	
	Salaried worker	46(92%)	4(8%)	
Religion	Christian	63(95.5%)	3(4.5%)	**0.048**
	Muslim	220(92.4%)	18(7.6%)	
	Traditionalist	9(75%)	3(25%)	
Ethnicity	Dagomba	131(89.7%)	15(10.3%)	0.34
	Gonja	54(96.4%)	2(3.6%)	
	Mamprusi	41(97.6%)	1(2.4%)	
	Ashanti	22(91.7%)	2(8.3%)	

	Others	44(91.7%	4(8.3%)	
Father's occupation	Trader Employed Unemployed Farmer Others	47(94%) 196(93.3%) 7(100%) 34(91.9%) 8(66.7%)	3(6%) 14(6.7%) 0 3(8.1%) 4(33.3%)	**0.015**
Father's education	Primary JHS/middle school SHS Tertiary None	8(100%) 11(61.1%) 107(91.5%) 150(96.8%) 16(88.9%)	0 7(38.9%) 10(8.5%) 5(3.2%) 2(11.1%)	**0.001**
Socioeconomic status	Low High	24(80%) 268 (93.7%)	6 (20%) 18 (6.3%)	**0.007**

ource: Field data, 2020

4.6 Prevalence of inadequate, adequate and excessive weight gain during pregnancy

From the study it was revealed that majority (55.87%) of the respondents gained adequate weight whiles 26.35% gained excessive weight and 17.78% gained inadequate weight



igure 4. 1: Prevalence of inadequate, adequate and excessive weight gain during pregnancy
ource: Field data, 2020

4.7 Weight gain during pregnancy and pre-pregnancy BMI

The results show that out of the number of women who were underweight,41, 6% gained adequate weight, 47.2% gained inadequate weight and 11.1% gained excessive weight. The majority of women (55.8%) who had normal BMI had inadequate weight gain compared to 26.7% of them who had excessive weight gain. Among those who were overweight 62.6% had inadequate weight gain while 28.6% gained excessive weight. More so, 43.5% of those who were obese gained inadequate weight while 39.1% of them had excessive weight gain (Table 4.6).

Table 4. 7: Weight gain during pregnancy and pre-pregnancy BMI

BMI	ADEQUATE	INADEQUATE	EXCESSIVE
Underweight	15 (41.6%)	17 (47.2%)	4 (11.1%)
Normal	29 (17.6%)	92 (55.8%)	44 (26.7%)
Overweight	8 (8.8%)	57 (62.6%)	26 (28.6%)
Obese	4 (17.4%)	10 (43.5%)	9 (39.1%)
Total	56 (17.9%)	176 (56.2%)	83 (26.5%)

Source: Field data, 2020

4.8 Association between Gestational weight gain, maternal factors.

Table 4.7 illustrates a bivariate analysis done to assess association between characteristics of respondents and gestational weight gain. About 67% of those who were divorced/cohabiting had inadequate weight gain while 58.2% of those who were married had adequate weight gain. Statistically significant association was observed between marital status and gestational weight gain (**p=0.018**). A statistically significant association was observed between participants' employment status and gestational weight gain (**p<0.01**). About 70.6% of participants who were housewives had adequate weight gain while about a third of those who were seamstress had inadequate weight gain and 30% of those who earn salary had excessive weight gain.

38.5% of the study participants who were <20 years had inadequate weight gain while those between 30-40years had adequate weight and those >40 (55.6%) gained excessive weight. Mothers age also showed a significant association with gestational weight gain (**p=0.003**). Participants with no child (36.8%) were found to have inadequate weight gain while those having 1-3 children (58.2%) had adequate weight gain and 40.8% of mothers with more than four children had excessive weight gained (**p=0.003**). Also, initial pregnancy BMI (**p =0.001**) of the women were significantly associated with gestational weight gain, among participants who were underweight, 41.6% gained inadequate weight while 62.6% and 28.6% of those who were overweight gained both adequate and excessive weight respectively. Also, the dietary diversity score was significantly associated with weight gain (**P= 0.004**). Educational level, locality, religion and ethnicity of the women were not associated with gestational weight gain with (**p>0.05**) but more women with university/tertiary education, those in urban areas, Muslims and Ashanti's were seen to gain more adequate weight as compared to the other classifications.

Table 4.8: Association between Gestational weight gain and maternal factors

Variable	Inadequate	Adequate	Excessive	P-value
Residence				
Urban	53(18%)	164(55.6%)	78(26.4%)	0.917
Rural	3(0.1%)	12(0.1%)	5(0.0)	
Age/years				
<20	10(38.5%)	10(38.5%)	6(23%)	
20-30	34(21.79%)	85(54.5%)	37(23.7%)	**0.003**
30-40	12(9.7%)	77(62.1%)	35(28.2%)	
>40	0(0%)	4(44.4%)	5(55.6%)	
Marital status				
Married	43(15.1%)	166(58.2%)	76(26.7%)	**0.018**
Cohabiting	8(66.7%)	3(25%)	1(8.3%)	
Divorce/separated	4(66.7%)	0(0%)	2(33.3%)	
Widowed	1(8.3%)	7(58.3%)	4(33.3%)	
Education				

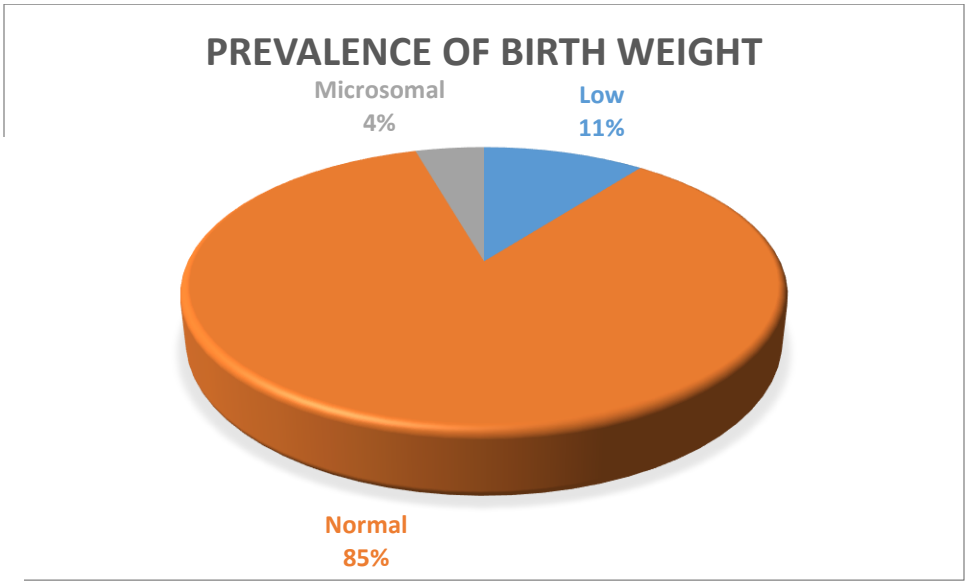
No formal education	9(17.6%)	30(58.8%)	12(23.5%)	0.498
Primary	6(14.6%)	21(51.2%)	1434.1	
JHS	16(24.6%)	3452.3%)	1523.07%)	
SHS/Vocational	18(18.4%)	51(52%)	29(29.6%)	
University/Polytechnic	7(11.6%)	40(66.6%)	13(21.6%)	
Parity				
No child	14(36.8%)	18(47.4%)	6(15.8%)	**0.003**
1-3	38 (16.4%)	135(58.2%)	59(25.4%)	
4-6	4 (8.9%)	23(51.1%)	18(40%)	
Ethnicity				
Dagomba	35(24.1%)	77(53.1%)	33(22.8%)	0.076
Gonja	10(17.9%)	32(57.1%)	14(25%)	
Mamprusi	8(19%)	22(52.4%)	12(28.6%)	
Ashanti/ewe	1(4.2%)	16(66.6%)	72(9.2%)	
Others	2(4.2%)	29(60.4%)	17(35.4%)	
Religion				
Christian	8(12.1%)	37(56.1%)	21(31.8%)	

Muslim	47(19.8%)	134(56.4%)	56(23.6%)	0.149
Traditionalist	1(8.3%)	5(41.7%)	6(50%)	
Mothers occupation				
Housewife	2(3.9%)	36(70.6%)	13(25.5%)	
Food seller	41(8.2%)	10(45.5%)	8(6.4%)	**0.018**
Petty trading	12(20%)	35(58.3%)	13(21.7%)	
Seamstress/hairdresser	15(33.3%)	17(37.8%)	13(28.8%)	
Salaried worker	8(16%)	27(54%)	15(30%)	
Fathers occupation				
:rader	13(26%)	23(46%)	14(28%)	
:mployed	32(15.3%)	121(57.9%)	56(26.8%)	
ınemployed	0(0%)	5(71.4%)	2(28.6%)	**0.010**
Farmer	4(10.8%)	23(62.2%)	10(27%)	
Others	7(58.3%)	4(33.3%)	1(8.3%)	
Fathers' education				
No formal education				
Primary	2(25%)	3(37.5%)	3(37.5	
JHS	7(41.2%)	5(29.4%)	5(29.5%)	**0.016**

SHS/Vocational	28(23.5%)	65(54.6%)	26(21.8%)	
University/Polytechnic	17(10.8%)	92(58.2	46(29.1%)	
	2(11.1%)	13(72.2%)	3(16.7%)	
BMI/kg/ m^2				
Underweight kg/ m^2	15(41.6%)	17(47.2%)	4(11.1%)	
Normal kg/ m^2	29(17.6%)	92(55.6%)	44(26.6%)	**0.001**
Overweight kg/ m^2	8(8.8%)	57(62.6%)	26(28.6%)	
Obese kg/ m^2	4(17.4%)	10(43.5%)	93(9.1%)	
Dietary diversity				
Adequate	46 (15.7%)	167 (57.2%)	79(27.1%)	**0.004**
Inadequate	10(43.5%)	9 (39.1%)	4 (17.4%)	

4.9 Prevalence of low birth weight

Among the respondents, majority (85.0%) had normal birthweight at delivery while 11.0% had low birth weight and 4.0% had macrosomal weight as shown in figure 4.2 below.



igure 4.2: Prevalence of low birth, normal and microsomal birth weight after delivery
ource: Field data, 2020

4.10 Maternal characteristics and birth weight

Among the respondents the mean birth weight was (3.1±0.1kg). Babies born to mothers who were living in urban areas was slightly heavier (3.1±1.7kg) than those living in rural areas (2.9±0.4kg). Babies of mothers within the age brackets 20-30 years were slightly heavier (3.1±2.3kg) as compared to those within the age group 30-40 (3.1±0.4kg), >40 (2.7±0.1kg) and <20 (2.6±0.28kg). This was statistically significant at a value of p<0.001.

abies of mothers who were married were heavier (3.1±1.7kg) than those who were divorced ?.9±0.16kg), and cohabiting (2.5±0.3kg) this difference was statistically significant (p=0.001).

abies of mothers who had university education were heavier (3.6±3.6Kg) compared to those of ıothers who had senior high education(3.0±0.43kg), junior high school (2.8±0.4Kg), primary ?.9±0.3 kg) and those without formal education (2.9±0.4kg). Also, babies born to mothers who ere housewives were heavier (3.5±0.9kg) than those who were food sellers (3.0±0.3kg), petty aders (3.1±0.5kg), seamstress/hairdresser (2.9±0.3 kg) and salaried workers (2.9±0.3 kg).

ewborns of mothers who had 1-3 children previously were heavier (3.1±1.9 kg) compared to abies of mothers who were first timers (2.8±0.5kg) and those of mothers with 4-6 children ?.9±0.2kg). A statistically significant mean difference was observed between first time mothers ıd those with 1-2 children and first-time mothers with those with 4-6 children (p=0.001).

Babies born to mothers who were Dagombas were also slightly heavier (3.2±2.4kg) than those of mothers who were Gonjas (2.9±0.4kg), Mamprusi (2.9±0.3kg), Ashanti (3.2±0.5kg) and other ethnic groups (3.0±0.4kg). Babies of mothers who were Muslims were slightly heavier (3.1±1.9kg) compared to those of mothers who were Christian (3.0±0.4kg) and traditionalist (3.1±0.4kg). Babies of mothers who gained optimal weight during the period of pregnancy were heavier

(3.2±2.1kg) compared to those of mothers who gained excessive weight (3.1±0.3 kg) and inadequate weight (2.6±0.4kg). Also a statistical mean difference was observed between inadequate weight gain and adequate weight gain as well as inadequate with excessive weight gain p= 0.001.

Table 4. 9: Maternal characteristics/factors and birth

Variable	Category	Frequency (%)	Means± Standard deviation	p-value
Residence	Rural	20(6.33%)	3.1±1.7	
	Urban	296(93.67%)	2.9±0.4	**0.001**
Age/years	<20	26(8.23%)	2.6±0.28	
	20-30	156(49.37%)	3.1±2.3	
	30-40	125(39.56%)	3.1±0.4	**0.017**
	>40	9(2.85%)	2.7±0.1	
Marital status	Married	286 (90.51%)	3.1±1.7	**0.001**
	Cohabiting	6 (1.90%)	2.5±0.3	
	Divorce/Separated	12 (3.80%)	2.9±0.16	
	Widowed		3.1±0.4	
EDUCATION	No education	51 (16.14%)	2.9±0.4	
	Primary	41 (12.97%)	2.9±0.3	
	JHS	66 (20.89%)	2.8±0.4	**0.02**
	SHS/Vocational	98 (31.01%)	3.0±0.43	
	University/Polytechnic	60 (18.99%)	3.6±3.6	
	Housewife	67 (21.20%)	3.5±0.9	

Occupation	Food seller	34 (10.76%)	3.0±0.3	
	Petty trading	77 (24.37%)	3.1±0.5	**0.001**
	Seamstress/hairdresser	62 (19.62%)	2.9±0.3	
	Salaried worker	76 (24.05%)	3.0±0.4	
Parity	0	38 (12.03%)	2.8±0.5	
	1-3	233 (73.73%)	3.1±1.9	**0.001**
	4-6	45 (14.24%)	2.9±0.2	
Ethnicity	Dagomba	146 (46.20%)	3.2±2.4	
	Gonja	56 (17.72%)	2.9±0.4	
	Mamprusi	42 (13.29%)	2.9±0.3	**0.001**
	Ashanti/ewe	26 (8.22%)	3.2±0.5	
	Others	46 (14.55%)	3.0±0.4	
Religion	Christian	66 (20.89%)	3.0±0.4	
	Muslim	238 (75.32%)	3.1±1.9	**0.001**
	Traditionalist	12 (3.8%)	3.1±0.4	
Husbands education	Primary	8 (2.53%)	2.9±04	
	JHS/middle school	18 (5.70%)	2.8±0.4	**0.002**
	SHS	117(37.03%)	2.9±0.4	

	Tertiary	155(49.05%)	3.2±2.3	
	None	18 (5.70%)	3.0±0.51	
Husbands' occupation	Trader	50 (15.82%)	3.0±0.5	
	Employed	210 (66.46%)	3.1±1.9	**0.012**
	Unemployed	7 (2.22%)	2.8±0.3	
	Farmer	37(11.71%)	2.9±0.35	
	Others	12 (3.80%)	2.7±0.5	
Weight gain/kg	Inadequate	56 (18%)	2.6±0.4	
	Adequate	176 (56%)	3.2±2.1	**0.001**
	Excessive	83(26%)	3.1±0.3	

ource: Field data, 2020

4.11 Association between maternal characteristics with birth weight

Table 4.9 illustrates a bivariate analysis done to assess association between characteristics of respondents and gestational weight gain. The result showed that 75% of mothers who were cohabiting gave birth to low birthweight babies. There was statistically significant association between marital status and birth weight (**p=0.011**). It was also observed that 21.1% of mothers who have had JHS as their highest level of education attained had low birth weight babies while 3.3% and 11.6% of the mothers who had University/Polytechnic had normal birth weight and macrosomia babies respectively.

findings showed that 46.2% of mothers less than 20 years had low birth weight babies while 87.8% of mothers who were between 20-30 years had normal weight babies and 22.0% of them had macrosomia babies. A significant association exists between maternal age and birth weight of babies (**p=0.001**). Also 39.5% of respondents with no previous child history had low birthweight babies whiles 87.1% of those with 1-3 children had normal weight babies and 15.6% of those with 4-6 children had macrosomia babies. The number of children mothers had showed a significant positive association with birth weight (**p=0.001**). Furthermore 25.0% of Ashanti's had macrosomia babies while 87.5% of Gonja's has normal weight babies. Mothers belonging to other ethnic groups were seen to give birth to low weight babies (**p=0.001**). Also 44.4% of underweight respondents had low birth weight babies while 91.0% of normal BMI respondents had normal birthweight babies. 14.3% of overweight respondents had macrosomia babies (**p =0.001**). Furthermore, low birthweight babies were prevalent among 50.0% of respondents with inadequate gestational weight gain while normal birth weight babies were prevalent among 65.6% of normal weight gained mothers and 32.7% of respondents with excessive weight gain had macrosomia babies. In addition, a positive association was observed between birth weight and dietary diversity

(**p=0.001**). However, locality and religion of the women were not associated with birth outcome with (**p>0.05**) but women who were Muslims and those living in urban areas were seen to deliver normal weight babies as compared to the others with (85.5%) and (83.6%) respectively even though this association was negative.

Table 4. 10: Associations between maternal characteristics with birth weight

Variable	Low birth weight	normal	Macrosomia	P-value
Residence				
Urban	30(10.1%)	253(85.5%)	1(34.4%)	0.77
Rural	3(15%)	16(80%)	1(5%)	
Age/years				
<20	12(46.2%)	14(53.8%)	0(0%)	
20-30	15(9.6%)	137(87.8%)	4(2.6%)	**0.001**
30-40	6(4.8%)	109(87.2%)	10(8%)	
>40	3(33%)	4(44%)	2(22%)	
Marital status				
Married	23(8%)	250(87.4%)	13(4.5%)	
Cohabiting	9(75%)	3(25%)	0(0%)	**0.011**
Divorce/separated	0(0%)	6(100%)	0(0%)	
Widowed	1(8.3%)	10(83.3%)	1(8.3%)	
Education				

No formal education	6(11.8%)	44(86.3%)	1(1.96	**0.001**
Primary	5(12.2%)	36(87.8%)	0(0%)	
JHS	14(21.2%)	52(78.8%)	0(0%)	
SHS/Vocational	8(8.2%)	84(85.7%)	6(6.1%)	
University/Polytechnic	0(0%)	53(88.3%)	7(11.6%)	
Parity				
No child	15(39.5%)	21(55.3%)	2(5.3%)	
1-3	18(7.7%)	203(87.1%)	12(5.2%)	**0.001**
4-6	10(22%)	28(62.2%)	7(15.6%)	
Ethnicity				
Dagomba	21(14.4%)	120(82.2%)	5(3.4%)	
Gonja	6(10.7%)	49(87.5%)	1(1.8%)	
Mamprusi	6(14.3%)	36(85.7%)	0(0%)	**0.001**
Ashanti/ewe	0(0%)	18(75%)	6(25%)	
Others	10(20.8%)	36(75%)	2(4.2%)	
Religion				
Christian	3(4.5%)	59(89.4%)	4(6.1%)	
Muslim	30(12.6%)	199(83.6%)	9(3.8%)	0.21

Traditionalist	2(16.7%)	9 (75%)	1(8.3%)	
Fathers' occupation				
trader	9(18%)	39(78%)	2(4%)	
employed	14(6.6%)	185(88.1%)	11(5.2%)	**0.001**
unemployed	1(14.3%)	6(88.7%)	0(0%)	
farmer	2(5.4%)	34(91.9%)	1(2.7%)	
others	7(58.3%)	5(41.6%)	0(0%)	
Fathers' education				
No formal education	2(11.1%)	16(88.9%)	0(0%)	
Primary	4(22.2%)	14(77.8%)	0(0%)	
JHS	18(15.4%)	96(82.1%)	3(2.6%)	**0.006**
SHS/vocational	5(3.2%)	140(90.3%)	10(6.5%)	
University/polytechnic	4(22.2%)	13(72.2%)	1(5.6%)	
Bmi/kg/ m^2				
Underweight	16(44.4%)	20(55.6%)	0(0%)	
Normal	15(9.0%)	151(91.0%)	0(0%)	**0.001**
Overweight	1(1.1%)	77(84.6%)	13(14.3%)	
Obese	1(4.3%)	21(91.3%)	1(4.3%)	

Weight gain				
Inadequate	28(50%)	28(50%)	0(0%)	**0.001**
Adequate	4(1.6%)	161(65.6%)	80(32.7%)	
Excessive	0(0%)	11(78.6%)	3(21.4%)	
Dietary diversity				
Adequate	23 (8%)	255(87%)	14 (5%)	**0.001**
Inadequate	10 (41.7%)	14 (58.3%)	0 (0%)	
Number of ante natal care visit				
Less than 4	2 (40%)	3(60%)	0 (0%)	**0.029**
At least four or more	31(10%)	247(79%)	33(11%)	
Socio-economic status				
Low	2 (7%)	25 (83%)	3 (10%)	
High	30 (10%)	244 (86%)	11 (4%)	**0.001**

ource: Field data, 2020

4.12 Determinants of birth weight

Table 4.11 illustrates the relationship between the dependent and independent variables. After controlling for confounders, maternal Body mass index and weight gain during pregnancy were strong predictors of low birth weight among pregnant women. The results showed that pregnant women who were underweight (BMI < 18Kg/m^2) were more likely to deliver a low birthweight child. Furthermore, pregnant women who did not gain adequate weight during pregnancy were more at risk of giving birth to low birthweight children. The risk increased by 98% compared to pregnant women with normal gestational weight gain.

Table 4. 11: Determinants of birthweight

Variables	Category	COR (95%CI)	P-value	AOR (95% CI)	p-value
Age (years)	<20	8.05 (3.2-20.5)	**0.001**	5.3(.35-81.4)	0.227
	20-30	Ref		Ref	
	30-40	0.5 (0.8-1.2)	0.134	0.9(.15-5.7)	0.958
	>40	1		1	
Marital status	Married	Ref		Ref	
	Cohabiting	0.06(.004-10)	**0.001**	16 (.09-276)	0.285
	Divorce/separated	1		1	
	Widowed	0.03(.0002-.34	**0.005**	0.01(.002-9.1)	0.189
Parity	No child	7.7(.3.5-17.4)	**0.001**	5.1 (.67-39)	0.115
	1-3	Ref		Ref	
	4-6	1		1	
Education	No education	1.5 (.49-4.6)	0.477	0.94(,04-17)	0.971
	Primary	1.5(.47-5.0)	0.459	0.94(.08-10)	0.960
	JHS	3.0(1.1-7.7)	**0.020**	3.9(.39-40)	0.242

	SHS/vocational University/Polytechnic	Ref 1		Ref 1	
Husband's occupation	Trader Employed Unemployed Farmer Others	0.8(0.5-1.3) Ref 1.5(0.5-5.0) 1.1(0.7-1.9) 0.2(0.1-0.6	**0.02** 0.56 0.43 0.63	0.6(.08-4.1) Ref 2259(1,7-29009) 1.27(.08-19) 4.5(.04-408)	0.589 **0.035** 0.862 0.513
BMI (kg/m^2)	Underweight Normal Overweight Obese	8.0(3.4-18.8) Ref 0.1(.01-.86) 0.45(.06-3.6)	**0.001** **0.035** 0.460	47(6.6-345) Ref .12(.01-1.9) 1.9(.11-34)	**0.001** 0.134 0.640
Dietary diversity	Inadequate Adequate	8.3(.3.3-20) Ref	**0.001**	8.8(.6-130) Ref	0.11

Socio-economic status	Low High	10.1(4.3-23) Ref	**0.001**	21(.54-815) Ref	0.102
Weight gain	Inadequate Adequate Excessive	42(14-131) Ref 1	**0.001**	45 (16-135) Ref 1	**0.001**

ource: Field data, 2020 ***COR: Crude odd ratio; AOR: Adjusted Odd Ratio***

CHAPTER FIVE

DISCUSSION

This thesis is aimed at establishing the association between dietary intake, gestational weight gain (classified as inadequate, adequate and excessive) and birth weight (classified as <2.5 kg for low birth weight and >=2.5 kg for adequate/normal weight babies) among pregnant women in the amale Metropolis.

.1 Dietary habits/practices and associated factors

ı this current study, the mean Dietary Diversity Score of pregnant women was 6.2 ± 0.1 SD which similar to finding by Ali et al. (2014) who also reported a mean score (SD) 6.17 (±0.99) and .cham et al, (2012) findings of a mean dietary diversity score (SD) of 6.70 (±2.22) (Thaver et al,)14).

t was established from the current study that 87.34% of the participants had a high dietary iversity score (more than 4 food groups) which is higher than that of a study that was conducted ı Islamabad, Pakistan among pregnant women which showed that only 5% had a high dietary iversity score and 89% had a medium dietary diversity, but similar to a Kenya based study that eported a high dietary diversity score among 61% of pregnant women (Ali et al, 2014b; Kiboi et ., 2017b). These findings revealed that pregnant women who participated in this study had a ɔsitive dietary practice compared to pregnant women in other locations.

Findings in this study further revealed a high meal frequency among pregnant women, thus a majority of the pregnant women had more than 3 meals per day. The frequent meals were mainly staples, which are a major requirement for the promotion of adequate and effective weight gain. It is also a requisite for promoting good health and a better nutritional status which will, in turn,

reflect in the birth weight of the unborn child. The most consumed foods according to the findings of the present study included staple foods/grains (maize, and millet, tubers), fats and oils, beans or nuts/legumes. This is supported by the fact that maize and other grains are Ghanaian staple foods and are consumed in many of the meals. Also, nuts/legumes are cultivated by natives of the study location, and this is almost consistent with findings from a study conducted among pregnant women in Kenya where cereals, fat and oil were the most consumed food group. Also, in Kenya, 00% of women were found to consume cereals while 54% consumed nuts, seeds and legumes Kiboi et al, 2017a; Ochieng et al, 2017).

urthermore, the consumption of meat and fish, as well as other fruits and vegetables, were high mong the study participants contrary to other studies where the consumption of meat and meat roducts was low. For instance, pregnant women in Kenya were reported to consume lower uantities of meat and meat products meanwhile in Bangladesh 84.2% pregnant women were eported to consume meat/fish products (Kiboi et al., 2017; Nguyen et al., 2017). The discrepancies study findings can be attributed to geographical location and time of the study. The high onsumption of meat and fish among pregnant women in the Tamale Metropolis can be attributed the location of irrigation dams near the metropolis and the rearing of livestock's in and around ıe metropolis for which the Northern region of Ghana is noted for. They also take advantage of ıe rivers and irrigations dams to do dry season gardens, which provide them with sufficient and ıough vegetables like tomatoes. Ironically with the availability of the dry season gardens, vitamin A rich vegetables were among the least consumed among study participants. This requires further investigation to unearth reasons associated with low consumption of vitamin A rich vegetables.

Like other findings, milk and milk products and vitamin A rich vegetables and fruits were the least consumed among study participants. These findings do not differ from a study in Tanzania where majority of pregnant women did not consume milk and milk products (Ochieng et al., 2017).

5.2 Factors Associated with Dietary Diversity among Pregnant Women

Findings of the study revealed an association between the level of education of the respondents nd how diversified their diets were. It was particularly noted that individuals with higher ducation had a greater likelihood of consuming more diversified diets than those without any ducational background. Perhaps women with higher education might have acquired essential nformation on appropriate feeding practices during their educational journey. Also, educated omen were more likely to have attained and understood information regarding nutritional equirements using different media outlets. Thus, as the educational level increases, the level of taining adequate dietary diversity intake is expected to increase. Similar observations were eported by Jamila, 2015 when education was significantly associated with dietary diversity of regnant women (P<0.001), it was further reported that secondary education (AOR 2.78; 95% CI .06, 5.32) and tertiary education (AOR 2.93; 95% CI 1.40, 8.63) were strong predictors of meeting inimum dietary diversity compared to no formal education among pregnant women. Also, nother study in Ghana found pregnant women with primary education to be 1.6 times more likely f achieving a higher dietary diversity as compared to those with no education (AOR 1.08,95 % I = 1.12, 2.20) (Amugsi et al, 2016; Kiboi et al., 2017a).

The present study also revealed a positive association between marital status and dietary diversity. It was observed that married pregnant women had higher dietary diversity compared to their counterparts who were single. Relatedly, it was realised that the occupation of the spouse (father) was positively associated with the dietary diversity of pregnant women. The finding was not

surprising as spouses play key roles in determining what the household consumes at what time. In most instances, spouses also provide moral and financial support as well as make available financial resources for the purchase of household food. These are secured measures of providing improved access to varied diets.

Surprisingly, however, the study revealed no compelling evidence that socio-economic status is indeed associated with the dietary diversity of a household or individual. This could be because socio-economic status does not necessarily correlate with adequate and diversified diet intake. Other factors influencing dietary diversity included adequate knowledge of good dietary practices and the health status of the individual. Thus, one may have all the resources to acquire food but fail to consume diversified diets due to poor dietary knowledge or poor cooking skills. Similarly, Nguyen et al (2017) also did not find any association between household socio-economic status and dietary diversity of pregnant women in Bangladesh. However, contrary to this finding, socioeconomic status was seen to be associated with the dietary diversity score of the pregnant females in studies conducted in Kenya and Nigeria (Emmanuel et al, 2018; Kiboi et al., 2017).

5.3 Weight gain and associated factors

In Ghana, obesity is growing, especially among females. Maternal obesity has long been linked to an increased risk of chronic disorders and adverse pregnancy outcomes.

With the increasing weight at gestation over the century, many institutions have found it necessary to research and standardize guidelines into its control (WHO, 2011). The determination of estational weight gain during pregnancy is based on pre-pregnancy weight. More than half of the espondents had normal pre-pregnancy BMI while about 7% were obese. About a third of the omen gained excessive weight during pregnancy while about a fifth had inadequate weight gain. his is closely similar to a study finding that reported 36.6% of pregnant women having excess estational weight gain while 29% were below the normal gestational weight gain (Rogozińska et ., 2019).

ivariate analysis between characteristics of participants and gestational weight gain showed itial pregnancy BMI to be significantly associated with gestational weight gain and further ıpport the fact that majority of women gained adequate weight in this study during pregnancy.

amim and his colleagues (2012) noted that among the many factors that influenced pregnancy utcomes, maternal weight gain is critical, as it influences foetal development, and infant and ıaternal morbidities. According to Yao et al., (2017) inadequate/excessive weight gains are nfitting and are often associated with adverse pregnancy outcomes. Available evidence indicates that weight-gain above that recommended by the IOM guidelines is an independent risk factor for several adverse outcomes including gestational diabetes, large for gestational age foetus, preeclampsia, caesarean delivery and neonatal morbidity and mortality (Truong et al, 2015; Hinkle & Sharma, 2010). Whereas in turn, inadequate/low weight gain or weight loss during pregnancy

can increase the risk of preterm and small for gestational age baby's birth (Johnson et al., 2013; Catalano et al., 2014; Truong et al., 2015). The current findings indicate that excessive weight-gain by women during pregnancy could be influenced by several factors such as pre-pregnancy BMI and Dietary diversity. According to Choquet & Meyre (2011) environmental, genetic and biological factors could contributively be part of the weight gain (especially excessive weight gain) of women during pregnancy. Peaceman & Kominiarek, (2017) indicated in their study that, there an intimate two-sided relationship between mother and foetus. Whiles the foetus itself affects ynamic endocrinal and homeostatic changes in its mother, there is an overwhelming control of ıe foetus' circulation, growth and metabolism. Furthermore, weight gain is expected naturally as relates to increased nutrients for utilization by the foetus. According to Michelle et al, (2017), it as observed that placenta, foetus and amniotic fluid which are known to be the products of onception comprise approximately 35 percent of the total Gestational Weight Gain.

.4 Association between maternal factors and birth weight

n examination on how socio-demographic and maternal factors were significantly associated ith birth weights of new-borns was conducted. Foremost, it was realised that the mean birth eight of babies in the study (3.1±0.1kg) only differed slightly from that ascertained in related udies conducted within the Northern Region of Ghana. For example, in a recent study at the amale Teaching Hospital by (Abubakari et al, 2016), a mean birth weight of 2.85 ± 0.5 kg was ound. Also, a recent study by (Abubakari et al, 2016) which sampled women delivering in private hospitals in the Northern Region of Ghana realised a mean birth weight of 3.2kg almost same as that observed in this study 3.1±0.1kg.

In comparison with the national low birth weight estimate prevalence of 13%, the study established a lower prevalence of low birthweight deliveries within the Tamale Metropolis. It is noteworthy

to mention also that the prevalence ascertained in this study falls slightly outside of the WHO's (2014) target of less than 10%. In similitude also, it was realised that the prevalence found in the present study was also lower than that of the MICS survey (11% in 2011). The prevalence obtained in this study was not surprising as improvements in health-related milestones in the Northern region have been reported in the Ghana Demographic and Health Survey Reports (GSS-GDHS, 2014). Also, in examining macrosomia births within the Metropolis, the estimated prevalence etermined in this report (4.43%) was low in comparison to that obtained in other studies onducted in Ghana (Abubakari et al., 2015; Addo, 2010). This could be due to the fact that the rget population of the present study was fairly uniform and mostly featured pregnant women ithin the middle-income group. This is depicted in the occupational status of the respondents. dditionally, since majority of the respondents had adequate minimum dietary diversity, the oderate occurrence of macrosomia and the low birth weight observed may have contributed to is.

esults from this current study revealed that maternal age, socio-economic status, pre-pregnancy MI, weight gain, marital status, parity, dietary diversity, and education together predicted the irthweight of babies born by pregnant women. It was particularly noticed that the state of being arried prevented the delivery of babies with inadequate weight. Perhaps contributively in this spect, could be the fact that married women tend to get the support they need from their spouses. dditionally, literature purports lower risks of depression among married pregnant women compared to unmarried pregnant women. This finding is consistent with a study by Foix L'Helias (2000) where it was realised that being single increased one's risk of delivering a low birthweight baby (Foix-L'Helias & Blondel, 2000). However, a study by Manyeh and his colleagues (2016) found no relationship between birth weight and marital status. This contrast could be attributed to

a methodological difference in the classification of the marital status variable (i.e. two variables versus four variables) (Manyeh et al., 2016).

In identifying strong predictors of low birth weight among pregnant women, maternal pre-pregnancy BMI and weight gain during pregnancy were strong predictors of low birth weight. The study realised that maternal pre-pregnancy BMI to a large extent determined the birth weight of babies delivered by respondents. Pregnant mothers who were underweight prior to pregnancy were more likely (8.02 times) to deliver babies with inadequate weight compared to those who were having a normal body mass index. There was no significant association between overweight and birth outcomes in this study. The above finding was not surprising as it is largely proven in literature that there exists an association between maternal pre-pregnancy BMI and the birth weight of new-borns. Similarly, a study finding in Beijing, China reported that pregnant women with inadequate weight prior to pregnancy were at higher risk of having a low birthweight baby (Zhang et al., 2015). Available literature attributes the association between low birth weight and a BMI of less than 18.5 to negative energy balance. It is purported that an inadequate supply of nutrients from the mother to the foetus often results in intrauterine growth retardation that presents as low birth weight at delivery. As expected, LBW of infants among underweight women was significantly higher as compared to LBW in the other groups. In line with earlier research, ends up in this study showed that mothers who were underweight during pregnancy were at higher risk of getting LBW babies compared with normal-weight mothers. A systematic analysis of 42 studies showed that offspring born to underweight mothers were at greater risk of having LBW compared to those born to women with an average weight in both developed and Low Middle-Income Countries (Dharmalingam et al, 2010). This finding is additionally supported by a recent meta-analysis within the context of LMICs: LBW was significantly associated with maternal

underweight, but not maternal overweight/obesity (Rahman et al., 2015). These findings, therefore, requires strong policy attention to cope with undernutrition among mothers, especially for the rationale of its intergenerational effects. During the last 8-10 years albeit matters has seen some progress, about 5 to 20 of African women still suffer from maternal malnutrition because of chronic hunger. This in effect presents adverse consequences on birth weight and, infant and maternal mortality (Amugsi et al, 2016). As undernutrition in itself is also a multifactorial problem, the ɔlution would require developing cross-cutting policies and placing the issue on broad national ealth and development agenda.

astly, the study also found an association between pregnancy weight gain and the birth weight of ıe child. It was ascertained mothers who gained inadequate weight were more likely to deliver ɔw weight babies compared to their counterparts who gained adequate weight. This finding is ɔnsistent with other studies conducted in many parts of the world. For instance, a study conducted y Lima et al, (2017) in Brazil found out that the effect of gestational weight gain on the increase ı birth weight was greater than that of pre-pregnancy body mass index (P-value of 0.001). Similar ndings have been reported by studies conducted in Beijing, China that women of inadequate estational weight gain had higher risks of low birth weight, and small for gestational age infant Zhang et al., 2015). Also, other findings revealed that the birth weight of the baby was gnificantly associated with gestational weight gain (Pal et al, 2017).

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 SUMMARY OF MAJOR FINDINGS

The study indicated 17.78%, 55.87% and 26.35%% prevalence of inadequate, adequate, and excessive gestational weight gain respectively and also 7.59% and 92.41% showed a prevalence of inadequate and adequate dietary intake respectively. Maternal Body mass index and weight gain during pregnancy were a strong predictor of low birth weight among pregnant women. The results showed that underweight pregnant women (BMI < 18Kg/m2) were 99.9% at risk of delivering a low birthweight child. Furthermore, pregnant women who did not gain adequate weight during pregnancy were more at risk of giving birth to low birthweight children. The risk increased by 3% compared to pregnant women with normal gestational weight gain. The prevalence of low birth weight was 11% and that of macrosomia births was 4%.

.2 CONCLUSION

The study found that dietary diversity is indeed correlated with pregnant women's socio-economic status. The finding specifically illustrated the vital role of education, employment, marital status in achieving minimum dietary diversity and eventually improving nutrient intake among pregnant women.

Also, the double burden of malnutrition coexisted among infants born in the Tamale Metropolis comprising of low birth weight (undernutrition) and macrosomia (overnutrition), which is currently being experienced by developing and transition counties. This research also revealed valuable details on the birth weight determinants of babies born in the Tamale Metropolis. Pre-pregnancy BMI and weight gain during pregnancy are strong predictors of birth weight. Low birth weight is a major Public health concern and as such several causes are correlated with it, to

minimise it, it takes a more holistic and multi-sectoral approach and hence the need for a paradigm shift in the war against diet-related diseases by focusing on preconception and maternal nutrition during pregnancy comprehensively and diversely.

Also, the study sought to determine the prevalence of inadequate, adequate, and excessive gestational weight gain and the socio-demographic and dietary factors correlated with it among 'omen in the Metropolis of Tamale. Analysis of the data revealed that adequate gestational weight 'as highly prevalent with a majority (55.87%) of the women gaining adequate gestational weight 'hile only 17.78% who gained inadequate gestational weight and 26.3% of them had excessive estational weight. Socio-demographic factors such as initial pregnancy weight, marital status, ge, parity, dietary diversity, and employment status were significantly associated with gestational 'eight gain.

he study, therefore, finalises its findings by saying that there is an association between dietary ıtake, weight gain and birth weight

.3 RECOMMENDATIONS

- Interventions aimed at high - risk mothers need to be introduced to include antenatal adolescents and women with high parity within quality health care facilities and to detect the existence of any high-risk factors as early as possible during birth, early pregnancy, and registration.
- Health education should be geared at women at high risk. Targeting social programs to boost women's socio-economic status in disadvantaged households will help minimize LBW incidents.

- Also, health institutions should consider nutrition education as a possible intervention in improving the health of pregnant mothers and the birth weight of the neonates.

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APPENDIX

ppendix 1 COMPONENTS OF WEIGHT GAIN DURING PREGNANCY

Body component	Increase in weight (Kg) At term (40 Wks)	Percentage (%) of total weight gain
Product of conception		
Fetus	3.40	27.2
Placenta	0.65	5.2
Amniotic fluid	0.80	6.4
Maternal tissues		
Uterus	0.97	7.8
Mammary gland	0.41	3.3
Blood	1.25	10.0
Extra cellular, extra vascular fluid	1.68	13.4

Total weight	12.5	100
Assumed fat deposition	3.35	26.8

Appendix 2 Table Institute of Medicine guidelines for recommended gestational weight gain per week based on pre-pregnancy body mass index

Body mass index	LOW	NORMAL	EXCESSIVE
Normal weight (18.5–24.9 kg/m2)	<0.35	0.35–0.50	>0.50
Overweight (25.029.9 kg/m2)	<0.23	0.23–0.33	>0.33
Obese (=30.0 kg/m2)	<0.17	0.17–0.27	>0.27

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/105/20

10th March, 2020.

Miss Zimpa Abdulai Nihad
Department of Nutritional Sciences
University for Development Studies
TAMALE.

Dear Madam,

LETTER OF APPROVAL

Protocol Title: *"Association between Dietary Habits, Gestational Weight Gain and Birth Weight."*

Proposed Site: *Tamale Central Hospital.*

Sponsor: *Principal Investigator.*

Your submission to the Committee on Human Research, Publications and Ethics on the above-named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 23rd October, 2019 from the Metro Health Directorate, Tamale (study site) indicating approval for the conduct of the study at the Metropolis.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning 10th March, 2020 to 9th March, 2021 renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you, Madam, for your application.

Yours faithfully,

Osomfo Prof. Sir J. W. Acheampong MD, FWACP
Chairman

Room 7 Block J, School of Medical Sciences, KNUST, University Post Office, Kumasi, Ghana
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CONSENT FORM

Title: Association between Dietary intake, Gestational weight Gain and birth weight among pregnant women.

Introduction: This study is being conducted by Zimpa AbdulaiNihad, a student of the University for Development Studies.

urpose of study: This study seeks to identify the factors which contribute to weight gain and irth weight during pregnancy. Information provided for the study will help in making necessary ecommendations to enable women gain optimal gestational weight.

tudy procedure: You are selected because you have recently delivered. You will be asked bout your socio-demographic characteristics, diet intake including fruits and vegetables

his interview will take about thirty (30) minutes to complete.

enefits: This study aims to collect information that will identify factors which contributes to estational weight gain. There is no direct benefit to you for participating other than the atisfaction that you are contributing to increase knowledge in weight gain during pregnancy.

isks: There is very minimal or no risk in this study. Precaution has been taken to protect the ıformation which you will provide. However, there is always a risk that the data collected ould be breached. To prevent this identity such as name will not be collected.

Confidentiality: To protect your information, code numbers will be used to identify you and no names will be used. Information you provide will be treated as strictly confidential and will solely be used for the study. Information collected will be stored under lock and key and will Be password protected.

Compensation: Your time and participation is appreciated. However, there is no Compensation involved.

Withdrawal from study: Participating in this study is entirely voluntary and you are entitled to refuse to participate as this will not affect you in any way. There is no penalty for withdrawing. Do you have any questions?

If you need further clarity regarding this study, you may contact:

articipant statement and signature

declare that the purpose, procedures as well as risks and benefits of the study have been horoughly explained to me and I have understood. I hereby agree to take part in this study.

ignature of participant _____ Date…… / ……/

…….....

Thumbprint for those who cannot read and write)

I. Structured Questionnaire

Study title: Relationship between Dietary habits, weight changes and birth outcome among pregnant women.

Questionnaire number _____

Interview Date ___ /___/___

espondent's Number _____

ection A: Socio-demographic characteristics of the respondents.

. Which Town/area/village do you come from? ……..1.Urban 2.Rural

. How old are you? (Completed years) _____

. What is your current marital status?

[a] Single [b] Married [c] Cohabiting [d] Divorced/separated [e] Widowed

. What is your highest educational level completed?

[a] No Formal Education [b] Primary Education [c] Junior High Education

[d] Senior High/Vocational/Technical [6] University/ Polytechnic/ Training College

. Occupation of the mother

a).Housewife (b)Cooked food seller c)Petty trading (d)Seamstress (e) Farmer

f) Salaried worker (g).others (specify)……

6. How many children do you have? [a] No child [b] 1-3children

[c]4-6children [d]7-9children

7. Ethnicity ……

a).Dagomba b)Gonja c)Mampurisi d)Bimoba e)Konkomba f)Ashanti g)Ewe h)Moose

i)Hausa j)Other (specify)

6. What is your religious affiliation?

[1] Christian [2] Muslim [3] none [4] others (specify)

. What is your husband's highest level of education?

a) Primary b)JHS/Middle School c) SHS d)Tertiary e) None

. What is the occupation of your husband?

)Trader b)Employed c) Unemployed d)Farmer e) Others (specify)……

ECTION B: **Household Assets and wealth**

1. What is the main source of water for your households?

) Pipe water b)Borehole c)Dugout well d)Bottle/Sachet water e).Others specify …….

Q2. Where is that water source located?

a) In own dwelling place

b) In own yard/plot

c) Others specify……

Q3. What kind of toilet facility do members of your household usually use?

a) Own flush toilet b).Public or shared flush toilet c)Own pit toilet d)Public or shared pit toilet

e) No facility

Q4. Do you share this toilet with otherhouseholds?

a) Yes, other household members

b) Yes, public

c) Not applicable

e) No response

5. How many households use this toilet facility?

Number of people: …….

Don't know……

5. Where is this toilet facility located?

a) In own dwelling b)In own yard/plot d) Others specify……...

6. What type of fuel does your household mainly usefor cooking?

) Electricity b) LPG (c) Charcoal(d) Kerosene (e) Firewood

1) Others specify …….....

Q7. Do you have a separate room which is used as kitchen?

a) Yes b) No

Q8. What type of house do members of the household dwell in?

a) Block house b) Brick house c) Mud house d) Others Specify ……

. Does your household have any of these assets?

ITEM	YES(1) No (0)
Radio	
Colour/black TV	
Satellite dish	
Sewing Machine	
Mattress	
Refrigerator	
DVD/VCD	
Computer	
Electric Fan	
Mobile Telephone	
Bicycle	
Motorcycle/Tricycle	
Animal-drawn cart	

Q10. How many rooms does the household have at their disposal? …….

SECTION C: PAST OBSTETRIC DATA AND MEDICAL HISTORY

Q1. At what gestational age did you start the antenatal clinic visits?

[a]. 1-3months [b]. 4-6months [c].7-9months

Q2. Why did you start at that stage?

[a] not sure of pregnancy [b] previous experience of miscarriages [c]family beliefs

[d] Others (specify)

Q3. Have you had any problems with the pregnancy?

[1] Yes [2] No

Q4. If yes what was/were the problem(s)……..

Q6.During this pregnancy, were you given an injection in the arm to prevent the baby from getting tanus, that is, convulsions after birth?

a) YES b) NO c) DON'T KNOW

7. How many times did you receive the tetanus injection ……..

8.During this pregnancy, were you given or did you buy any iron tablets or iron syrup?

a) Yes b)no

9. Have you taken any dewormer throughout your pregnancy?

[a] Yes [b] No

Q10. Were you given any malaria drugs during any of your ANC visits?

[a] Yes [b] No

If yes What drugs did you ke…….....

Q11.Do you sleep in a treated bednet?

[a] yes [b] no

If no, why.....

[a] I don't have [b] uncomfortable to use [c] don't know

[d] Others (specify)……

Q12. In your opinion did u consider your child to be very large, larger than average, average, smaller than average, or very small?

a)very large b) larger than average c) average d)smaller than average e)very small . f) don't know

Q13.Was child delivered by caesarean or through vaginal delivery ……

ECTION E:DATA ON CULTURAL FACTORS

Q1. Are there any cultural practices that inhibit the intake of certain foods in pregnancy?

[1] Yes [2] No

)2 If yes, what are they?

……..

……..

)3 if no reason for not onsuming……
.

ection F: Food frequency during pregnancy

.. How many times did you eat in a day during your 1st trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] other (specify)……

2. How many times did you eat in a day during your 2nd trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] other (specify)……

3. How many times did you eat in a day during your 3rd trimester?

[ ] Once [ ] Twice [ ] Thrice [ ] Other (specify)……

Dietary assessment (FFQ)

1.Did you practice pica when you were pregnanat? **(Multiple response possible)**

	Seldom/never	sometimes	often	Non usually
Eating of soil/rock/clay	☐	☐	☐	☐
Eating of ice block	☐	☐	☐	☐
Eating of starch	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐

Ideal pattern

. **How often did you have the following meals per week when you were pregnant?**

	7	6	5	4	3	2	1	0
breakfast	☐	☐	☐	☐	☐	☐	☐	☐
snack	☐	☐	☐	☐	☐	☐	☐	☐
3. Lunch	☐	☐	☐	☐	☐	☐	☐	☐
4. Snack before supper	☐	☐	☐	☐	☐	☐	☐	☐

5. Supper	☐	☐	☐	☐	☐	☐	☐	☐
6. Snack, after supper	☐	☐	☐	☐	☐	☐	☐	☐

2. **How many eggs did you eat on average when you were pregnant? Include eggs eaten with ll meals?**

	Per day		Or per week			Or per month		
	2+	1	5-6	3-4	1-2	2-3	1	0
, -fried, boiled, scrambled, Omelet	☐	☐	☐	☐	☐	☐	☐	☐

. **How many cups/glass/sachet did you drink on average of the following beverages when ou were pregnant?**

ow many glasses/sachets

	Per day					Or per week			Or per month		
Milk/yogurt	8+	6-7	4-5	2-3	1	5-6	3-4	1-2	2-3	1	0
Fan yogo	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fan ice	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Fan milk	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fan choco	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Yogurt drink	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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How many glasses/bottles

	Per day					Per week			Per month		
Juice/soft drink/water/alcohol	8+	6-7	4-5	2-3	1	5-6	3-4	1-2	2-3	1	0
Orange juice	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Alvaro	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Donsimon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tamarine juice	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coconut juice	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Energy drink (lycozine, etc	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coca cola/pepsi with sugar	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fruit tele	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other soft drinks with sugar	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Malt	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Mashed kenkey	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Tap water	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Pure water	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Wine	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐
Beer (specify)	☐ ☐ ☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐

. **How often did you on average have the following for your hot meals when you were regnant?**

[ow often

	Per week						Per month			
	6+	5	4	3	2	1	3	2	1	0
Meat and meat product	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Offal	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Meat prepared as grilled	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Chicken/gunea fowl/duck	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fish, fish products, boiled/cooked in oven	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fish , fish products, fried/smoked/dried	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

. **How often did you on average have the following for your hot meals when you were regnant?)**

[ow often

	Per week						Per Month			
Hot meals with soup	6+	5	4	3	2	1	3	2	1	0
ΓZ										
Fresh green leafy vegetable soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dried leafy vegetables	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Palm nut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fresh okro soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dried okro soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Fufu											
Light soup with tomatoes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Dried okro soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Leafy vegetables soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Palmnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Other (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Banku											
Fresh okro soup/stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Tomato sauce with pepper	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Dried okro soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Kenkey											

Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rice balls										
Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fresh leafy vegetable soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Light soup with tomatoes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Plain rice										
Groundnut soup	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Hot meals with stew	Per week						Per month			
	6+	5	4	3	2	1	3	2	1	0
Plain rice										
Beans stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Palava sauce	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aleefu/kontomire stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Tomato stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Jollof rice										
Tomato stew with spices (shito)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Beans stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rice and beans										
Tomato stew with spices (shito)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fried Rice										
Tomato stew with spices (shito)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Boiled yam/cassava/cocoyam										
Beans stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tomato stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Aleefu/kontomire stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Palava sauce	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fried yam										
Beans stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tomato stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Aleefu/kontomire stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Palava sauce	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kenkey										
Tomato stew (shito)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Palava sauce	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Beans stew	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Others (specify)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tomato sauce with pepper										

Others (specify)		

9. How often did you on average have the following vegetable when you were pregnant?

How often

Vegetables	**Per day**		**Per week**			**Per month**		
	2+	**1**	**5-6**	**3-4**	**1-2**	**2-3**	**1**	**0**
Onions, leek, spring onion raw	☐	☐	☐	☐	☐	☐	☐	☐
Onion, leek, spring onion boiled	☐	☐	☐	☐	☐	☐	☐	☐
Tomatoes	☐	☐	☐	☐	☐	☐	☐	☐
Pepper	☐	☐	☐	☐	☐	☐	☐	☐
Leafy vegetables	☐	☐	☐	☐	☐	☐	☐	☐
Okra	☐	☐	☐	☐	☐	☐	☐	☐
Garden eggs	☐	☐	☐	☐	☐	☐	☐	☐
Carrots raw	☐	☐	☐	☐	☐	☐	☐	☐
Carrot boiled	☐	☐	☐	☐	☐	☐	☐	☐

	☐	☐	☐	☐	☐	☐	☐	☐
Cabbage raw	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐
Garlic	☐	☐	☐	☐	☐	☐	☐	☐
Lettuce	☐	☐	☐	☐	☐	☐	☐	☐
Aleefu	☐	☐	☐	☐	☐	☐	☐	☐
Kontomire	☐	☐	☐	☐	☐	☐	☐	☐
Ayoyo	☐	☐	☐	☐	☐	☐	☐	☐
Mushroom	☐	☐	☐	☐	☐	☐	☐	☐
Cucumber raw	☐	☐	☐	☐	☐	☐	☐	☐
Cucumber boiled	☐	☐	☐	☐	☐	☐	☐	☐

10. How many fresh fruits did you eat on average when you were pregnant?

	Per day					Per week			Per month		
	8+	6-7	4-5	2-3	1	5-6	3-4	1-2	2-3	1	0
Fresh fruit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

How often

Fruits	Per day				Per week			Per month		
	4+	3	2	1	5-6	3-4	1-2	2-3	1	0
Orange	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mango	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pineapple	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pawpaw	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Banana	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Watermelon	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grapes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coconut	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Pear	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Avocado	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Apples	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tangerine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grapefruit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Strawberries	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other fruits	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Hot meals bought from food venders, Kiosks and fast food restaurants

1. How often did you eat hot meals bought at kiosks, food venders and fast food restaurants?

	Per day			Per week			Per month		
Food bought from	4+	2-3	1	5-6	3-4	1-2	2-3	1	0
Kiosks	☐	☐	☐	☐	☐	☐	☐	☐	☐
Food venders	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fast food restaurant	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. Did you start to eat or drink certain food items when you were pregnant? ☐ Yes ☐ No

8. If Yes, name the two most important food items you have started to eat/drink.

Write the name of the food item

Checklist from maternity health record book

. Height of woman.....

. Number of weeks pregnant at first ANC visit.....

. Weight at first ANC visit.....

. Weight at last ANC visit …….

. Weight at delivery…….

. Number of ANC visits before birth …….

. Number of weeks pregnant at delivery …….

. Gestational diabetes

. Baby's weight at birth …….

ECTION D: weight ASSESSMENT

Level of visit	**Weight**
At first visit	

First trimester	
Second trimester	
Third trimester	

his is the end of the interview. Thank you