UNIVERSITY OF EDUCATION, WINNEBA

NUTRITIONAL KNOWLEDGE, DIETARY HABITS, AND ASSOCIATED FACTORS INFLUENCING THE NUTRITIONAL STATUS OF PREGNANT WOMEN IN THE KROWOR MUNICIPALITY OF THE GREATER ACCRA REGION OF GHANA

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A thesis in the Department of Food and Nutrition Education, Faculty of Health, Allied Sciences and Home Economics Education, submitted to the school of Graduate Studies in partial fulfilment of the requirements for award of the degree of Master of Philosophy (Home Economics) in the University of Education, Winneba

AUGUST, 2023

DECLARATION

STUDENT'S DECLARATION

I**, Mary Nkansah**, declare that this thesis except for quotations and references contained in published works which have all been identified and acknowledged, this thesis is entirely my own original work, and that it has not been published or submitted in part or whole for another degree elsewhere'

Signature : ……

Date : ……

SUPERVISOR'S DECLARATION

We hereby certify that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University of Education, Winneba.

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Signature : ……

Date : ……

DEDICATION

To God Almighty for His loving kindness, grace and protection. Also, to my husband Nicholas Nii Kpakpoe Addo, our children Emily, Kingsford, Charlotte and family for the constant encouragement, unflinching support and invaluable sacrifices made throughout the course. I remain forever grateful and indebted to them.

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ABBREVIATIONS

ANC	-	Ante-natal Clinic
BMI	-	Body Mass Index
BUN	-	Blood Urea Nitrogen
CED	-	Chronic Energy Deficiency
MCN	-	Maternal and Child Nutrition
FAO	-	Food and Agriculture Organization
GDM	-	Gestational diabetes Mellitus
GHS	-	Ghana Health Service
Hb	-	Haemoglobin
HBW	-	High Birth Weight
HDDS	-	Household Dietary Diversity Score
IFA	-	Iron and Folate Acid
IOM	-	Institute of Medicine
IUGR	-	Intrauterine Growth Restriction
KAP	-	Knowledge, Attitudes and Practices
LBW	-	Low Birth Wight
MDDS	-	Minimum Dietary Diversity Score
MDD-W	-	Minimum Dietary Diversity for Reproductive women
MHRB	-	Maternal Health Record Book
MUAC	-	Mid Upper Arm Circumference
MVMS	-	Multivitamin and Mineral Supplements
N-Status	-	Nutritional Status
PTB	-	Pre-Term Birth
RDA	-	Recommended Dietary Allowance

SEM	-	Socio-Ecological Model
SES	-	Socioeconomic Status
SGA	-	Small for Gestational Age
SLT	-	Social Learning Theory
SPSS	-	Statistical Package for the Social Sciences
UNICEF	-	United Nations Children's Fund
VBI2	-	Vitamin B12
VD	-	Vitamin D
WHO	-	World Health Organization

ABSTRACT

Pregnancy marks a critical phase in a woman's life, necessitating careful attention to nutritional needs to support both maternal well-being and foetal development. This study examined the nutritional knowledge, dietary habits, and associated factors influencing the nutritional status of pregnant women attending antenatal clinic in the public health facilities in the Krowor Municipality. A cross-sectional design was adopted, employing a questionnaire for data collection. Systematic random sampling was used to recruit 266 participants for the study. The study found that most participants had moderate level of nutritional knowledge (45%). A greater proportion of respondents had less than four meals a day (59.8%) and did not skip meals (67.7%). Almost all respondents were nourished (98.5%) and most were non-anaemic (68.4%). Marital status ($p=0.030$) and income level ($p=0.009$) significantly predicted nutritional status. In conclusion, the study signifies that pregnant woman in the Krowor Municipality maintain an acceptable level of nutritional status. It is recommended that public health authorities implement comprehensive and evidenced based nutritional education initiatives tailored to the specific nutritional needs of pregnant women in the Krowor Municipality.

CHAPTER ONE

INTRODUCTION

1. 0 Overview

This chapter consists of background of the study, problem statement, purpose and objectives of the study, research questions, significance, limitations and delimitations of the study. It also contains definition of terms as well as operational abbreviations used in the study and the organisation of the study.

1.1 Background to the Study

Maternal mortality is a prevailing global issue and concern, persisting as a significant public health challenge. The prevalence of such mortality has shown a declining trend but continue to fall below the recommended thresholds outlined by the World Health Organisation (WHO) (WHO, 2024). The global occurrence of maternal mortality remains excessively high in an unacceptable manner (UNICEF, 2023). Throughout the year 2020, nearly 800 women died daily from pregnancy and childbirth, with a maternal death transpiring approximately every two minutes during that same year (WHO, 2024). Furthermore, WHO reports that approximately 287,000 maternal deaths in 2020 (WHO, 2024). In 2020, Sub-Saharan Africa (SSA) and Southern Asia together were responsible for 87% (about 253,000) of all estimated maternal deaths globally, with SSA alone accounting for nearly 70% and Southern Asia accounting for 16% of these fatalities (WHO, 2024). Paramount among the factors accountable for adverse pregnancy outcomes is poor nutritional status (N-Status) (Shenoy *et al.*, 2023). The association between poor N-Status and adverse pregnancy outcomes, such as maternal mortality, has been established in literature (Christian, 2018; Filippi *et al.*, 2016; Gyimah *et al.*, 2022; Janssens & van Dongen, 2017).

Globally, the incidence of acute malnutrition among pregnant women has experienced a substantial increase from 5.5 million to 6.9 million since the year 2020 in 12 nations that have been severely impacted by the worldwide food and nutrition crisis, as per a recently published report by UNICEF in 2023 (UNICEF, 2023). According to Jemal and Awol (2019), iron deficiency affected approximately 9.5% of women in the United States, while less than 1% of the overall population experienced deficiencies in both vitamin E and folate. In contrast, in Pakistan, Minimum Dietary Diversity for Reproductive women (MDD-W) among pregnant women varied significantly, with 86% having a moderate Minimum Dietary Diversity Score (MDDS), 5% classified as low, and only 9% achieving a high score.

In developing nations, between 13% and 38% of pregnant women are affected by undernourishment (Tafara *et al*., 2023). A 2023 UNICEF report highlights Sub-Saharan Africa as the epicenter of the ongoing nutrition crisis impacting adolescent girls and women. (UNICEF, 2023). The occurrence of undernourishment among women of reproductive age (WRA) in Africa is notably higher due to prolonged deficiencies in energy and/or micronutrients, particularly during pregnancy (Lartey, 2020). A comprehensive analysis of 23 studies involving pregnant women on the prevalence of malnutrition among pregnant women across Africa revealed that malnourishment was present in 23.5% of cases (Demelash *et al*., 2019). According to a 2018 report from the WHO African region, nine African countries displayed prevalence of undernourishment exceeding 15% (WHO, 2018a).

In Ghana, a study by Saaka (2020) focusing on pregnant women reported that the average daily intake of energy, protein, and fat were 2,770.8 Kcal, 59.2 g, and

105.25g, respectively. The proportion that met the recommended dietary allowance (RDA) for these macronutrients were 58.8%, 27.0%, and 50.3%, correspondingly. The micronutrients adequacy ratio of meals, estimated based on the presence of 14 nutrients, was determined to be 68%, serving as a comprehensive measurement of nutrient sufficiency. More than half of pregnant women consumed less than 66% of the RDA for key nutrients including iron, calcium, riboflavin, folic acid, and Vitamin B12 (VB12). In Ghana, a separate study reported that 46.1% of pregnant women met their dietary requirements, whereas 43.9% fell short (Jemal & Awol, 2019). According to Cetin and Laoreti (2015), N-Status during pregnancy plays a critical function in ensuring both her health and that of her unborn child, with implications for immediate and long-term outcomes.

Pregnancy instigates notable physiological stress, consequently elevating the demand for energy, protein, and/or vital vitamins and minerals. If these requirements are not adequately met, not only will the nutritional status of the individual be compromised, but the trajectory of pregnancy and lactation will also be affected (Global Nutrition Report, 2018). Evidence from low-income countries indicates that approximately 2.2 million deaths are attributed to the combined impacts of stunting, severe wasting, and intrauterine growth restriction (IUGR). Additionally, poor nutrition of mother and child is estimated to be responsible for 3.5 million deaths (Iqbal and Ali, 2021).

It has been estimated that poor N-Status during pregnancy accounts for 14% of cases of IUGR among foetuses in developing countries, and maternal stunting accounts for an additional 18.5% (Tafara *et al.*, 2023). Should women experience undernourishment during pregnancy, the cycle of poor maternal nutrition leading to restricted foetal growth, stunted childhood development, reduced lifelong

productivity, and heightened risks of illness and death for both mother and child is likely to continue. (Black *et al*., 2013).

Furthermore, the mother is at risk of experiencing complications such as anaemia, bleeding, abnormal weight gain, and infectious diseases due to poor nutritional status. Pregnant women with inadequate nutrition may encounter difficulties during delivery, leading to prolonged labour and premature birth (PTB), ultimately resulting in the need for surgery (Karemoi *et al*., 2020). Karemoi *et al*. (2020) further assert that insufficient maternal nutrition can contribute to foetal abortion, PTB, growth issues, low birth weight (LBW), and newborn mortality.

Nutritional status during pregnancy is a crucial element for foetal health, as insufficient or excessive nutrition can lead to complications pertaining to fertility, foetal development and other perinatal issues. These maternal health concerns may account for unfavourable pregnancy outcomes (Marshall, 2022).

Studies indicate that maternal undernutrition is linked to factors such as young age, limited educational achievements, low socio-economic standing, having a large family, insufficient income, limited decision-making authority for women, household food insecurity, lack of knowledge on nutrition, place of residence, dietary variety, absence of proper sanitation facilities, and unintended pregnancies (Ayele *et al*., 2020; Dadi *et al*., 2019; Gelebo *et al*., 2021; Muze *et al*., 2020). Knowledge regarding nutrition is a crucial determinant in achieving positive birth outcomes and enhancing the nutritional wellbeing of the child (Wakwoya *et al*., 2022). Understanding nutrition and holding positive attitudes toward healthy eating are essential for promoting sound

dietary habits. They also represent key areas for targeted nutritional interventions, particularly among vulnerable groups like pregnant and lactating women (Katenga-Kaunda *et al*., 2021). Otuneye *et al*. (2017) contend that assessing dietary habits is vital for understanding N-Status. They concluded that adhering to a balanced eating pattern supports good health, growth, cognitive development, and the prevention of disease, whereas unhealthy dietary habits can contribute to malnutrition.

1.2 Statement of the Problem

Improving the N-Status of pregnant women is fundamental to improving pregnancy outcomes and reducing maternal mortality (Abubakari *et al*., 2023). However, Ghana is among other developing countries facing the double burden of malnutrition characterised by the coexistence of widespread undernutrition alongside increasing rates of overweight and obesity. (USAID, 2021). For instance, in 2022, anaemia prevalence was 51% among pregnant women (Ghana Statistical Service [GSS], 2023). A study by Saaka (2020) reports that approximately half of pregnant women consumed below 66% of the RDA for essential nutrients including iron, calcium, riboflavin, folic acid, and VB12. In a separate study, only 46.1% of pregnant women were found to meet their dietary requirements, while 43.9% failed to do so. (Jemal & Awol, 2019).

Several interventions have been implemented to improve the nutritional situation over the past years. In 2013, Ghana's National Nutrition Policy which is a five-year policy was implemented to expand the reach of high impact and nutrition oriented interventions, aiming to achieve optimal nutrition for Ghanaians, with particular emphasis on enhancing maternal and child nutrition (MCN) (Ministry of Health [MoH], 2013). In 2014, the World Bank launched the MCN improvement project in Ghana, aiming to enhance access to community-based health and nutrition services

for WRA particularly pregnant women and children under two years (Debpuur *et al*., 2021). Initiatives such as growth monitoring, micronutrient supplementation, behaviour change, and management of malnutrition at the community level were also introduced to strengthen MCN. However, despite these interventions, undernutrition among mothers and children continues to pose a significant challenge in Ghana (Sienso & Lyford, 2018).

Pregnant women's nutritional well-being is shaped by a range of factors, including socio-demographic, economic, reproductive, medical, behavioural, healthcare-related, environmental, and dietary influences (Arero, 2022). Notably, studies conducted in other contexts have shown a strong link between pregnant women's knowledge of nutrition and dietary behaviours and their overall health and nourishment (Diddana, 2019; Shemsu *et al*., 2020; Tesfaye *et al*., 2022; Teja & Dewi, 2022).

Nutritional knowledge is crucial for pregnant women to ensure they consume enough nutrients (Gezinu *et al*., 2022). Therefore, it is important for pregnant women to possess sufficient knowledge to fulfil their higher dietary requirements and achieve optimal nutritional well-being during pregnancy (Gezinu *et al*., 2022). Likewise, maintaining a healthy dietary habit is crucial for pregnant women, as those who consume adequate levels of both macronutrients and micronutrients are more likely to experience positive pregnancy outcomes and enjoy improved health outcomes for both mother and child (Gyimah *et al*., 2022).

In the Krowor Municipality there is evidence of poor N-Status among pregnant women. In 2023, 6% of pregnant women in the Municipality had anaemia and as of September 2024, 19% of pregnant women were presented with anaemia (Krowor

Municipal Health Directorate, 2024). Despite these relatively high rates of anaemia in the Municipality, there is dearth of evidence on the influence of nutrition knowledge and dietary habits on N-Status of pregnant women. The current study thus sought to explore the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women in the Krowor Municipality of Ghana. Understanding the dynamics of N-Status of women in the municipality is valuable to improving the well-being of expectant mothers in the municipality.

1.3 Objectives of the study

1.3.1 Purpose of the Study

This study sought to investigate the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women attending antenatal clinic in public health facilities in the Krowor Municipality.

1.3.2 Specific objectives of the study

The specific objectives of the study were to:

1. evaluate the level of nutrition knowledge of pregnant women in the Krowor Municipality.
2. assess the dietary habits of pregnant women in the Krowor Municipality
3. determine the nutritional status of pregnant women in the Krowor Municipality.
4. investigate the factors that influence the nutritional status of pregnant women in the Krowor Municipality.

1.4 Research Questions

This research was guided by the questions below:

1. What is the level of nutrition knowledge of pregnant women in the Krowor Municipality?
2. What is the dietary habit of pregnant women in the Krowor Municipality?
3. What is the nutritional status of pregnant women in the Krowor Municipality?
4. What factors influence the nutritional status of pregnant women in the Krowor Municipality?

1.5 Significance of the Study

The findings of the study would be helpful in enlightening pregnant women on their nutritional knowledge and impact their dietary decisions and nutritional well-being. Moreover, the study would help to plan nutrition interventions for Krowor Municipal Health Directorate based on the findings of the study. Furthermore, it may be a useful source of information to both governmental and non-governmental organisations, policy makers and families to create awareness among pregnant women through local mass media. Finally, the study may add up to literature and provide data as foundation on which future research would be built.

1.6 Delimitation

There might be many issues affecting pregnant women within the Krowor municipality, but the study only focused on the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women attending antenatal clinic in the public health facilities within the Krowor municipality. The independent variables were delimited to nutritional knowledge and dietary habit of pregnant women.

1.7 Limitation of the study

The study would have been based on the entire population of pregnant women in the Krowor municipality, but due to time constraints only expectant women who attended antenatal in the public health facilities within the municipality were captured. This procedure therefore would decrease generalisation of the findings to all pregnant women in the municipality. The study was descriptive in design and so cause and effect relationship between nutritional knowledge and dietary habit and N-Status cannot be established.

1.8 Definition of Key Terms

There were terms which were used in the study and needs to be explained by the researcher for better understanding of this study.

Ante-natal Care: refers to routine care of pregnant women provided between conception and the onset of labour.

Dietary diversity: refers to the number of various food groups consumed over a given reference period.

Dietary habits: refers to qualities, proportions, variety combination of different foods, drink and nutrient in diets and frequency with which they are habitually consumed.

Maternal Nutrition: refers to the nutritional needs of women through the antenatal and postnatal periods and may encompass the pre-conception phase.

Nutrition knowledge: refers to the consciousness of practices and notions associated with nutrition and well-being, encompassing sufficient food consumption, ailments linked to diet, and foods that serve as primary reservoirs of nutrients, alongside dietary guidelines and suggestions.

Nutritional Status: refers to health of individuals as determined by their intake and utilisation of nutrients.

Pregnancy: refers to the condition in which a woman carries a developing embryo or foetus from the point of fertilisation until childbirth.

1.9 Organisation of the Study

The study was organised into five chapters. The first chapter mainly presented the introduction which encompass the background, the problem statement, purpose and the objectives of the research. It also consisted of the research questions, significance of the research, delimitation and limitation; the definition of terms used in the research and the organisation of the study. The second chapter discusses extensively the relevant literature. This chapter reviewed the main concepts of the study. It also reviewed the relevant theories as well as the relevant previous studies. The chapter also presented the conceptual framework developed for the research. Chapter three presented the research paradigm, approach, design, study area, population, study variables, sample and sampling techniques, research instrument, validity and reliability, data collection and analysis procedures, and ethical consideration. The fourth chapter presented the results and discussion of the study respectively. Finally, Chapter five consisted of a summary of findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This study sought to investigate the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women attending ANC in public health facilities in the Krowor Municipality. The chapter is organised along the following sub-headings:

i. Theoretical Review
ii. Nutritional knowledge of pregnant women
iii. Dietary habit of pregnant women
iv. Dietary diversity during pregnancy
v. Essential nutrients requirement during pregnancy
vi. Importance of nutrition in major stages of pregnancy
vii. Socio-economic factors and pregnancy
viii. N-Status of pregnant women
ix. Causes of poor N-Status among pregnant women
x. Consequences of poor N-Status among pregnant women
xi. Strategies to improve N-Status of pregnant women
xii. Conceptual framework

2.1 Theoretical Review

The UNICEF model on maternal child and nutrition (UNICEF- MCN), the Socio-ecological model (SEM) and the Social Learning Theory (SLT) served as the theoretical basis for the study.

2.1.1 UNICEF Model of MCN

The UNICEF model of MCN outlines UNICEF's conceptualisation of the determinants of MCN (UNICEF, 2020), building upon earlier models developed by the organisation. This framework recognises the triple burden of malnutrition, which stems from poor diets and inadequate care services and practices. It underscores the critical function of both diet and care as direct influences on MCN. By presenting a constructive narrative around the drivers of good nutrition for women and children, the model clearly identifies the immediate, underlying, and enabling factors necessary for adequate nutrition. Furthermore, it illustrates the vertical and horizontal interconnections among these factors and emphasises the positive outcomes such as survival, growth, development, improved functioning, and economic prosperity that result from enhanced MCN.

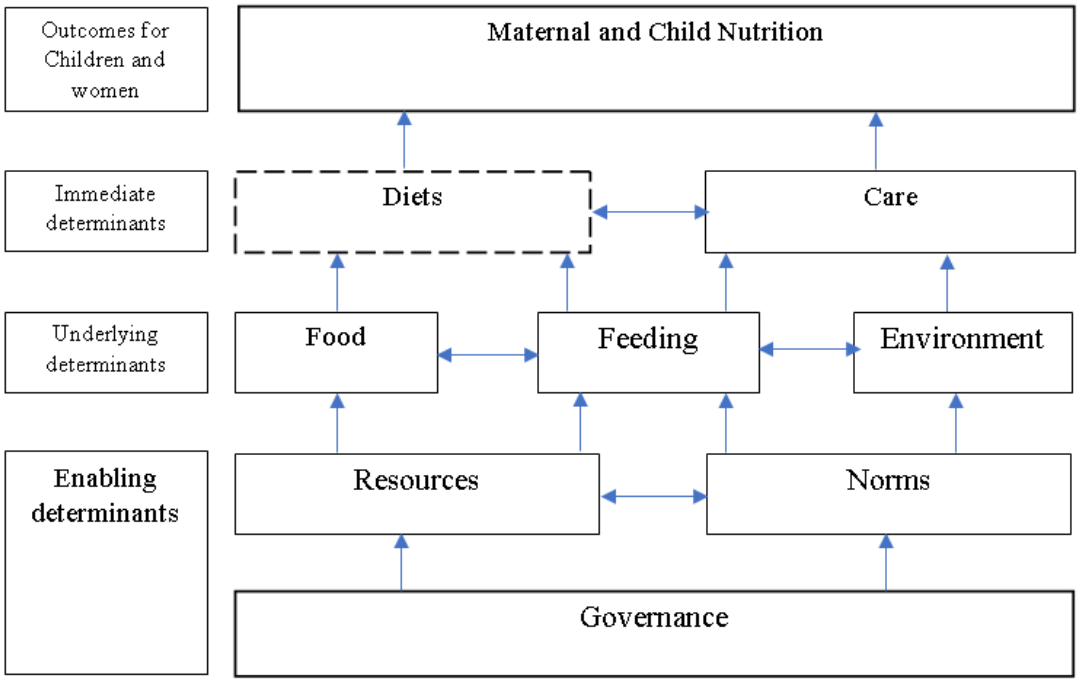

Figure 1 UNICEF Model of Maternal and Child Nutrition, 2020

According to the theoretical framework, the facilitating determinants of MCN encompass governance, resources, and cultural norms. Governance encompasses public and private sector initiatives that empower the rights of children and women to adequate nutrition. Resources pertain to the availability of sufficient environmental, financial, social, and human capital necessary to safeguard the nutrition rights of women and children. Norms are associated with the positive social and cultural standards and practices that promote the rights of children and women to nutrition.

The fundamental determinants consist of food, feeding practices, and the surrounding environment. Food pertains to the provision of age-appropriate, nutrient-dense options, including breast milk during early childhood alongside access to potable water and food security. Feeding involves the application of age-specific dietary practices, responsive feeding and developmental stimulation in early childhood, supported by the provision of adequate and nutritious food preparation, consumption, and hygiene standards. The environment, as articulated within the model, encompasses healthy food ecosystems, sufficient nutrition, health, and sanitation services, as well as conducive living conditions that foster optimal dietary choices and physical activity. The immediate determinants identified in the model include diet and caregiving practices. Diet concerns the provision of nutritious food, facilitated by adequate feeding practices for both children and women. Care, conversely, pertains to the provision of effective caregiving, supported by sufficient mother and child oriented services.

The UNICEF model of MCN relates to the nutritional well-being of pregnant women by emphasising the importance of addressing immediate, underlying, and basic causes of malnutrition. For pregnant women, inadequate dietary intake and disease can severely impact both their health and the development of their unborn child. The

model highlights the need for food security, proper care, and access to health services to guarantee that pregnant women have access to sufficient nutrition. By addressing socio-economic factors and ensuring that resources are available and equitably distributed, the model seeks to improve maternal nutrition, which is pertinent for the health of the mother and the unborn child, ultimately reducing the risk of complications and promoting healthy pregnancies.

2.1.2 The Socio-ecological Model (SEM)

Bronfenbrenner's Model (SEM) was initially presented in the 1970s as a conceptual framework to explain the development of humans. In the 1980s, it was further reformed into a theory (Kilanowski, 2017). The original theory was characterised by concentric circles with the individual positioned at the core and surrounded by different systems, namely micro, meso, exo, macro, and chrono systems (Bronfenbrenner, 1977; Bronfenbrenner, 1986; Bronfenbrenner, 1989). The socio-ecological model is a conceptual framework that considers the various levels of influence on the health of individuals and communities, spanning from personal factors to broader environmental and societal influences. As per this theory, there are numerous elements that have bearing on the dietary decisions and well-being of pregnant women. These factors encompass individual, interpersonal, community, institutional, and policy level aspects. Figure 2 represents the SEM.

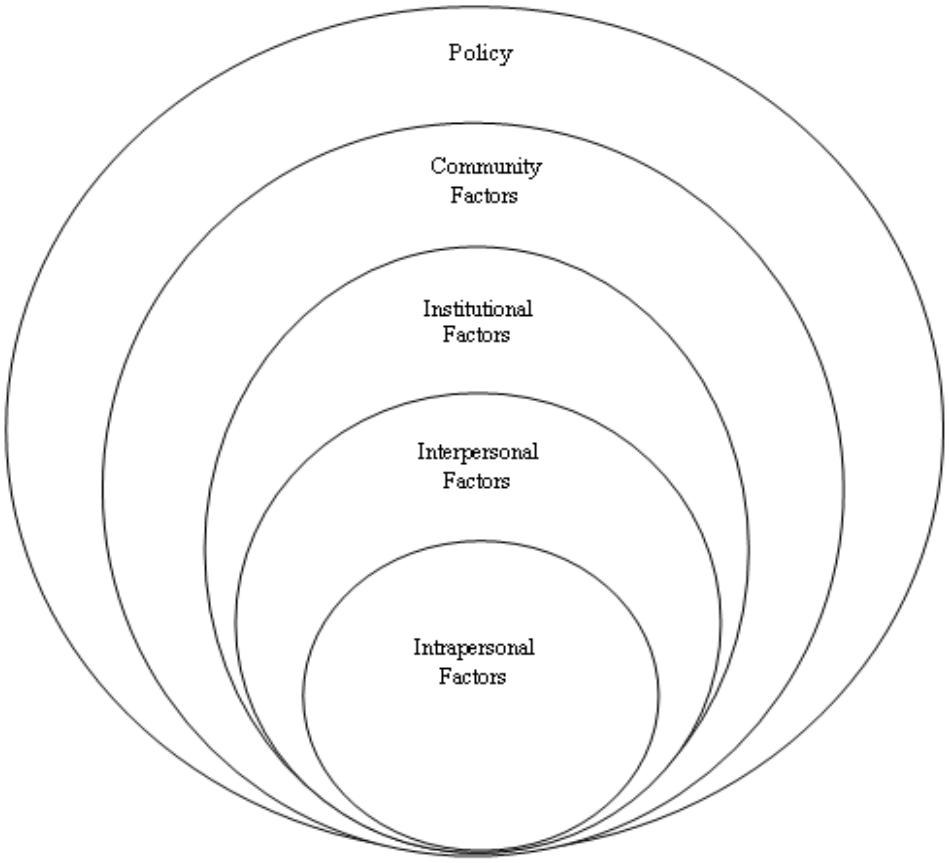

Figure 2: Bronfenbrenner's Socio-Ecological Model

When considering the socio-ecological model in relation to malnutrition, we can examine how different elements at different levels contribute to the occurrence and persistence of poor nutrition. At the personal level, the nutritional standing of pregnant women is predisposed by biological factors including genetics, age, and overall health. The model suggests that certain individuals may be more susceptible to malnutrition due to underlying health conditions or genetic predispositions. Additionally, the knowledge and attitudes of pregnant women towards nutrition and dietary practices can have an impact on their N-Status. Similarly, a lack of awareness regarding proper nutrition or cultural beliefs concerning food choices can contribute to malnutrition.

At the interpersonal level, the model asserts that family dynamics and social support networks perform a pivotal role in ensuring access to nutritious food. Social, economic, household food security, and cultural factors within the family can affect dietary patterns and contribute to malnutrition. Likewise, peer influence can have an impact on dietary choices. Peer pressure or shared cultural norms may influence individuals' preferences and consumption patterns. At the community level, the model argues that the accessibility of adequate food within the community can impact dietary behaviours and the nutritional circumstance of pregnant women. Food deserts, characterised by limited access to fresh and healthy food, contribute to malnutrition by restricting individuals' choices. The presence or absence of community programs, such as nutritional education initiatives or food assistance programs, can also affect the overall nutritional well-being of individuals.

At the institutional level, the SEM asserts that access to healthcare services, including preventive care and treatment for malnutrition, is crucial. For instance, the availability of hospitals can enhance the nutritional well-being of expectant women by providing access to essential prenatal care, nutritional counselling, and supplementation programs. Hospitals help promote healthier pregnancies and improved outcomes for both mothers and infants by minimising obstacles to accessing healthcare.

Finally, at the policy level, the model suggests that government policies related to agriculture, food distribution, and poverty alleviation can significantly influence malnutrition rates. The SEM explains that policies that address socio-economic inequalities, promote sustainable agriculture, and ensure food security contribute to the reduction of malnutrition.

By examining malnutrition through the socio-ecological model, it becomes evident that an all-inclusive approach is necessary to resolve the complex inter-play of factors at different levels. However, for the purposes of this study, only the nutritional knowledge of pregnant women, which is a concept at the individual level within the model is relevant and will be evaluated.

2.1.3 The Social Learning Theory (SLT)

Albert Bandura, esteemed as the foundational figure of cognitive theory, is the architect of the SLT. This framework posits that individuals acquire knowledge through their social engagements. Upon observing the behaviours exhibited by others within their social milieu, individuals internalise and replicate these behaviours (Nabavi, 2012). Nabavi articulates that learning is characterised as "a lasting alteration in behaviour or the capacity to act in a specific manner, resulting from practice or other experiential modalities." From this viewpoint, learning is not restricted to any particular phase of life but is recognised as a continuous process. This theory posits that individuals learn through the mechanisms of observation, imitation, and modelling. The observer, or individual, meticulously scrutinises the behaviour of a designated individual, referred to as the model. Subsequently, the observer endeavours to replicate this behaviour. Should societal reinforcement accompany the behaviour, the observer is motivated to persist in its enactment. In the realm of dietary practices, children closely observe their parents' selections of food, methodologies of food preparation, and eating behaviours. Parents function as exemplars for their offspring, who subsequently emulate these practices and maintain them if societal endorsement is present. Nonetheless, when these children find themselves in a novel environment, they are likely to modify their dietary habits, potentially once again engaging in the processes of observation, imitation, and

modelling. It is imperative to acknowledge that members of a community learn from one another.

The SLT is thus deemed appropriate for application in this inquiry, as the selection of dietary intake constitutes a behaviour which is learned. According to Koster and Mojet (2006), the dietary choices of humans are predominantly a learned phenomenon. They assert that the process of learning persists throughout the entirety of an individual's life. From this standpoint, it follows that individuals possess the capability to acquire novel dietary habits and internalise them, thereby enabling the learning and adoption of new diets that yield beneficial effects on their health. Carmody et al. (1986) have utilised the framework of social learning theory to formulate and execute health initiatives designed to instigate modifications in dietary lifestyles. This theoretical approach is employed in contexts where behaviour-focused interventions are warranted. For example, SLT has been applied across numerous studies to advocate for heart-healthy dietary patterns (Carmody et al., 1986).

Mayer and Gast (2008), in their application of the SLT within research involving preadolescent females identified a connection between peer influence and the prevalence of eating disorders, thereby substantiating the premise that eating behaviours are learned from individuals within one's social milieu. In a longitudinal investigation involving French children, Nicklaus et al. (2005) explored the relationship between food preferences at the ages of 2 and 22. The results revealed a robust association between favourite food for childhood and adult with approximately 50% of dietary items, signifying a substantial link between early and later food preferences. This finding suggests that children assimilate new knowledge throughout their developmental trajectory. Nonetheless, a limitation of the theory resides in the

observation that while individuals may learn from one another, not all acquired knowledge is invariably adopted. Individuals retain their autonomy and, consequently, can make personal choices predicated on their individual assessments of suitability.

2.2 Empirical Review

2.2.1 Nutritional Knowledge of Pregnant Women

Knowledge regarding nutrition substantially influences the development of a healthy dietary disposition in relation to eating behaviours and dietary practices (Paripati et al., 2022). The absence of fundamental nutritional knowledge poses a significant risk for the misapplication of food and nutrition information, rendering it ineffective for proper communication aimed at fostering healthy eating habits (Branca, 2015). Doyle et al. (2017) argue that possessing nutritional knowledge mitigates information overload by enabling consumers to focus on pertinent information regarding food while disregarding marketing elements that lack relevance to nutritional quality.

Users of nutritional knowledge, in comparison to non-users, expressed a more pronounced belief in the benefits of scrutinising nutrition in scenarios such as food comparisons and the selection of healthier food options (Ayaz et al., 2020). Ayaz et al. (2020) demonstrated that motivations for utilising knowledge pertaining to overall health, calorie tracking, and concerns regarding specific nutrients significantly contribute to health enhancement and indicated that regular health status assessments were predicted by health-related motivations (e.g., diabetes management, dietary balance, and overall well-being), the pursuit of nutrient information, weight management, and nutritional literacy. Furthermore, they identified three factors that forecast infrequent utilisation; purchasing preferred foods irrespective of their nutritional content, time limitations, and a general disinterest (El-Nagar *et al*., 2017).

Pregnant women's nutritional knowledge varies, according to studies. According to an Indian study, 40 percent of participants knew what healthy nutrition was, 45 percent of pregnant patients knew what food meant and the implications of eating a healthy diet (47 percent), and 43 percent knew that food was necessary for proper functioning and infection prevention (67 percent) (Nagi et al. (2016). A study in Lebanon by Harb et al. (2018) discovered that 56% of the community under investigation did not know enough about pregnant women's nutrition. Lim et al. (2018) did a cross-sectional study of 88 prenatal mothers who were chosen at random to receive prenatal care at a tertiary teaching hospital in Malaysia. The object of the study was to appraise antenatal mothers' level of nutritional knowledge during pregnancy and related factors. The study revealed that healthcare professionals, such as doctors and nurses, along with mass media, were key sources of information on nutrition during pregnancy. Interestingly, antenatal mothers were found to seldom receive nutritional information from dietitians, relying more frequently on friends and family members instead. Over one- half of the mothers had a good level of nutritional knowledge. However, the study also indicated inadequate knowledge of nutrition in pregnancy among mothers, suggesting a need for intensified nutritional education. The study identified higher occupational status and income to be significantly associated with a higher nutritional knowledge.

In China, a survey was executed to evaluate the Knowledge, Attitudes, and Practices (KAP) of pregnant women concerning nutritional aspects. The findings indicated that in terms of nutritional knowledge and practices, only 15.2% and 47.3% surpassed the threshold of 0.6, respectively. Factors such as age, the educational attainment of husbands, family monthly income, nutritional knowledge, and nutritional attitudes emerged as statistically significant predictors of the at-risk demographic. The research

underscores the importance of nutritional education interventions aimed at specific populations to potentially enhance the conversion rate of nutrition-related practices and introduces a predictive model to identify the susceptible group (Wang et al., 2023).

Xu *et al*. (2020) conducted a cross-sectional study aimed at assessing the extent of disparities in dietary knowledge and dissecting the factors contributing to this inequality. The study identified a notably low percentage of correct responses to dietary knowledge inquiries among certain participants. Urban residents exhibited a higher rate of accurate responses compared to their rural counterparts, with evident pro-rich disparities in dietary knowledge. This inequality was influenced by both individual characteristics and broader regional factors. The research suggests tailored strategies in dietary education programs based on educational levels and a focus on marginalised populations, while emphasising the importance of incorporating local dietary practices in educational materials development.

In Ethiopia, a study by Tenaw *et al.* (2018) evaluated the nutritional KAP of pregnant women attending ANC in public hospitals. The investigation unveiled that the nutritional knowledge of expectant mothers regarding dietary requirements during pregnancy was notably inadequate. In Egypt, Mahmoud and Ghaly (2019) revealed their study that a mere 4.7% of the participants possessed a commendable understanding of nutrition during pregnancy. Moreover, it was determined that 81.6% of pregnant women exhibited fair knowledge, while only 13.8% displayed poor knowledge. In Kenya, Obonyo (2018) undertook a cross-sectional and comparative study to analyse the determinants influencing the translation of acquired nutritional knowledge into practice. The results indicated that a majority of caregivers

demonstrated sufficient nutrition knowledge, whereas one third possessed insufficient knowledge.

In Ghana, a study indicated that approximately 85% of pregnant women recognised the necessity of increased food intake compared to their non-pregnant counterparts, while merely 16.9% acknowledged the significance of folic acid supplementation (Agyei *et al*., 2021). Another cross-sectional investigation in Ghana revealed that only 49.9% of pregnant adolescents exhibited high levels of nutritional knowledge (Appiah *et al.,* 2022).

2.2.2 Dietary Habit of Pregnant Women

Diet during pregnancy is recognised as a vital environmental factor that can profoundly affect maternal health, while also shaping the growth and long-term well-being of the foetus and child throughout their lifespan. Therefore, dietary habit of pregnant women holds immense importance for the proper advancement of pregnancy and the well-being of the foetus (Chantal *et al*., 2022). Odiwuor *et al*. (2022) emphasised the significance of maintaining a balanced diet during pregnancy, ensuring adequate intake of both macronutrients and micronutrients. It has been highlighted that the energy requirements per day for women engaging in moderately active lifestyles, increase during pregnancy, with the specific amount depending on the stage of the foetus (Kocyłowski, 2018). Progressing through pregnancy, the demand for protein in women escalates, reaching its peak in the third trimester. Therefore, an appropriate protein intake in the diet becomes essential to support the biosynthesis of protein required to meet the needs of maternal tissues, placenta, and the developing foetus (Chantal *et al*., 2022).

Maintaining healthy dietary habits in the course of pregnancy is essential for supporting the long-term nutritional health of the mother and the unborn child (Gibore *et al*., 2021). It has been observed that dietary inadequacy resulting from inadequate dietary behaviours are especially common during pregnancy compared to other phases of the life cycle (Nana & Zema, 2018). Studies have shown that a significant number of women in developing countries intentionally consume less food during pregnancy due to concerns about delivering a baby with high birth weight (HBW), as they fear it may predispose them to birth complications, in addition to 32adhering to cultural beliefs (Gibore *et al*., 2021).

Poor nutrition during key stages of foetal development, often resulting from unhealthy dietary behaviours, can trigger changes in foetal tissue development, increasing the likelihood of non-communicable diseases in the future (Olatona et al., 2021). Foetal malnutrition may occur due to both inadequate and excessive maternal nutrient intake. Excesses can result in maternal overweight, complicating pregnancy and labour, thereby increasing the likelihood of severe birth abnormalities (Olatona *et al*., 2021). Conversely, nutrient deficiencies elevate the risk of intrauterine growth retardation (IUGR), a condition that often influences early life growth patterns and survival outcomes, alongside factors such as age and gender (Alisjahbana *et al*., 2019).

Pregnant women with inadequate dietary intake have elevated likelihood of delivering babies with either LBW or HBW (Momora & Krupa, 2019). Improper diet also heightens the chances of developing pre-eclampsia, nutrient deficiencies like iron-deficiency anaemia, and may contribute to abnormal foetal development, congenital anomalies, and a myriad of health issues that could manifest during postnatal life (Momora & Krupa, 2019). Abdollahi et al. (2021), through a global systematic

review, found that greater maternal adherence to a healthy diet was linked to a lower risk of pre-eclampsia, depression, LBW, and preterm birth (PTB), as well as increased gestational and birth weight. Yang *et al*. (2022) concludes in their study that women who consumes higher quality diet had lower risk of inappropriate gestational weight gain and lower risk of PTB.

A study in Nigeria highlighted that 52.0%)of the participants consumed meals three times per day, while 43.1% reported skipping meals, with lunch (37.4%) being the most frequently omitted meal. A significant proportion (71.7%) dined outside their residences, and only less than a quarter consumed five fruits and vegetables every day. Additionally, 5.6% engaged in alcohol consumption, whereas 38% either refused specific foods or adhered to a special diet during their present pregnancy. Rice was identified as the predominant cereal consumed, whereas plantain and cassava constituted the primary roots and tubers consumed. The intake of animal protein was predominantly sourced from meat (Olatona *et al*., 2021).

In a study Kenya, maize, which serves as the principal component of the staple diet, constitutes over 60% of the total caloric intake from staple foods and 36% of the overall caloric consumption, with individual ingesting on average 88 kilograms of maize annually (Mohajan, 2014). Furthermore, an investigation among both pastoralist and non-pastoralist women revealed forty distinct food items. Nevertheless, of these items, only seven were consumed by at least 50% of women across both demographic zones. The investigation identified a notably stumpy consumption rate of various food items, such as meat, vegetables, milk, and fruits (Olimba, 2018).

In Egypt, a study which analysed the daily dietary patterns of women concerning the intake of essential nutrients during gestation revealed that over half of the respondents did not alter their dietary habits during this period. Additionally, over half of the women consumed only 1–2 servings of vegetables and fruits daily (53.0% and 51.1%, respectively). Moreover, approximately one-fifth of the pregnant women consistently consumed breakfast and lunch (21.5% and 22.2%, respectively), while over three-quarters (79.3%) occasionally partook in dinner. Nearly half (47.4%) sometimes consumed fast food (Osman et al., 2022). The remainder reported consuming two meals (26.9%) or more than three meals (7.0%) daily (Osman *et al*., 2022).

A study in Ethiopia confirmed that 29.46% of expectant women had high MDD-W, 37.5% had high FCS, and 24.78% consumed food from animal sources. A minority reported appropriate dietary practices. When considering the consumption of various food groups, it was observed that cereals constituted 100% of the women's diet, followed by other vitamin A-rich fruits and vegetables at 96.43%, and pulses and nuts at 53.35%. The fruits consumption was less, accounting for only 1.7%. This limited variety in the diet may be accounted for cultural factors and the limited availability of diverse food options during the survey period (Fite *et al*., 2022).

Loo *et al*., (2022) conducted a research study focusing on the prevalence of maternal meal skipping and meal delaying, along with the corresponding lifestyle patterns observed during pregnancy. The participants were women in their second trimester of pregnancy recruited from the ANC clinics at a Hospital in Singapore between 2019 and 2020. The findings revealed that 35.6% of participants, or 32 women, experienced irregular meal patterns, with 27.8% reporting meal skipping and 28.9% reporting meal

delays at least three times per week. The study identified that women exhibiting sleep and emotional problems had increased likelihoods of both meal skipping and meal delaying. However, patterns such as 'sedentary' (marked by extended daily screen time) and 'weight and inactivity' (linked to higher body mass index (BMI) and lower physical activity levels) did not show significant associations with meal regularity. The research highlighted that around 30% of pregnant women experienced meal irregularities, with sleep and emotional problems being specifically linked to higher rates of meal skipping and delaying.

A study in Ethiopia which aimed at evaluating the food consumption and related factors of pregnant women receiving ANC revealed that out of the 422 participants, 1.9% had poor food consumption scores, 16.6% had borderline scores, while 81.5% had acceptable scores. Factors such as residence (rural or urban), religious affiliation (specifically being Orthodox) were found to be associated with FCS. The study's findings suggest that the FCS among pregnant women is predominantly deemed unacceptable (Ambaw *et al*., 2021).

In a study in Tamale Metropolis of Ghana, it was shown that about 53% of respondents reported eating three meals per day, while 26.9% consumed two meals, and 7.0% ate more than three meals daily. Most adolescents consistently consumed dinner (57.7%), followed by lunch (38.6%), and breakfast (31.1%) in week. Approximately 12% of adolescents reported frequently skipping meals, while 12.2% indicated that they never skipped any. Breakfast was identified as the most commonly skipped meal (66.3%), whereas supper was the least frequently omitted (10.8%) (Abdulai *et al*., 2023).

Another study in Winneba, Ghana, indicated that, despite moderate consumption of fish, meat, eggs, and dairy products, along with legumes and nuts, students exhibited a less consumption of fruits and vegetables, coupled with high consumption of energy-dense and fast foods, including cakes and pastries among others. Additionally, it was ascertained that a significant number frequently skipped meals, particularly breakfast (Oti & Eshun, 2020).

2.2.3 Dietary Diversity during Pregnancy

Gyimah et al. (2021) contend that insufficient nutrition during gestation can precipitate detrimental birth outcomes, particularly for pregnant adolescents who necessitate adequate nutrients to fulfil their developmental requirements and those of the fetus. Dietary diversity is conceptualised as the variety of distinct food groups or items consumed within a specified timeframe (Weerasekara et al., 2020). Dietary diversity serves as a crucial metric for sustainable diets and has been empirically demonstrated to enhance N-Status (Weerasekara *et al*., 2020). Various methodologies have been employed to estimate dietary diversity within both research and programmatic frameworks. Nonetheless, in contexts characterised by limited resources, a select number of straightforward indicators reflecting food group varieties have been encouraged for extensive application. These indicators encompass the Household Dietary Diversity Score, the MDDS, and the Women's Dietary Diversity Score (FAO, 2024). Different recall reference time frames, such as 24 hours, 3 or 7 days, and a month have been used to estimate dietary diversity. The 24-hour recall period is preferred by FAO for its reduced vulnerability to recall bias, reduced burden on the respondent, ease of data analysis, and alignment with the recall period used in several studies.

Women residing in resource-poor nations are more prone to experiencing insufficiency in their dietary intake during the onset of pregnancy. This is attributed to the presence of nutrient deficiencies, inadequate consumption of food items rich in micronutrients, and poor nutrient absorption. Furthermore, the prevalence of frequent infections, adolescent pregnancy, high fertility rates, and short gaps between pregnancies contribute to the heightened vulnerability faced by these women. It is worth noting that socio-demographic attributes, economic profiles, physical well-being, family income, food security, knowledge adequacy, attendance of antenatal care visits, as well as distinctive cultural norms and taboos exert considerable influence on maternal dietary behaviours. In rural regions of India, women exhibit less MDD-W as compared to the rest of their family members, as highlighted by Gupta *et al*. (2020).

A study in Tanzania reports that higher MDDS was connected with reduced likelihood of small for gestational age (SGA) (Madzorera *et al*. 2020). In Ethiopia, a study demonstrated that pregnant woman's age, husband's age and nutrition knowledge were associated with MDD-W (Tilahun & Kebede (2021). A study by Quansah and Boateng (2020) in Ghana establishes that a diminished MDDS during gestation is significantly correlated with an elevated likelihood of infant LBW, while dietary choices regarded as "healthy" and "traditional" were found to be associated with a decreased probability of LBW in infants. This study posits that enhanced MDD-W, alongside "healthy" and "traditional" dietary patterns during gestation, may confer a protective effect against LBW. It has been identified that hunger status, food aversion, and socioeconomic poverty significantly influence the MDD-W of pregnant adolescents (Gyimah *et al*., 2021). Studies have also indicated that pregnant

adolescents experiencing severe hunger are significantly more likely to have inadequate MDD-W as opposed to their peers who do not face hunger (Gyimah *et al*., 2021).

2.2.4 Essential Nutrients Requirement during Pregnancy

2.2.4.1 Protein

Protein plays a crucial role in both structural and biological processes in the course of pregnancy (Murphy *et al*., 2021). The RDA for protein intake during the initial trimester of pregnancy is approximated at 46 g/day (0.8 g/kg body weight/day), whereas in the second and third trimesters, it is set at 71 g/day (1.1 g/kg body weight/day) (Murphy *et al*., 2021). A review by Herring *et al*. (2018) found that insufficient protein intake results in the greatest abdominal adiposity in foetuses and increases neonatal mortality. A study by Yang *et al*. (2022) demonstrated that increase in energy from total protein from all sources is associated with HBW. Also, increase in energy from total protein, lowers the risks of LBW, SGA and IUGR.

2.2.4.2 Vitamin D (VD)

Research has shown that VD levels tend to increase with gestational age in pregnant women, and maintaining high levels of this vitamin in pregnancy is considered effective in lowering the risk of its deficiency (Shen, 2020). In a comprehensive review of thirteen systematic reviews, Bialy et al. (2020) identified links between maternal VD status and adverse outcomes such as pre-eclampsia, PTB, gestational diabetes mellitus (GDM), and SGA infants. Similarly, a study by Chen *et al*. (2021) found that lower VD levels in pregnancy were associated with increased rates of abortion and SGA, with abortion and SGA being notably higher in the group classified as “VD deficient” compared to other cohorts.

2.2.4.3 Vitamin E

Vitamin E is a fat-soluble vitamin and has numerous benefits including fertility, anti-oxidation, anti-aging, and improving immunity (Lee & Han, 2018). Vitamin E is closely linked to abnormal lipid metabolism, oxidative stress, pre-eclampsia, and other unfavourable outcomes in pregnancy (Chen *et al*., 2020). Vitamin E deficiency can lead to aging of the placenta, elevated risk of pre-eclampsia, foetal distress, and premature rupture of foetal membranes (Wang *et al*., 2023). A global systematic review conducted by Wang et al. (2023) found that maternal vitamin E levels were significantly lower in women who experienced adverse pregnancy outcomes compared to those with favourable outcomes.

2.2.4.4 Vitamin A

Vitamin A insufficiency in gestation compromises the immune system and has been found to be linked to poor vision in the night (Daltveit *et al*., 2004), in addition to increased rates of IUGR and premature delivery. A study in Brazil revealed that vitamin A deficiency was positively linked to a high risk of maternal anaemia and negatively associated with both maternal and newborn weight (Neves *et al*., 2020).

2.2.4.5 Folate

Folate is critical in pregnancy as both maternal and foetal development rely on a sufficient supply of folate (Ayaz *et al*., 2020). A deficit of folate at the time of conception has also been linked to neural tube defects such as spina bifida and other related conditions (Oliveira *et al*., 2022). The RDA for folate increases in the course of pregnancy to 600 µg daily. Prenatal MVMS may help fulfil this requirement, especially for women with a history of insufficient folate intake, multiple gestations,

or folate-related anemia (Shatwan & Almoraie, 2022). A study of pregnant women attending a specialised hospital revealed that lower folate levels were associated with an increased risk of intrahepatic cholestasis of pregnancy and pre-eclampsia, but a reduced risk of GDM (Yuan, 2022).

2.2.4.6. Iron

During the final two trimesters of pregnancy, women require an additional 30 mg of iron daily to sustain the increased production of haemoglobin (Hb) and to build iron reserves for the developing fetus (Doyle *et al*., 2017). Since iron supplements may reduce appetite and lead to side effects including constipation, it is advisable to take them between meals or before bedtime (Pundir *et al*., 2021). A systematic review revealed that iron supplementation in pregnancy improved maternal anaemia, marginally reduced in the risk of LBW, and PTB (Keats *et al*., 2021). Another systematic review in Africa involving 10 studies revealed that persistent iron-only supplementation during pregnancy reduces perinatal death (Bekele *et al*., 2024).

2.2.4.7 Calcium

The importance of calcium supplementation during pregnancy is well supported, with strong evidence from several systematic reviews indicating that it plays a crucial role in lowering the risk of hypertensive disorders, especially preeclampsia and eclampsia (Hofmeyr *et al*., 2019). A recent randomised controlled trial found that calcium supplementation of 500 mg daily was linked with the reduction of maternal blood pressure, pre-eclampsia, PTB, and LBW and admission to neonatal intensive care unit especially in a low dietary calcium intake mother (Jasim & Sadiq, 2022).

2.2.4.8 Zinc

During gestation, zinc performs a critical function in maternal well-being and foetal development; the requirement for zinc in relation to foetal growth and functionality escalates throughout the third trimester, potentially resulting in diminished zinc levels in maternal serum when juxtaposed with healthy non-pregnant women (Jin, Hu & Zheng, 2022). Significantly reduced zinc levels may precipitate a range of dysfunctions within biological processes and elevate the risk of feto-maternal complications, including GDM, PTB, pre-labour rupture of membranes, PTB, and LBW (Jin, Hu & Zheng, 2022). An umbrella review comprising meta-analyses of 15 studies showed that zinc supplementation mitigates the risk of PTB. The review further identified a substantial connection between inadequate zinc levels and the likelihood of pregnancy-related complications (Iqbal & Ali, 2021).

2.2.4.9 Fatty Acids

Fatty acids such as omega-3 and 6 of critical importance for health and development of humans. However, they cannot be produced endogenously by the human body and must therefore be obtained through dietary sources. These essential fatty acids perform a crucial function in foetal development, particularly in membrane formation and brain development. Despite their importance, they have historically received limited scholarly attention. Emerging evidence suggests that increased intake of omega-3 fatty acids in the course of pregnancy may be associated with prolonged gestational duration and potentially improved foetal growth (Wang et al., 2021). A systematic review by Abdelrahman et al. (2023), involving 59 randomised control trials reports that fatty acids provided a protective effect against pre-eclampsia. Their intake was significantly associated with longer gestational duration, a reduction in PTB and an HBW. Additionally, an umbrella review concluded that omega-3

supplementation in the course of pregnancy may have beneficial effects including reduced risk of pre-eclampsia, LBW, PTB, and postpartum depression. The review also noted improvements in infant anthropometric and immune parameters, visual acuity, and cardiometabolic outcomes in pregnant women (Firouzabadi *et al*., 2022).

2.2.4.10 Water

The National Research Council of the USA recommends a general daily intake of total water including water from all dietary sources of 2.7 litres for women and 3.7 litres for men. Pregnant women require additional fluid intake to maintain proper hydration. The Institute of Medicine specifically advises an average daily water consumption of 2.2 and 3.0 litres respectively for women and men. For pregnant women, a daily intake of 2.4 litres (approximately 9 cups) is recommended (Sharifan *et al*., 2021). A recent global systematic review of six studies by Rosemiarti *et al*. (2023) demonstrated that a direct correlation exists between higher water intake, better hydration, and HBW.

2.2.5 Importance of Nutrition in Major Stages of Pregnancy

During pregnancy, additional nutrients and energy are essential for foetal development, and to strengthen the physiological alterations occurring in the mother's body to house the growing foetus. Nutritional deficiencies during the first trimester can disrupt or impair developmental processes, potentially leading to long-term consequences (Qiu *et al*., 2020). At this early stage, the foetus develops rapidly, and the absence of a critical nutrient may cause adverse effects even before the mother shows any symptoms of deficiency. Therefore, it is pertinent for pregnant women to consume nutrient-dense foods, even if their overall energy intake remains similar to that before conception (Flaherty *et al*., 2021).

During the second trimester, nutritional inadequacies are likely to impact the mother more significantly than the foetus. For example, if a woman's nutritional needs are not adequately met during this period, her capacity to breastfeed effectively may be compromised, as the fat accumulated throughout pregnancy functions as an energy reserve for lactation (Shatwan & Almoraie, 2022). In the third trimester, the foetus displays parasitic behaviour in relation to the mother's iron reserves, leading to a depletion of maternal iron stores. Consequently, if the mother does not meet her iron requirements during this period, she may experience substantial iron deficiency after delivery (Khumros et al., 2019). To address increased nutritional requirements and to promote the health of both the mother and the infant, multivitamin and mineral supplements (MVMS) are routinely prescribed to pregnant women during their initial ANC visit (Khumros et al., 2019).

2.2.6 Socio-economic Factors and Pregnancy

Socio-demographic statuses reflect an individual's demographic and social roles and accomplishments within a given population, as discussed by Abdullahi (2020). These statuses encompass a collection of socio-demographic variables, including socioeconomic status (SES) which is commonly gauged by factors such as levels of education, income and occupation status as highlighted by Vo *et al.* (2023). Social determinants of health pertain to the social environment in which individuals are born, grow, work, reside, and age, exerting an influence on health outcomes. These determinants encompass various aspects such as income, education, employment status, housing conditions, and access to basic amenities, as outlined by the WHO in 2020.

From a broader perspective, poverty exhibits a strong correlation with growth impairments during both the foetal and postnatal stages, particularly evident in elevated rates of stunting and wasting among women with lower SES in underprivileged communities, as observed by Dhaded *et al*. (2020). The onset of growth and development deficiencies typically initiates during the prenatal phase and may endure throughout an individual's entire lifespan, as noted by Ngandu *et al*. (2020). The repercussions of growth impairments during the foetal period underscore the necessity to scrutinise the environmental conditions in which expectant women operate, as emphasised by Dhaded *et al*. (2020). Factors such as maternal age (either young or advanced), lower levels of maternal education, and maternal employment status are recognised socio-demographic determinants that perform a pivotal function in the occurrence of adverse birth outcomes, as indicated by Jordaan *et al*. (2024).

A number of studies have also identified socio-demographic variables that are linked with the decision to terminate pregnancies in developing nations. These factors encompass the age of the women, their marital, educational, and employment status, as well as the parity (Armah-Mensah & Armah-Mensah, 2024). It has been highlighted by Dankwah *et al*. (2018) that women who are in employment, living together with a partner, possessing intermediate levels of education, and falling into the middle-class or wealthy category are more inclined to report instances of terminating a pregnancy as oposed to their counterparts. Moreover, according to Ahinkorah *et al*. (2021), the socio-demographic determinants influencing abortion among young women include age, level of educational, marital status, and access to electronic media, parity, as well as the literacy level within their community.

The findings from these studies underscore the intricate interplay of various socio-demographic variables in shaping the decision-making process regarding pregnancy among women in developing countries, thereby emphasising the need for targeted interventions and support programmes aimed at addressing these multifaceted determinants comprehensively. Furthermore, the identification of specific socio-demographic factors associated with pregnancy can aid policymakers and healthcare providers in formulating more tailored and effective strategies to meet the needs and reduce the barriers faced by women in these settings. Considering the nuanced nature of these socio-demographic determinants, a holistic approach that considers the interconnections between various factors are essential for promoting women's reproductive health and well-being in developing countries.

2.2.7 Nutritional Status of Pregnant Women

A study among pregnant women in Ethiopia found that 13.9% were undernourished. It was also highlighted that household wealth, decision-making autonomy, and access to nutritional counselling were independently linked to their N-Status. (Wakwoya *et al*., 2022). In the Ashanti Region of Ghana, a study among pregnant adolescents showed that most participants consumed less than the RDA for thiamine, riboflavin, folate, vitamin A, iron, zinc, and calcium. Furthermore, intakes of energy, protein, and dietary fibre were below the RDA. Anaemia and wasting were prevalent in most of the adolescents, respectively. Mean carbohydrate intake and dietary fibre intake were significantly higher among those who delivered at term as opposed to those who experienced PTB. In a study involving pregnant women in the Northern Region of Ghana, it was found that prevalence of maternal underweight was 26%. It was also reported that food insecurity and not MDD-W was associated with maternal N-Status during pregnancy (Saaka *et al*., 2021).

An exploratory study among mothers in Columbia reported that most participants were well nourished. A minority of them were found to be undernourished (Kpewou, 2020). In India, pregnant women who have no obstetrical and medical complications known to affect foetal growth were followed from 20 to 24 weeks' gestation until delivery. It was revealed that their mid – upper arm circumference (MUAC) ranged from 16 to 35.5 cm and 27.3% were wasted when MUAC of < 22 cm was considered. As for Hb status, only 23.2 % had Hb concentration in excess of 11 g/dl. About 55.3 % had mild anaemia, 18.4 % had moderate, and 3.2% had the severe form (Vasundhara *et al*., 2020). An Indonesian study showed that most of the expectant mothers had MUAC ≥23.5 cm whereas 17.3% of respondents' had MUAC < 23.5 cm (Indriyani *et al*., 2023).

In Kenya, a descriptive cross-sectional study found that 62% of pregnant women had normal N-Status (22.8–30.7 cm), 27% were obese (>30 cm), and 11% were underweight (<22 cm) (Maloba, 2022). A cross-sectional survey among pregnant women attending ANC at health facilities in Kwabre East Municipality in Ghana showed that 11.4% of participants were anaemic. Over half of the women had anaemia with red blood cells of normal size and colour, while over a third had anaemia with smaller and paler red blood cells. Iron deficiency was found in a minority of participants. Predictors of anaemia included iron sulphate intake, ANC follow-up, household size of ≥5, folic acid intake, and pregnancy stage. The study's conclusion suggests that although anaemia prevalence is low in urban areas compared to previous reports, collaborative healthcare efforts to eliminate this issue are recommended (Akowuah *et al*., 2022).

Kofie *et al*. (2019) carried out a descriptive study to investigate the prevalence and related risk factors of anaemia in women who were receiving antenatal and postnatal care at the Hohoe Municipal Hospital. The results revealed anaemia rates of 33% among pregnant women and 16% among postpartum mothers. Pregnant women had a higher occurrence of malaria parasitaemia (2%) compared to postpartum mothers (1%). Additionally, 4% of postpartum mothers experienced abnormal blood loss, while 5% suffered from postpartum haemorrhage during childbirth. The study also indicated that only the age of the mothers was statistically significant among postpartum mothers, with those aged 20-29 being 73% less likely to have anaemia.

2.2.7.1 Clinical Evaluation of Nutritional Status (N-Status)

The clinical evaluation of N-Status entails assessing a person's health by reviewing their medical history and performing a physical examination. This process aims to detect indicators, both observed by healthcare professionals (signs) and reported by the patient (symptoms), that may be linked to malnutrition (Ekmay & Herman, 2016). During this evaluation, focus is placed on identifying physical signs and symptoms that could point to specific nutrient deficiencies. Clinical approaches to assessing nutrition involve inspecting these areas for visible signs of deficiencies or asking the patient about any experiences or discomforts that may suggest a lack of essential nutrients (Calabrese *et al*., 2022). Additionally, vital signs such as blood pressure, body temperature, respiratory rate, and pulse can be assessed to determine the N-Status of individuals (Kesari & Noel, 2022). Hypothermia can be associated with conditions that impair N-Status, and abnormal respiratory rate and patterns can also be evaluated to determine N-Status (Kesari & Noel, 2022).

2.2.7.2 Anthropometric Measurements of N-Status

Anthropometric assessments are simple and numerical assessments of the human body. According to the Centres for Disease Control and Prevention, these measurements serve as important indicators of N-Status in both adults and children (Fryar *et al*., 2016). In paediatric populations, anthropometry is commonly used to assess overall health, nutritional adequacy, and growth and development patterns (Gavriilidou *et al*., 2015). Among adults, such body measurements are useful for evaluating nutritional and health status, as well as estimating the risk of future health conditions. Furthermore, these assessments can aid in evaluating body composition, identification of N-Status and diagnosis of obesity among adults (Gavriilidou, *et al*., 2015).

The fundamental components of anthropometry encompass stature, body weight, cranial circumference, BMI, MUAC, and skinfold thickness. In accordance with the guidelines provided by the American Academy of Paediatrics, precise sequential anthropometric estimations contribute to the identification of underlying medical, nutritional, or social issues. The crucial anthropometric elements consist of height, weight, cranial circumference, BMI, body circumferences (waist, hip, and limbs) for adiposity assessment, and skinfold thickness. Of these, the weight of an individual constitutes the most significant anthropometric measurement that can be obtained. During pregnancy, weight measurements assume great importance as they ensure the well-being of the mother. It is ideal to conduct weight measurements with the individual wearing minimal clothing and without footwear. The use of balance scales is customary. The employment of a reliable scale holds utmost significance in achieving accurate measurements (Oliveira *et al*., 2022). Most often, anthropometric

assessments serve to evaluate N-Status of expectant women with obesity (Ververs *et al*., 2013).

Additionally, anthropometric measurements also enable the assessment of body composition in athletes, thereby optimising their competitive performance and aiding in the recognition of medical issues, such as eating disorders. They are also employed to measure body composition in athletes and to evaluate medical problems, including eating disorders.

2.2.7.3 Laboratory Evaluation of Nutritional Status

The laboratory assessment of N-Status encompasses routine clinical tests that aid in the comprehensive evaluation of the patient's nutritional well-being (Truijen, 2021). Such tests comprise serum electrolytes, blood urea nitrogen, creatinine, blood glucose levels, lipid profile, liver enzymes, and complete blood count. In individuals affected by malnutrition, abnormalities in serum electrolyte levels and hydration status are often observed. Blood urea nitrogen and serum creatinine are commonly used to assess nitrogen balance and kidney function, and both tend to be lower in malnourished patients. A decrease in serum creatinine may also reflect a reduction in muscle mass. However, both BUN and creatinine levels can be influenced by hydration status and renal function. Laboratory tests often reveal low cholesterol levels in undernourished individuals, while decreased Hb levels are suggestive of anaemia (Gerriets & MacIver, 2014).

Levels of visceral proteins can serve as valuable indicators for evaluating a person’s nutritional standing using the laboratory testing method. However, it is important to note that these tests alone lack specificity in detecting malnutrition and are susceptible to the impact of various factors (Bharadwaj *et al*., 2016). Additionally, the assessment

of micronutrient levels can provide insight into N-Status of an individual (Kesari & Noel, 2022). The measurement of essential vitamins can be utilised to ascertain the N-Status of an individual. Furthermore, more targeted tests, such as the Schilling test for VB12 deficiency can be conducted using clinical presentation (Kesari & Noel, 2022). Alternatively, non-nutrition-specific markers, like C-reactive protein, can also be employed to ascertain inflammation (Bharadwaj *et al*., 2016).

2.2.7.4 Dietary Assessment of N-Status

The evaluation of N-Status through dietary methods involves the examination of past or current nutrient intakes from food among individuals or groups to determine their N-Status. This form of assessment is critical in ensuring that individuals receive adequate nutrition and hydration (Kesari & Noel, 2022). To conduct a dietary assessment, a qualified nutritionist gathers information regarding dietary habits, meal frequencies, serving sizes, and current food and fluid intake from sources including medical records, family members, patients, caregivers (Kesari & Noel, 2022). A range of methods, including the 24-hour recall method, food frequency questionnaire, diet charts, observation, wearable monitoring devices, and phone apps among others are employed in the dietary assessment of nutrition (Reber *et al*., 2019). From the aforementioned information, it becomes evident that various methods exist for assessing the N-Status of individuals. However, this study opted for the MUAC method of assessment for its ease of application, cost-effectiveness, and non-invasive approach, making it a practical and reliable tool for evaluating N-Status (Nyakotey *et al*., 2022), alongside Hb measurement, which falls under laboratory-based nutritional assessments.

2.2.8 Causes of Poor N-Status among Pregnant Women

At every stage of life, malnutrition in women results from poor diets, limited access to essential services, inadequate health and nutrition practices, and a lack of supportive conditions in their environment (UNICEF, 2021). Several factors limit pregnant women's access to adequate and safe foods, as well as nutrition services, including the low availability and accessibility of such foods, limited access to nutrition services for women, low awareness of the significance of nutrition care, and the influence of detrimental gender-based socio-cultural practices (UNICEF, 2021). Inadequate maternal diets serve as a noteworthy health risk factor during pregnancy and can lead to unfavourable pregnancy outcomes (Raghavan, 2019; UNICEF, 2021).

Across different countries, women's diets lack diversity and have limited consumption of fruits, dairy, meat, and vegetables. As a result, micronutrient insufficiencies occur due to the disparity between the daily nutrient requirements and the actual intake of high-quality nutrients (Balk *et al.*, 2017; Gernand *et al.*, 2016). The inadequate provision of nutrition services in the course of pregnancy is also affected by women's limited use of essential services, including healthcare, water and sanitation, and available social protection schemes (UNICEF, 2021). Inadequate access to these essential services can elevate the likelihood of infections and illnesses, which may negatively impact the well-being of both mothers and their children. Moreover, despite being a key component of maternal healthcare, quality nutrition counselling remains inaccessible to many women (UNICEF).

Weak enabling environment stands as a significant underlying factor contributing to the inadequate N-Status experienced by pregnant women. Despite the existence of substantial evidence and global recommendations aimed at supporting the nutritional

well-being of women, there exist obstacles in effectively translating these recommendations into policies and programs that yield desirable outcomes (WHO, 2018b). There is broad consensus that the N-Status of expectant mothers is intricately connected to the growth and development of their children during the initial 1,000 days of life. Regrettably, only a limited number of countries possess the necessary policies and guidelines that outline the requisite components and strategies for achieving healthy diets for pregnant women (UNICEF, 2020). The lack of regulations concerning food marketing potentially facilitates accessibility to unhealthy food products, snacks, and beverages, thereby contributing to suboptimal dietary practices (UNICEF, 2021). Furthermore, the lack of dedicated food-based dietary guidelines that address women's specific nutritional needs throughout their lifespan limits the information disseminated to women and the structure of nutrition programmes designed specifically for their benefit (UNICEF, 2021). Furthermore, many countries lack nutrition-sensitive social protection programs that would otherwise aid in meeting the nutritional requirements of women in general and other vulnerable populations (UNICEF).

More so, the issue of malnutrition in pregnant women can be traced back to inadequate care practices at the personal, family, and community levels. These confluence of variables significantly influences the capacity of women to make appropriate choices regarding their nutrition (UNICEF, 2021). The knowledge, values, beliefs, apprehensions surrounding pregnancy, lack of familial support, and the complexities surrounding the sharing of food within the household all exert an influence on their dietary and care-seeking behaviours and choices of women (Schmied, 2020; Siekmans *et al*., 2018). On a broader community scale, detrimental cultural practices relating to pregnancy, gender norms, and income disparities all have

the potential to restrict women's access to resources thereby shaping gendered practices concerning the type, timing, and quantity of food consumed by women (UNICEF, 2021).

2.2.9 Consequences of Poor N-Status in Pregnant Women

All types of malnutrition in women have serious implications for their health, well-being, and ability to participate fully in society (UNICEF, 2021). Women who are malnourished prior to pregnancy are at greater risk of complications including pregnancy induced diabetes and hypertension and the need for caesarean delivery, as well as experiencing unfavourable outcomes related to both pregnancy and breastfeeding (Dean *et al*., 2014). During pregnancy, gestational weight gain that falls outside the recommended guidelines heighten the likelihood of unfavourable outcomes for both mother and baby, including small or large-for-gestational-age births, PTB, and caesarean section. It may also contribute to weight gain after birth (Voerman et al., 2019). Anaemia in pregnancy, largely caused by nutritional deficiencies, is linked to increased morbidity, mortality, and poor birth outcomes (Rahman, 2016).

Pregnant women who suffer from anaemia during the last trimester may subsequently experience anaemia in the after delivery, particularly if they undergo excessive blood loss in the course of childbirth or if they have multiple births (UNICEF, 2021). Inadequate nutrition in pregnancy can culminate in stunting, wasting, and shortages of essential micronutrients in infants, placing them at risk of potential long-term negative consequences. These consequences can range from inadequate growth, development, and early childhood learning preparedness to the development of chronic diseases in adulthood (Li et al., 2020).

Pregnant women who are affected by overweight face an increased likelihood of experiencing adverse outcomes. Furthermore, their children are at a greater risk of overweight, obesity, as well as cognitive developmental challenges that may continue through to adulthood (Voerman, 2019). Deficiencies in essential vitamins and minerals in the course of pregnancy are also associated with unfavourable health outcomes. These outcomes include miscarriage, stillbirths, congenital defects, LBW, infant mortality, impaired cognitive development, and increased cardio-metabolic risks in adulthood (Gernand *et al*. 2016). Pregnant adolescents who are overweight have an elevated likelihood of experiencing GDM, pre-eclampsia, and delivering by caesarean section as opposed to those within the normal weight range (UNICEF, 2021).

2.2.10 Strategies for Improving Maternal N-Status

Numerous measures can be employed to address the issue of nutrition among pregnant women. These measures encompass strategies such as food and bio fortification and, MVMS along with enhanced education and improved SES for women. Additionally, nutrition education and counselling represent an additional approach that is also recommended by the WHO (WHO, 2016). A study conducted to analyse the influence of nutrition supplementation, disease prevention, education, and promotion of hand hygiene found that these interventions have the potential to reduce IUGR and micronutrient deficiencies by approximately 25%. Thus, it was demonstrated that micronutrients have the capacity to mitigate the likelihood of LBW (Bhutta *et al*., 2008). Iron and folate acid are among the nutritional supplements that can be provided to pregnant mothers. Supplementation with IFA has been scientifically proven to increase Hb levels and decrease the likelihood of LBW

(Bhutta *et al*., 2008). Hambidge and Krebs (2018) contend that although iron and folic acid supplementation (IFAS) provides only modest benefits, these advantages are nonetheless meaningful.

A randomised controlled trial in India found that participants who received nutrition education exhibited behavioural changes compared to those in the comparison group. Participants in the experimental group adopted several positive practices, including consuming at least three meals per day (Daniel *et al*., 2016). Excess weight gain in the course of pregnancy is associated with heightened likelihood of unfavourable outcomes. However, this risk can be reduced through appropriate dietary changes and physical activity. Randomised controlled trials have explored the impact of such interventions, with findings indicating that women who received guidance on diet and exercise had a decreased likelihood to experience excess weight gain in the course pregnancy (WHO, 2016).

In Ghana, the national nutrition policy delineated a series of initiatives targeted at ameliorating the nutritional health of pregnant women (MoH, 2013). These initiatives encompass, firstly, comprehensive behaviour change communication strategies focusing on diversified diets, healthy food selections, and lifestyle modifications, which were executed as a fundamental component of nutrition services for women and adolescent girls. Secondly, antenatal care programs were instituted to assist pregnant women in achieving and sustaining an appropriate weight during the course of their pregnancy. Thirdly, interventions including family planning, safe motherhood practices, and the prevention and management of infections were implemented to foster optimal maternal nutritional well-being. Fourthly, support services encompassing weight management and dietary counselling were made available to aid

women in preserving ideal body weight. Lastly, pregnant and lactating women were administered IFAS within six weeks postpartum.

2.2.11 Factors that Influence Dietary Habits of Pregnant Women

Research has demonstrated that a wide range of factors influence and shape individuals' eating patterns. Dietary behaviours are not uniform; they vary significantly between communities, ethnic groups, and individuals. A number of explanations have been offered to account for people's food choices. These include cultural traditions, where specific eating practices are passed down through generations, as well as social influences, food availability, personal preferences, nutritional knowledge, media exposure, and advertising. Environmental factors such as climate and geography also shapes the formation of dietary habits.

When it comes to pregnant women, several determinants can influence their food choices. Cultural beliefs, in particular, have a strong impact. In some societies, specific foods are considered inappropriate during pregnancy due to longstanding taboos. For instance, certain groups may discourage the consumption of foods like rabbit meat, based on cultural prohibitions. Such restrictions can lead pregnant women to avoid specific food items, potentially compromising their nutritional intake (Mohamad & Ling, 2016). A Chinese study involving pregnant women highlighted a strong adherence to traditional dietary customs, including the avoidance of foods like rabbit meat (Gao *et al*., 2021). Similarly, research conducted in Khartoum found that pregnant women often avoided particular foods for reasons rooted in personal beliefs, social norms, and cultural taboos (Tahir et al., 2018).

Justifications for these dietary restrictions vary across cultures. In Tanzania, for example, a study focusing on pregnant Maasai women discovered that traditional

norms dictated both the type and amount of food consumed during pregnancy. Participants reported being advised not to eat excessively and to avoid items such as meat and beans, based on the belief that these could lead to having larger babies and thus complications during childbirth (Lennox *et al*., 2017). Unfortunately, such restrictions may deprive pregnant women of essential nutrients found in the prohibited foods. Additionally, food choices of pregnant women are also influenced by aversions, financial limitations, and the general supply of food within the household (Kavle & Landry, 2018).

Available evidence indicates that food cravings and aversions are commonly experienced by pregnant women and can significantly impact their dietary behaviours and N-Status (Salih *et al*., 2023). When faced with cravings, women often respond by consuming the desired items which are frequently nutrient-poor and high in sugar, salt, or spice. A study by Hainutdzinava *et al*. (2017) involving mothers in the United States found that most participants had food cravings. Despite this, a section of them were still able to meet their nutritional needs. In Fiji, research showed that participants who reported aversions to certain foods tended to crave alternatives that offered comparable nutritional benefits (McKerracher *et al*., 2016).

Additional factors such as nausea, vomiting, and reduced appetite—commonly experienced during pregnancy—can also interfere with regular eating patterns, leading some women to skip meals and consequently miss out on essential nutrients (Lennox *et al*., 2017; Tahir, 2018). Moreover, dietary behaviours in pregnancy are also influenced by women's personal attitudes and perceived social expectations (Luo *et al*., 2016).

Socio-demographic characteristics have strong link with food choices. Variables such as gender, age, income, household size, and educational attainment have all been shown to impact individual dietary patterns. For instance, a study in Mauritius found gender, age, education, and occupation as key determinants of dietary habits. Younger males (aged 21–40) consumed more meals outside the home, while older males (41–60) were more likely to eat oily foods (Krige *et al*., 2012). Age-related trends also suggest that younger individuals tend to consume more energy-dense, nutrient-poor foods, whereas older adults are more inclined to prioritise health in their food choices. A UK-based study conducted at Reading University revealed that individuals aged 60 and above made food choices primarily on health reasons, wheras to younger adults were less likely to factor health into their dietary decisions (Chambers *et al*., 2008).

In Ethiopia, a study by Tenaw *et al*. (2018) involving pregnant women found that household income, spouse's level of education, and occupation were positively linked to improved eating practices during pregnancy. The affordability and availability of food significantly shape dietary behaviours. Individuals from lower-income households tend to consume less healthy, unbalanced diets with lower intake of fruits and vegetables. This is primarily because energy-dense, low-nutrient foods are generally cheaper than healthier alternatives, making them more accessible to people from lower socio-economic backgrounds (Darmon & Drewnowski, 2015).

Nonetheless, it is significant to note that a higher SES does not always equate to healthier eating. A global analysis of dietary trends indicated that wealthier nations not only consumed more nutritious foods but also had higher intake levels of unhealthy food items (Imamura *et al*., 2015). Similarly, research by Fite *et al*. (2022) identified several factors influencing dietary practices among pregnant women. These

included the woman's occupation, her husband's education level, ANC attendance, perceived susceptibility and severity of malnutrition, perceived benefits of healthy nutrition, food aversions, dietary restrictions, and khat consumption. The study revealed that appropriate dietary practices were more common among women engaged in trade and those whose husbands had at least completed secondary education. Conversely, women who restricted their food intake or chewed khat during pregnancy were less inclined to adopt good dietary behaviours.

The outcomes of a study in Ghana by Appiah *et al*. (2021) demonstrates noteworthy links between favourable dietary practices and factors such as ethnicity, education, occupation, and prior pregnancy history. Furthermore, results supported the connection between ethnicity and dietary habits and revealed that Ga-Adangbes adolescents were more inclined to possess favourable eating habits compared to their counterparts who were Akan's, while Ewes adolescents and Northerners had reduced likelihood to possess favourable eating habits compared to their Akan's counterparts. Additionally, those who had basic and secondary education were less inclined to possess favourable eating habits as opposed to those received no formal education. Similarly, adolescents engaged in petty trading had a higher likelihood to possess favourable eating habits compared to those who pursued a career as a seamstress, while hairdressers had decreased likelihood to possess favourable eating habits compared to their seamstress counterparts. Furthermore, adolescents in their initial pregnancy had more likelihood to possess favourable eating habits compared to those who had a second pregnancy.

2.2.11.1 Influence of Socio-demographic Factors on N-Stratus

Numerous socio-demographic factors influence the N-Status of pregnant women. Factors including education, age, religion, parity, and income among others have been found to contribute to their N-Status. Women over the age of 30 are classified as being at risk due to a decline in their immune system, which increases the likelihood of various diseases occurring at this stage of life (Deswati *et al*., 2019). Research conducted in Ethiopia indicates that those who are elderly may experience complications during delivery and be more susceptible to anaemia-related diseases (Gudeta *et al*., 2019). Similarly, a study from Morocco suggests that anaemia in young women is impacted by factors such as primiparity and lack of previous childbirth experience (Ouzennou *et al*., 2019).

The risk of chronic energy deficiency (CED) is higher for expectant mothers with a parity of more than three (Syakur *et al*., 2020). Additionally, grand multiparity is linked with an elevated likelihood of pregnancy complications (Hikmah *et al*., 2020). High parity also diverts a woman's attention away from her own nutrition and health, as she focuses on caring for her children (Kumera *et al*., 2018). Furthermore, frequent childbirth can lead to iron deficiency and anaemia (Abrori *et al*., 2015). Subsequent pregnancies also carry an elevated risk of anaemia and haemorrhage if adequate nutrition is not prioritised (Subekti & Sulistyorini, 2018).

Hikmah *et al*. (2020) contends that a mother's level of education influences her capacity to comprehend and implement guidance by healthcare professionals, which in turn affects her attitude towards dietary choices. A pregnant woman's N-Status is largely determined by the quality of her diet, rather than just the quantity of food consumed (Wijanti *et al*., 2019). Another study highlights the importance of education

in relation to preventing CED in pregnant women (Syakur *et al*., 2020). Research conducted in Ethiopia found that women with lower levels of education are at higher risk of malnutrition as opposed to those with higher education levels who are more likely to access information sources that impact their food choices (Kumera *et al*., 2018). Additionally, pregnant women with only basic literacy skills had elevated likelihood to develop anaemia as opposed to those with a diploma or higher education (Gudeta *et al*., 2019).

According to the findings of a study, the N-Status of pregnant mothers was influenced by their financial situation. The study also established a relationship between financial status and income. The financial status as a determinant for the standard of living is required to afford healthy food (Ouzennou *et al*., 2019). Income is fundamental as it has a strong impact on pregnant mothers in a linear manner (Hamzah, 2017). To put it differently, families with low income are more susceptible to poor nutrition due to their inability to afford nutritious food (Derso *et al*., 2017). This statement is also supported by another study. Additionally, there is another statement regarding anaemia. Anaemia is not only experienced by poor families but also by wealthy families who fail to comply with the consumption of free iron tablets provided by medical officers. Therefore, pregnant mothers with poor financial status also consume these tablets (Afriyanti, 2020). The subsequent study conducted at the Leiling Public Health Centre revealed a correlation between house ownership and pregnant mothers. When the pregnant mother is not a homeowner, the family's income has to be shared to cover rental expenses (Karemoi et al., 2020).

The occupation of a pregnant mother determines whether they can generate their own income or not, as it depends on their husband's support. This financial independence

enables them to easily meet their nutritional needs (Musni *et al*., 2017). Occupation performs a significant function in affecting the N-Status, specifically anaemia, of pregnant women. The workload of pregnant women increases with their occupation, which in turn increases the likelihood of anaemia during pregnancy. However, if pregnant women are able to manage their workload effectively, being employed can also provide additional financial resources to fulfil their daily needs and assist their spouses (Afriyanti, 2020). Furthermore, participants residing in rural areas face a higher likelihood of suffering from malnutrition as opposed to those in urban areas. This is because rural areas often lack proper infrastructure and are heavily influenced by cultural and traditional agricultural practices (Kumera *et al*., 2018).

An investigation conducted by Rathod *et al*. (2019) involving pregnant women in Northern Maharashtra, India, revealed various significant factors associated with this problem. Their study observed that participants in rural areas, had been married for less than three years, and residing in joint families were more likely to experience undernutrition. Furthermore, not utilising family planning methods, having fewer antenatal care visits, and consuming a lower frequency of meals per day were also identified as contributing factors to undernutrition among pregnant women. These outcomes underscore the significance of addressing socio-demographic variables, healthcare utilisation, and dietary practices to augment the N-Status of pregnant women in the region. By specifically targeting these factors through tailored interventions and public health initiatives, it is possible to effectively tackle the challenge of inadequate nutrition among pregnant women (Rathod *et al*., 2019).

A descriptive study by Teja & Dewi (2022) on the factors impacting the N-Status of pregnant women amid the Covid-19 pandemic revealed significant associations

between education, income, knowledge, family support, and the N-Status. Conversely, age, parity, and occupation showed no correlation with the N-Status of participants in their third trimester.

A cross-sectional study by Armini *et al*. (2020) in Indonesia identified technological, sociocultural-economic, political, and legal factors as being linked to their N-Status. Cultural values emerged as the most influential factor affecting N-Status, while positive family support and understanding of political and legal matters were associated with improved N-Status. The study's conclusion highlighted the impact of various factors, including cultural values, family support, and knowledge of politics and laws, on pregnant women's nutritional well-being.

2.2.11.2 Influence of Nutritional Knowledge on N-Status

A study in Nigeria found no association between nutritional knowledge and the N-Status of respondents. The study concludes that the lack of a significant association may be attributed to other limiting factors that hinder the application of knowledge into practice such as income level, access to healthy food choices, and conflicting cultural norms (Olatona *et al*., 2023).

A cross-sectional study among non-academic staff members aged 18-59 years in Ghana found that 56% of the participants had good nutrition knowledge, and there was prevalence of overweight and obesity. However, no connection was identified between nutrition knowledge and overweight. The study highlights the need for promoting better nutrition and dietary behaviours among non-academic staff to improve their N-Status (Issahaku, & Alhassan, 2021).

A study by Siregar *et al.* (2020) involving students of Universitas Negeri Medan, revealed that nutrition knowledge influences N-Status. Also, an experimental study in Ethiopia involving pregnant women found that intensive nutrition education and counselling were effective in enhancing their N-Status (Wakwoya *et al.*, 2023). Another study in health facilities in Ethiopia found that good nutritional knowledge was significantly associated with inadequate nourishment. The study concludes that nutrition knowledge was an important risk factor of undernutrition (MUAC < 23 cm) (Muze *et al.*, 2020). In Kenya, a descriptive study of pregnant women receiving nutrition education while attending ANC found that nutrition knowledge was largely linked with N-Status of the participants (Maloba, 2022).

2.2.11.3 Influence of Dietary Habit on N-Status

A study in Saudi Arabia involving students found that factors such as high income, frequency of daily meals, breakfast consumption, restaurant dining, and the intake of soft drinks, sweets, and potato chips were associated with the N-Status of participants (Alshammari *et al.*, 2022). In Indonesia, a study by (Hikmah *et al.*, 2020) involving pregnant women showed that among others, there was a strong correlation of eating patterns and the presence of CED among pregnant women.

In Ethiopia, a study involving pregnant women determined the associated of dietary practice and N-Status. The community-based cross-sectional study involving 604 participants found that poor MDD-W and poor dietary practice were associated with poor nourishment among the study participants (Diddana, 2019). In another study in Ethiopia which used a facility-based cross-sectional design, a semi-structured questionnaire and 378 study participants, it was revealed that not taking additional meal and skipping meals were associated with undernutrition (Shemsu *et al.*, 2020).

In Ghana, the cross-sectional descriptive study by Oti and Eshun (2020) showed that all the dietary habits identified collectively impacted the N-Status of undergraduate students. In another study at a public university in Ghana involving non-academic staff members, Issahaku and Alhassan (2021) reported that a statistically significant association existed between MDD-W and N-Status.

2.3. Conceptual Framework of the Study

The UNICEF's conceptual model on MCN (UNICEF, 2020), the SEM (Bronfenbrenner, 1980) and findings from previous studies (Alshammari *et al*., 2022; Issahaku, & Alhassan, 2021; Olatona *et al*., 2023) served as foundations for the conceptual model for the study which is presented in Figure 3.

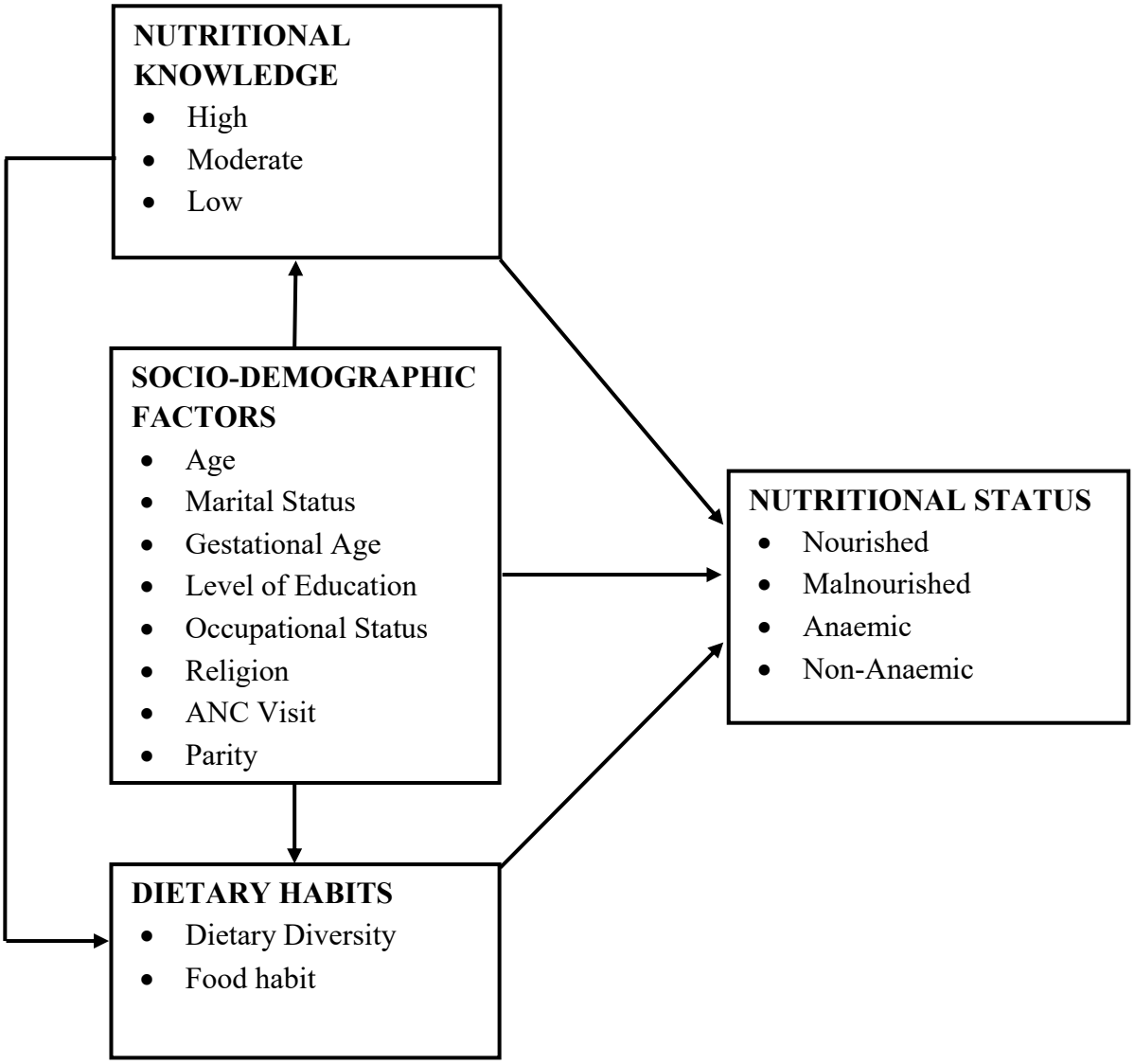

Figure 3: Conceptual Framework of the Study

In this framework, socio-demographic factors such as age, marital status, and gestational age**,** level of education**,** occupational status**,** religious affiliations, ANC visit and parity are seen as factors that may influence the level of nutritional knowledge, dietary habits and N-Status of pregnant women. For instance, a pregnant woman whose level of education is high would have a good level of nutritional knowledge, good dietary habit and a good N-Status. In addition, it is posited that a good level of nutritional knowledge can result in good dietary habits among pregnant

women. Furthermore, it is posited that dietary habit, and the level of nutritional knowledge can influence N-Status of pregnant women. For instance, a pregnant woman who has a good dietary habit would have a good N-Status. Also, a pregnant woman who has a high level of nutritional knowledge is likely to have an improved N-Status.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This study investigated the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women attending ANC in public health facilities in the Krowor Municipality. This section focuses on the methods that were employed to gather data for the study. It highlighted the research paradigm and approach, study design, area, population, and variables, sample and sampling techniques, research instruments, validity and reliability, data collection procedure, data analysis method and research ethics.

3.1 Research Paradigm

A research paradigm is "a set of common beliefs and consensus shared among scientists on how to understand and address problems" (Kuhn, 2018). This research is underpinned by the philosophy of positivism. Positivism is closely associated with the French philosopher Auguste Comte (Webster& Pring, 2018). In a study underpinned by a positivist philosophy, evidence gathered are used to either support or reject hypotheses formulated at the beginning of the study (Kuranchie, 2021). Positivists maintain that knowledge should be generated objectively, free from the influence of the values held by researchers or participants. To uphold this independence, they embrace the principles of dualism and objectivity (Park *et al*., 2020). Put simply, positivist thought assumes that researchers and participants can be distinctly separated (dualism). Central to this paradigm is the belief that quantitative methods, particularly the use of statistical inference to estimate the effects of an experiment, are essential to ensuring research rigor.

Positivist researchers empirically test ideas. They use quantitative techniques such as experiments, survey, correlational and causal comparative to undertake studies. In the quantitative approach, it's important to have enough participants so the results are reliable and any meaningful differences can be detected using the right statistical tests. Unlike some other research approaches, positivist studies rely heavily on statistics, so researchers need to plan carefully and decide in advance what size of effect they expect to find (Park *et al*., 2018). A key goal of positivist research is to identify and explain connections or cause-and-effect relationships, which can then help predict and manage the issues being studied. The researcher believes that adopting a positivist paradigm will help to objectively assess the factors influencing nutritional knowledge, dietary habit and N-Status of pregnant women.

3.2 Research Approach

This study adopted the quantitative research approach. The main aim of this approach was to provide explanations and predictions that could be applied to other people, situations, and locations (Taherdoost, 2022). The main advantage of this approach involves the possibilities of generalising results, sharing and replicating the methods and frameworks of the study over time (Taherdoost, 2022). The approach is also time efficient. However, one disadvantage of this approach is the limits of deep and in-detail explanation of situations (Taherdoost, 2022).

3.3 Research Design

A descriptive cross-sectional survey design involving pregnant women receiving ANC services in the two (2) main public health facilities, Clean Town Health Centre and LEKMA polyclinic of the Krowor Municipality was carried out during February 2023 to March 2024. Cross- sectional survey involves the observation of a sample or

a cross section of a population or issue that are done at one point in time (Babbie, 2010). This survey collects data only one point in time as it intends to describe situations but not to establish causal patterns. This design was chosen because it helps to gather data on pregnant women receiving ANC services at a point in time at the two main health facilities in the Krowor Municipality. The design enabled the researcher to collect and describe the N-Status of pregnant women receiving ANC services at the two main public health facilities in the Krowor Municipality.

3.4 Study Area

The study was conducted in the ANC unit of the two main public health facilities, Clean Town Health Centre and the LEKMA polyclinic both in the Krowor Municipality of the Greater Accra Region. Krowor is among the newly created municipalities in the region and lies on the coast between Tema West Municipality to the East and partly North-east to Ledzokuku Municipality. It was carved out of the former Ledzokuku Krowor Municipality in the year 2018 with Legislative instrument 2318 of 2017. According to the GSS 2021 general report on population and housing census, the municipality has a total population of 143,012 representing 2.6%. The female population of 72,277 which represent 50.5% whiles the male population is 70,735 which also represent 49.5%. The population density for the municipality is 9,183.4 (persons per square km). The area is 16 km2. The youth population in the area, defined as individuals aged 24 years and below, is estimated at 49.5%. Regarding religious affiliation, approximately 90% of the municipality's population identify as Christians, followed by 3% Muslims. About 1.15% adhere to other religions, while roughly 3.5% report having no religious affiliation. Sixty percent of the population are indigenes while the remainder are settlers. Now, there are seven health facilities made of three hospitals, one Polyclinic and four health centres. Crop

farming, livestock rearing, and fishing are the main agricultural activities in the municipality. Most of the municipality's inhabitants are in the middle-income bracket.

3.5 Population

The target population of the study consisted of all pregnant women attending ANC in the public health facilities in the Krowor municipality. The accessible population were pregnant women aged 20-45 years receiving ANC services at the Clean Town Health Centre and LEKMA Polyclinic respectively and had consented to participate in the study during the data collection period. The average monthly attendance for ANC services in February according to the ANC record books was estimated at 707 for LEKMA polyclinic and 50 for Clean Town Health Centre. Therefore, the total ANC attendance for both facilities was 757.

3.6 Eligibility Criteria

3.6.1 Inclusion Criteria

The study involved healthy pregnant women aged 20-45years, who were in any gestational age and had expressed willingness to deliver in the health facility and to participate in the study and who had been resident in the Krowor Municipality for a minimum of one year prior to the time of the study. One year was deemed adequate as it covered the whole food security cycle as they had experienced both bumper and lean harvesting seasons (dietary intake challenges) of the municipality.

3.6.2 Exclusion Criteria

Any woman who attended the health facilities for reasons other than antenatal care was excluded from this study. Also, pregnant women with a past medical history of complications, require specialist care or has recurrent miscarriages with known diseases such as HIV, diabetes type II, cardiovascular disease, confirmed malaria and

on regular medication were excluded. The reason is that such medical conditions have been confirmed to impact on food intake, the N-Status, and MDD-W and thus bias the results of the study.

3.7 Sample and Sampling Techniques

3.7.1 Sample size determination

The sample size was estimated using Yamane's (1967) formula, which is

$$n = \frac{N}{1 + N(e)^2},$$

Where:

n - The sample size,

N - Population size

e - Level of precision, sampling error or margin of error

Therefore, substituting the figures into the formula, we have:

$$n = \frac{757}{1+757(0.05)^2}$$

$$n = 265.9$$

n = 266

This total sample size of 266 was proportionally allocated to the two (2) health facilities based on the number of monthly attendances recorded. Ninety three percent (93%) of the total attendance of ANC came from LEKMA polyclinic and seven percent (7%) came from Clean Town Health Centre. Consequently 243 (93%) participants were recruited from LEKMA polyclinic and 19 (7%) from Clean Town Health Centre.

3.7.2 Sampling Technique / Procedure

The health facilities were purposefully chosen because they are the only government health facilities that provide ANC services in the municipality for the populace and, all social groups can attend the LEKMA polyclinic and the clean town health centre because they are free. In the same facilities, you can find wealthy women, average and poor. At each ANC clinic, eligible pregnant women were recruited using a systematic random sampling technique. The sampling interval was determined by dividing the average monthly attendance (757) by the sample size (266), as shown below:

$$Kth = \frac{\text{Average monthly attendance}}{\text{Required sample size}}$$

$$= \frac{757}{566}$$

$$= 2.8$$

Therefore, Kth=3

Based on this calculation, every third pregnant woman who arrived at the clinic was interviewed until the required sample size was reached. First, the lottery method was used to randomly select the initial participant. Thereafter, every third pregnant woman was chosen. If a selected participant did not meet the inclusion criteria, the next eligible individual was recruited.

3.8 Study Variables

The study had two main variables: independent and dependent variables. The independent variables were age, marital status, education level, religious group and occupation (socio-demographic factors), gestational age, parity, number of ANC follow up (obstetric factors), nutrition knowledge of food consumed and dietary habits. The dependent variable was N-Status.

3.9 Research Instrument

This study used a questionnaire to collect data. The instrument comprised of five sections A-F. Section A consisted of 13 questions related to socio-demographic, and obstetrics factors. Section B consisted of 14 knowledge indicators used to evaluate the expectant mothers' nutrition knowledge. Section C consisted of 5 questions that assessed the dietary habits. Section D assessed the dietary intake of expectant mothers' during pregnancy using dietary diversity questionnaire, MDD-W of reproductive age score and FCS. Finally, section E of the questionnaire assessed the nutrition status of pregnant women with anthropometric measurement (MUAC) and biochemical biomarker (Hb).

3.9.1 Assessment of Nutritional Knowledge

Women's nutritional related knowledge could impact their N-Status and pregnancy outcomes (Weerasekara *et al.* 2020). Nutritional knowledge was assessed using a binary response of 'Yes' or 'No' adopted from (Lim *et al*., 2018). A list of 14 questions on food sources, nutrients, health risks and nutrient deficiencies during pregnancy were asked. A correct answer attracted a score of one and a wrong answer attracted a score of zero. Respondent's level of nutritional knowledge was categorised based on Bloom's cut off categories of total knowledge score: 80%-100% = high level of knowledge, 60% - 79% = moderate level of knowledge and < 60 = low level of knowledge (Alzahrani *et al*., 2022).

3.9.2 Assessment of Dietary Habit

In the course of pregnancy, the body experiences increased metabolic and physiological demands that must be met through adequate nutrition. Poor dietary habits during this period can contribute significantly to undernutrition and

micronutrient deficiencies, resulting in poor maternal N-Status and unfavourable birth outcomes (Fite *et al.,* 2022). Dietary habit was assessed using five items. All the items were categorical and were measured on a nominal scale. Items covered were skipping of meals, meal frequency, and types of meals skipped.

3.9.3 Assessment of Dietary Diversity for Women

Available evidence indicates that the MDD-W score may serve as a surrogate indicator of the adequacy of micronutrient intake within the diets of WRA (Saaka et al., 2021). The MDDS was derived from a total of 10 food groups, which encompass grains, white roots, tubers, and plantains; pulses; nuts and seeds; dairy; meat, poultry, and fish; eggs; dark green leafy vegetables; as well as various vitamin-rich fruits and vegetables that are characterised by their nutrient density. The MDD-W was assessed utilising a 24-hour dietary recall methodology, adhering to the guidelines established for the estimation of the MDD-W indicator for WRA (FAO, 2016). Food groups that were consumed were assigned a score of '1', and those not consumed attracted a score of '0'. The aggregated score was classified to formulate a binary outcome variable: adequate dietary diversity (consumed $\geq$ 5 food groups) and inadequate dietary diversity (consumed $\leq$ 5 food groups).

3.9.5 Assessment of N-Status

Nutritional status was evaluated with the MUAC and Hb concentration level. The MUAC is a recognised technique to measure the N-Status of pregnant women (Al-Shammari *et al*., 2017). At each visit, MUAC was measured to assess wasting among the study subjects using a non-stretchable adult MUAC measuring tape. Measurements were recorded to the nearest 0.1 cm, with the left arm resting naturally

alongside the body. To obtain an approximation of the nutritional condition, the data for MUAC was evaluated. A threshold of < 23 cm, which is advised for most pregnant women who have a likelihood of having LBW babies in African settings, was selected (Ververs *et al*., 2013). Participants with MUAC < 23 cm were classified as malnourished, whereas those with MUAC ≥ 23 cm were classified as nourished.

Haemoglobin concentration level has been reported as a reliable measure of anaemia during pregnancy (Shi *et al*., 2022). The Hb concentration level of participants was recorded from each participant's maternal health record book (MHRB) or blood test report available with the participant at the time of the interview. Anaemia was defined as Hb <11.0 g/dL. The reference value of Hb was categorised based on the WHO classification; participants with Hb< 11 were classified as anaemic and those with Hb≥11 were classified as non-anaemic.

3.10 Sources of Data

Both primary and secondary data sources were used for the study. The primary data included Socio-demographic and general information that was collected using a questionnaire. Secondary data was sourced from the MHRB.

3.11 Validity and Reliability of Instrument

The research instrument was validated by the supervisor of the researcher prior to data collection to ascertain content and face validity. The questionnaire was also checked for proper construction and wording as well as ambiguity. To ensure reliability, the questionnaire was pre-tested at Korle-Bu Polyclinic ante-natal clinic unit. Korle-Bu Polyclinic was chosen as the site for the pilot testing because the facility provides similar health services as Clean Town Health Centre and LEKMA Polyclinic. The pilot -test was done on 5% (13) of the total sample size. Some questions were

modified based on comments from supervisor and remarks of the respondents. The pre-test made it possible for the researcher to construct a clear and understandable questionnaire.

3.12 Data Collection Procedures and Technique

The questionnaire was individually administered to each pregnant woman at any gestational age of pregnancy attending antenatal care services at the Clean Town Health Centre and LEKMA polyclinic in the Krowor Municipality. Respondents who could not read and write were guided by the researcher. The researcher read and explained to the respondent and ticked the appropriate multiple-choice option. The study also collected data on monthly iron levels from hospital records.

3.13 Data Analysis Method

Data analysis was preceded by data screening which was done in two phases. In phase one, each questionnaire was manually checked for errors and completeness. In the phase two, frequencies were run for each variable to identify missing values after the data had been coded and entered into Microsoft Excel 2020 and exported to the Statistical Package for Social Science (SPSS) Version 22.0 software. Missing categorical data were replaced with the median of the nearby points and missing quantitative date were replaced with the series mean. Normality of the data was performed with inspection of histogram and the normal curve as well as the Kolmogorov-Smirnov test. Outliers were identified by inspecting the box plot and transformed with the logarithmic method of transformation (Ofori & Dampson, 2011). Descriptive analysis was performed for all relevant variables. For socio-demographic characteristics relevant descriptive statistics such as frequency distribution tables and

percentages, bar and pie charts were used. For nutritional knowledge, dietary habit and N-Status, arithmetic mean, frequencies and percentages were used.

For inferential analysis, the influence of socio-demographic factors on nutritional knowledge, MDD-W, MUAC and anaemic status were analysed with the chi-square first. The variables that had significant association were further analysed with multivariate logistics regression on all independent variables. Also, MDD-W, nutritional knowledge, MUAC, dietary habits and number of ANC visits were regressed on N-Status. This is essential to achieve the goal of the study which is to investigate the factors that influence N-Status of pregnant women in the Krowor Municipality. A significance level of 0.05 was used for all the statistical tests.

3.14 Research Ethics or Ethical Consideration

The research was conducted according to standard ethical principles as declared by the Ghana Health Service (GHS). Ethical approval was obtained from the GHS Ethics Review Committee (GHS-ERC 050/09/22) before data collection begun. Permission to collect data was sought from the Regional Health Directorate through the Municipal Health Directorate and the clinical health unit as well as the hospital directors of LEKMA Polyclinic and Clean Town Health Centre respectively.

The principles of beneficence, respect to human dignity and justice were observed as participants were given information about the research and the opportunity to either be part of the study or refuse or discontinue where they felt uncomfortable with some or any line of questioning. All participants were given the informed consent form to fill after briefing them of the objectives of the study. Confidentiality of participants' data was maintained by avoiding any potential identifiers, such as respondents'

names. Instead, only identification numbers were used as references. All completed questionnaires were securely stored throughout the research process.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This study sought to investigate the nutritional knowledge, dietary habits and associated factors influencing the N-Status of pregnant women attending ANC in public health facilities in the Krowor Municipality. Two hundred and sixty-six questionnaires were analysed. The results of both descriptive and inferential analysis are summarised in tables and graphs by research objectives.

4.1 Socio-demographic Background of Respondents

Table 1 shows information on socio-demographic background of respondents. A total of 266 pregnant women participated in the study.

Table 1 Socio-demographic Background of Respondents

Variable	Frequency	%
Age Group (Years)		
20-30	180	68
31-40	65	25
Above 40	21	8
Total	266	
Marital Status		
Married	169	64
Single	97	37
Parity		
0-2	193	73
3-4	70	26
5 and above	5	2
ANC Visit		
1-3	121	46
4-6	115	43
7-9	30	11
Level of Education		
Basic	101	38
Non-Formal	22	8
Tertiary	44	17

Vocational/Secondary	99	37
Religion		
Christian	198	74
Muslim	59	22
Traditionalist	5	2
Others	4	2
Ethnicity		
Akan	96	36
Ewe	48	18
Ga-Adangbe	64	24
Others	58	22
Income Level		
> GHC1,100	50	19
GHC500 – GHC700	73	27
GHC800 – GHC1,000	24	9
<GHC500	119	45
Nutritional Education		
No	35	13
Yes	231	87
Gestational Age		
First trimester	77	29
Second trimester	109	41
Third trimester	80	30
Source of Food		
Buy	230	87
Cook	1	0
Garden	1	0
Own farm	34	13
Employment Status		
Employed	191	72
Unemployed	75	18

Source: Field Data, 2023

From Table 1, it was observed that most participants were between the ages of 20-30 (n = 180, 68 %). The age group 40 and above had the fewer number of respondents which was (8 %). Majority of the pregnant women had parity ranging from 0-2 (n = 193, 73%) with a mean of 2.33 (± 0.86). Most of the pregnant women recorded ANC visits ranging from 1-3 (n= 121, 46%) with a mean of 3.84 (± 2.14). It was also observed that majority of the respondents were married (n = 169, 64%). Additionally, most of the respondents had completed basic education (n =101, 38%). Non-formal education had the least number of respondents (n = 22, 9%).

A greater proportion of the respondents were Christians (n = 198, 75%) and came from the Akan ethnic group (n= 96, 36%). Most of the respondents had income levels below GHC 500.00 (n = 73, 45%). It was observed that most participants were in the second trimester of their pregnancy (n = 109, 41%). It can further be observed that a greater proportion of the participants have been educated on nutrition prior to the study (n = 231, 87%) and engage in food buying as source of food (n = 230, 87%). Also, less than one fifth (13%) of the respondents owned farms. In terms of employment status, it was observed that over two-thirds of the participants were employed at the time of data collection (n = 191, 72%). Most of the respondents were into trading (39%). Figure 1 provides a breakdown of specific occupations of respondents.

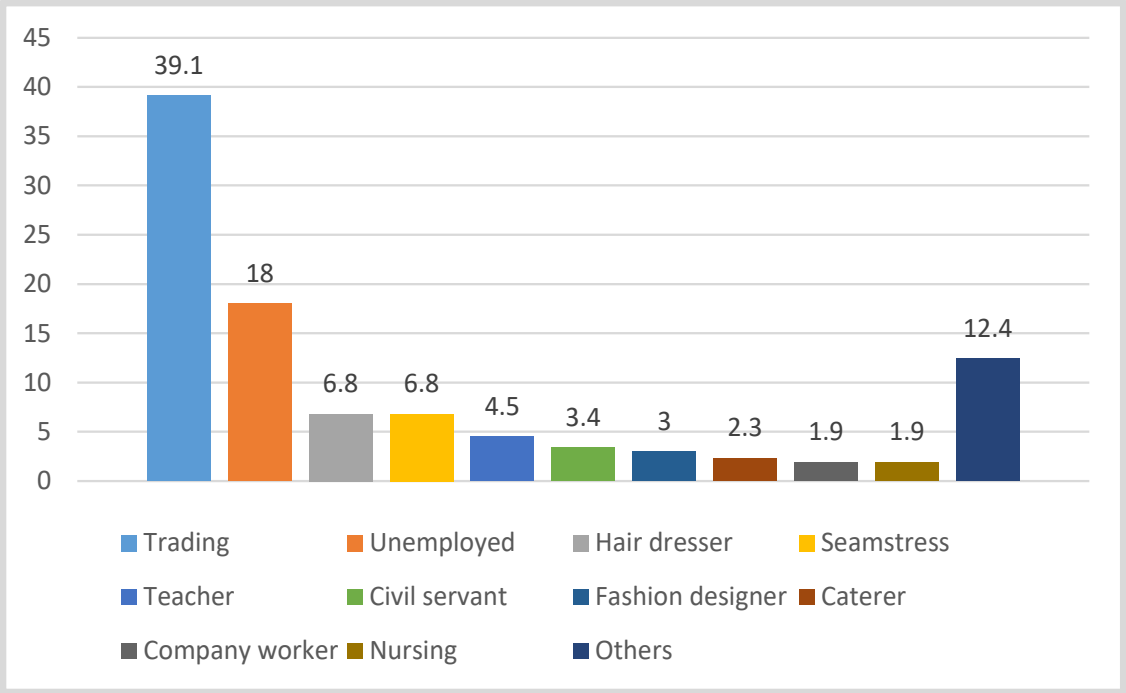

Figure 1: Occupational Background of Respondents

4.3 RQ 1: What is the Level of Nutrition Knowledge of Pregnant Women in the Krowor Municipality?

4.3.1 Sources of Nutritional Education

Figure 2 depicts the sources of nutrition education among participants.

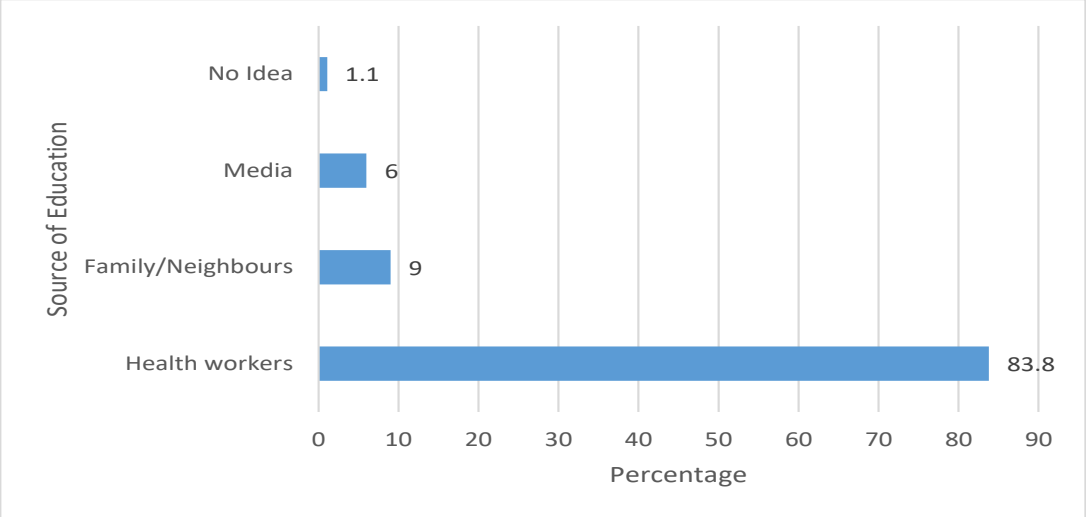

Figure 2: Sources of Nutrition Education among Respondents

Most pregnant women in the Krowor municipality had received nutritional education from health workers (84%). About 13% of respondent had never received any nutritional education prior to the study. It was also observed from Figure 2, that over four fifth of the respondents have had nutritional education prior to the study (87%).

4.3.2 Level of Nutrition Knowledge among Pregnant Women

Figure 3 shows the level of nutritional knowledge among respondents.

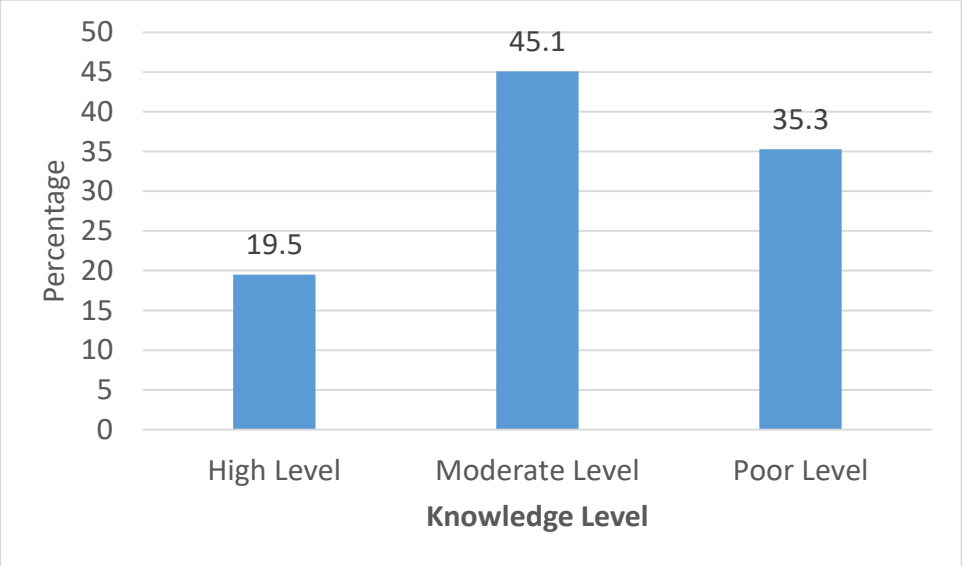

Figure 3: Level of Nutrition Knowledge among Respondents

Respondents showed moderate level of nutrition knowledge with a mean score of 11.24 (±2.48). Observations from Figure 3 indicates that under half of the participants had moderate level of nutritional knowledge (45%). Also, it can be observed that over 35% of respondents had poor knowledge about nutrition with almost one-fifth depicting a high level of nutritional knowledge (20%).

4.3.3 Relationship between socio-demographic Factors and Nutritional Knowledge

Table 2 depicts the relationship between respondents' socio-demographic characteristics and nutritional knowledge.

Table 2 Socio-demographic Factors and Nutritional Knowledge

Variable	Knowledge Level			Total F (%)	χ^2, P-Value
	High F (%)	Moderate F (%)	Poor F (%)		
Age Group (years)					
20-30	37(21)	79 (44)	64(36)	180 (68)	1.783,
31-40	13 (20)	29 (45)	23(35)	65(24)	0.789
Above 40	2 (10)	12 (57)	7 (33)	21 (8)	
Marital Status					
Married	31(18)	81(48)	57(34)	169(64)	1.500,
Single	21(22)	39(40)	37(38)	97(37)	0.472

Parity					
0-2	41(21)	84(44)	68(35)	193(73)	4.778,
3-5	10(10)	36(51)	24(34)	70(26)	0.257
6 above	1(33)	0(0)	2(67)	3(1)	
ANC Visit					
1-3	25 (21)	59 (49)	37(31)	121(45)	
4-6	19 (17)	52 (45)	44 (38)	115 (58)	5.080,
7-9	8 (27)	9 (30)	13 (43)	30 (11)	0.277
Level of Education					
Non-Formal	4(18)	9(41)	9(41)	22(8)	17.36
Basic	18(18)	55(55)	28(28)	101(38)	0.007*
Voc./Secondary	13(13)	42(42)	44(44)	99 (37)	
Tertiary	17(39)	14(32)	13(30)	44 (17)	
Religion					
Christian	44(22)	96(48)	58(29)	198(74)	15.53,
Muslim	7(12)	23(39)	29(49)	59(22)	0.005*
Traditionalist	1(25)	0(0)	4(75)	5(2)	
Others	0 (0)	1(25)	3(75)	4(2)	
Ethnicity					
Akan	21(22)	45(47)	30(31)	96(36)	2.65,
Ewe	10(21)	22(46)	16(33)	48(18)	0.085
Ga-Adangbe	11(17)	30(47)	23(36)	64(24)	
Others	10(17)	23(40)	25(43)	58(22)	
Gestational Age					
First trimester	12(16)	36(46)	29(38	77(29)	0.99,
Second trimester	17(16)	46(42)	46(42)	109(41)	0.042*
Third trimester	23(29)	38(48)	19(24)	80(30)	
Nutrition Education					
Yes	46(20)	106(46)	79(34)	231(87)	5.42,
No	6(17)	14(40)	15(43)	35(13)	0.607
Employment status					
Employed	39(18)	97(46)	76(36)	212(80)	14.07,
Unemployed	13(24)	23(43)	18(31)	54(19)	0.007*
Income Level					
> GHC1,100	17(34)	19(38)	14(28)	50(19)	
GHC800 - 1,000	3(13)	9(38)	12(50)	24(9)	23.74,
GHC500 – 700	7(10)	28(38)	38(52)	73(27)	0.00*
<GHC 500	25(21)	64(54)	30(25)	119(45)	

Source: Field Data, 2023 * Significant at $p < 0.05$ GHC – Ghana cedis

From Table 2, it was observed that income level ($p = 0.00$), level of education ($p = 0.007$), gestational age ($p= 0.042$), employment status ($p = 0.007$) and religion ($p = 0.005$) presented a significant relation with nutritional knowledge.

4.4 RQ 2: What are the Dietary Habits of Pregnant Women in the Krowor Municipality?

4.4.1 Dietary Habits of Pregnant Women

Table 2 depicts the dietary habits of participants.

Table 2 Dietary Habits of Pregnant Women

Variable	Frequency	Percentage
Meal Frequency		
< 4 (0-3)	159	60
≥ 4	107	40
Meal Skipping		
Does not skip meals	180	68
Lunch	43	16
Breakfast	35	13
Supper	8	3
Crave for Other Food		
Do not crave for other items than food	222	84
Clay	28	11
Coke	4	2
Ice block	2	1
Clay & Coke	3	1
Clay & Ice block	3	1
Clay, Ice block & Coke	3	1
Ice block & Coke	1	0
Total	266	100

Source: Field data, 2023

From Table 2, it was observed that a greater proportion of participants had less than four meals a day (n = 159, 60%). Furthermore, a greater proportion of the participants did not skip meals (n = 180, 68%) whilst about 16% (n = 43) skipped lunch. All, but 3% (n = 8) skipped supper and about 16% craved for items such as clay, coke and ice block.

4.4.3 Relationship between Socio-demographic Factors and Meal Frequency

Table 3 shows the relationship between socio-demographic factors and meal frequency.

Table 3 Relationship between Socio-demographic factors and Meal Frequency

Variable	Meal Frequency		Total (%)	χ^2, p -value
	0 – 3 F (%)	4 and Above F (%)		
Age (years)				
20-30	104 (58)	76 (42)	180 (68)	0.972, 0.623
31-40	42 (65)	23 (35)	65 (24)	
Above 40	13 (62)	8 (38)	21 (8)	
Marital Status				
Married	109 (65)	60 (36)	169 (63)	4.299, 0.026
Single	50 (52)	47 (49)	97 (37)	
Parity				
0-2	114 (59)	79 (41)	193 (73)	1.267, 0.609
3-5	44 (63)	26 (37)	70 (26)	
6 above	1 (33)	2 (67)	3 (1)	
ANC Visit				
1-3	79 (65)	42 (35)	121 (46)	3.174, 0.206
4-6	62 (55)	53 (46)	115 (43)	
7-9	18 (60)	12 (40)	30 (11)	
Education level				
Basic	68 (67)	33 (33)	101 (38)	
Non-Formal	14 (64)	8 (36)	22 (8)	5.013, 0.173
Tertiary	22 (50)	22 (50)	44 (17)	
Vocational/Secondary	55 (56)	44 (44)	99 (37)	
Religion				
Christian	118 (60)	80 (40)	198 (74)	
Muslim	34 (58)	25 (42)	59 (22)	3.584, 0.314
Traditionalist	5 (100)	0 (0)	5 (2)	
Other	2 (50)	2 (50)	4 (2)	
Employment status				
Employed	130 (61)	83 (39)	213 (80)	0.704, 0.247
Unemployed	29 (55)	24 (45)	53 (20)	
Gestational Age				
First trimester	50 (65)	27 (35)	77 (29)	12.382, 0.002*
Second trimester	74 (68)	35 (32)	109 (41)	
Third trimester	35 (44)	45 (56)	80 (30)	
First Pregnancy				
Yes	130 (61)	83 (39)	213 (80)	0.130,

No	29 (55)	24 (45)	53 (20)	0.408
Ethnicity				
Akan	55 (115)	41 (85)	96 (36)	
Ewe	30 (47)	18 (28)	48 (18)	1.816,
Ga-Adangbe	42 (66)	22 (34)	64 (24)	0.612
Others	32 (55)	26 (45)	58 (22)	
Income Level				
> GHC1,100	23 (46)	27 (54)	50 (18)	
GHC800 – GHC1,000	53 (73)	20 (27)	73 (28)	12.570,
GHC500 – GHC700	18 (75)	6 (25)	24 (9)	0.005*
<GHC 500	65 (54)	54 (45)	119 (45)	
Nutrition education				
Yes	23 (66)	12 (34)	35 (13)	0.591,
No	136 (59)	95 (41)	231 (87)	0.282

Source: Field data, 2023 * Significant at $p < 0.05$

From Table 3, it is observed that gestational age ($p = 0.002$) and income level (0.005) had significant relation with meal frequency of respondents.

4.4.4 Relationship between Socio-demographic factors and Meal Skipping

Table 4 shows the relationship between socio-demographic factors and meal skipping.

Table 4 Relationship between Socio-demographic factors and Meal Skipping

Variable	Meal Skipping				Total F (%)	χ^2, (p – value
	Do not Skip Meal F (%)	Skips Breakfast F (%)	Skips Lunch F (%)	Skips Supper F (%)		
Age (years)						
20-30	120 (67)	27 (15)	26 (14)	7 (4)	180 (68)	4.6,
31-40	47 (72)	6 (9)	11 (17)	1 (2)	65 (24)	0.6
Above 40	13 (62)	2(10)	6 (29)	0(0)	21 (8)	
Marital Status						
Married	117 (69)	22 (13)	27 (16)	3 (2)	169 (64)	2.5,
Single	63 (65)	13 (13)	16 (16.5)	5 (5.2)	97 (36.5)	0.5
Parity						
0-2	128 (66)	28 (15)	29 (15)	8 (4)	193 (73)	6.0,
3-5	50 (71)	7 (10)	13 (19)	0 (0)	70 (26)	0.4
6 above	2 (67)	0 (0)	1 (33)	0 (0)	3 (1)	
ANC Visit						
1-3	78 (65)	17 (14)	21 (17)	5 (4)	121	3.9,

					(46)	0.7
4-6	84 (73)	13 (11)	16 (14)	2 (2)	115 (43)	
7-9	18 (60)	5 (17)	6 (20)	1(3)	30 (11)	
Education level						
Basic	73 (72)	8 (8)	17 (17)	3 (3)	101 (38)	
Non-Formal	15 (68)	3 (14)	4 (18)	0 (0)	22 (8)	5.9, 0.7
Tertiary	30(68)	6 (14)	6 (14)	2(5)	44 (17)	
Vocational/Secondary	62(63)	18 (18)	16 (16)	3 (3)	99 (37)	
Religion						
Christian	140 (71)	22 (11)	29 (15)	7(4)	198 (74)	
Muslim	35(59)	12 (20)	11 (19)	1 (2)	59 (22)	11.6, 0.2
Other	3 (75)	1 (25)	0 (0)	0 (0)	4 (2)	
Traditionalist	2 (40)	0 (0)	3 (60)	0 (0)	5 (2)	
Employment status						
Employed	140 (66)	32 (15)	37 (17)	4 (2)	213 (80)	8.9* 0.03
Unemployed	40 (76)	3 (6)	6 (11)	4(8)	53 (20)	
Gestational Age						
First trimester	41(53)	15 (20)	20 (26)	1(1)	77 (29)	
Second trimester	74 (68)	12 (11.0)	17(16)	6 (5.5)	109(41)	18.1,* 0.00
Third trimester	65 (81)	8 (10)	6 (8)	1 (1)	80(30)	
First Pregnancy						
Yes	117(69)	23(14)	27 (16)	3 (2)	170(64)	2.6, 0.4
No	63 (66)	12(13)	16(17)	5 (5)	96 (36)	
Ethnicity						
Akan	64 (67)	15(16)	14 (15)	3(3)	96 (36)	
Ewe	33 (69)	4 (8)	11(23)	0 (0)	48 (18)	
Ga-Adangbe	46 (72)	8 (13)	8 (13)	2 (3)	64 (24)	5.8, 0.7
Others	37 (64)	8 (14)	10(17)	3 (5)	58 (22)	
Income Level						
> GHC1,100	42 (84)	3 (6)	5 (10)	0 (0)	50 (19)	
GHC800 – GHC1,000	41 (56)	14(19)	15 (21)	3 (4)	73 (27)	
GHC500 – GHC700	13 (54)	6 (25)	5 (20.8)	0 (0)	24 (9)	16.0* 0.04
<GHC 500	84 (71)	12(10)	18 (15)	5 (4)	119 (45)	
Nutrition Education						
Yes	22 (63)	6 (17)	6 (17)	1 (3)	35 (13)	
No	158 (68)	29 (13)	37 (16)	7 (3)	231 (87)	1.0, 0.8

Source: Field data, 2023 * Significant at $p < 0.05$

Observations from Table 4 indicates that employment status (p = 0.030), gestational age (p = 0.003) and income level (p = 0.045) had significant relationship with meal skipping among respondents.

4.2 Dietary Diversity of Respondents

Figure 4 shows the MDD-W status of respondents before the day of data collection.

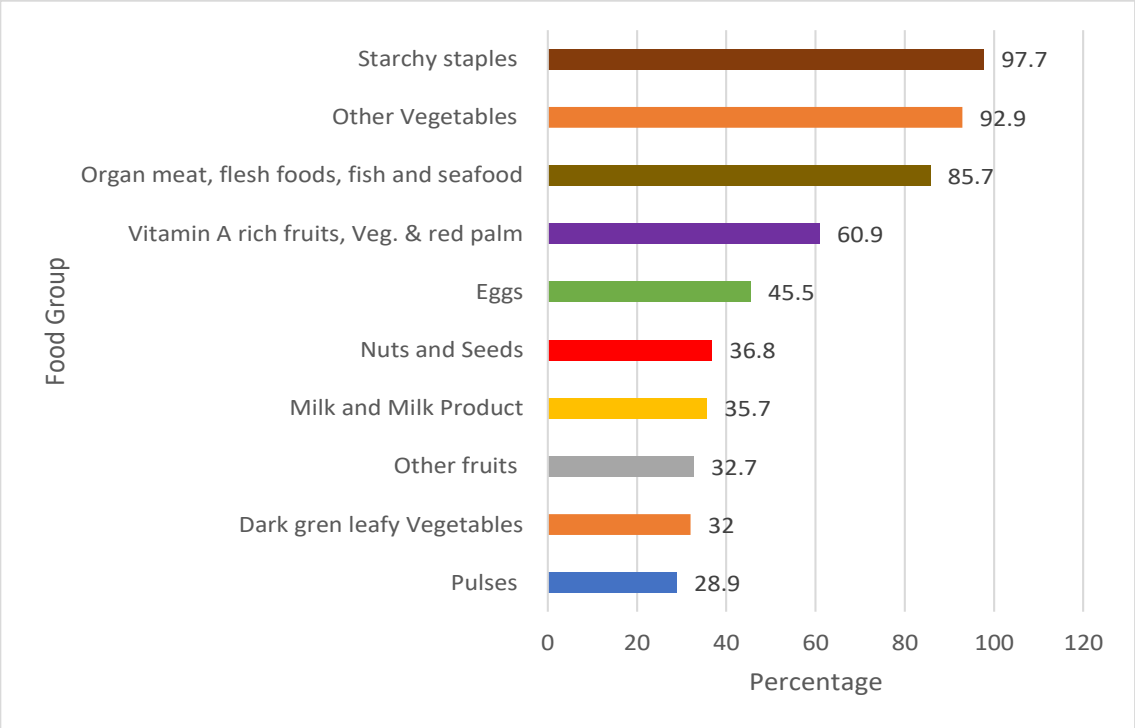

Figure 4: Proportions of pregnant women consuming different food groups

Figure 4 shows the MDD-W for respondents before the day of data collection. Almost all the participants consumed food from the starchy staples (98%) and other vegetables (93%) a day prior to the study. Over four fifth (86%) consumed organs meat, fleshy foods, fish and sea foods. A little above half of the participants had consumed food from Vitamin A rich fruits, vegetable and red palm oil a day before data collection (61%). About a third of the respondents had eaten from the pulses (29%), dark green leafy vegetables (32%) and other fruits (33%) food groups a day prior to the study.

4.4.5 Minimum Dietary Diversity for Women (MDD-W) of Respondents

The MDD-W score ranged from zero (0) to eight (8). The mean MDD-W score was 5.46 (±1.36). Approximately, four fifth of the respondents (n = 212, 80%) presented an adequate whilst the rest presented inadequate MDD-W score (n= 54, 20%).

4.4.6 Socio-demographic Factors association with MDD-W

Table 5 presents result of the chi-square analysis of the relationship between socio-demographic factors and MDD-W.

Table 5 Relationship between Socio-demographic Factors and MDD-W

Variable	MDD-W		Total (%)	χ^2, p -value
	Adequate F (%)	Inadequate F (%)		
Age (years)				
20-30	143 (79)	37 (21)	180 (68)	1.952, 0.388
31-40	55 (85)	10 (15)	65 (9)	
Above 40	15 (71)	6 (28)	21 (7)	
Marital Status				
Married	141(83)	28(17)	169 (63.5)	1.892, 0.742
Single	71(73)	26(27)	97 (37)	
Parity				
0-2	154(80)	39(20)	193(73)	3.871, 0.135
3-5	58(83)	12(17)	70(26)	
6 above	1(33)	2(67)	3(1)	
ANC Visit				
1-3	90 (74)	31 (26)	121	7.835, 0.020*
4-6	94 (82)	21 (18)	115	
7-9	29 (97)	1 (3)	30	
Education level				
Basic	71(70)	30(30)	101(38)	11.186, 0.009*
Non-Formal	18(82)	4(18)	22 (8.3)	
Voc./Secondary	82(83)	17(17)	99 (37)	
Tertiary	41(93)	3(7)	44 (17)	
Religion				
Christian	154(78)	44(22)	198 (74)	2.567, 0.420
Muslim	51(86)	8(14)	59 (22)	
Traditionalist	4(80)	1(20)	5 (2)	
Others	3(75)	1(25)	4 (2)	

Employment status				
Unemployed	46(85)	8(15)	54(19)	7.055, 0.029*
Employed	166(78)	46(22)	212(80)	
Gestational Age				
First trimester	62(81)	15(19)	77(28.9)	2.767, 0.251
Second trimester	82(75)	27(25)	109(41)	
Third trimester	68(85)	12(15)	80(30.1)	
First Pregnancy				
Yes	74(77)	22(23)	96(36)	0.635, 0.425
No	138(81)	32(19)	170(64)	
Ethnicity				
Akan	74(79)	22(21)	96(36.1)	1.328, 0.723
Ewe	37(77)	11(23)	48(18)	
Ga-Adangbe	53(83)	11(17)	64(24)	
Others	48(83)	10(17)	58(21)	
Income Level				
> GHC1,100	47(94)	3(6)	50(18)	12.66, 0.005*
GHC800 – GHC1,000	19(79)	5(21)	24(9)	
GHC500 – GHC700	61(84)	12(16)	73(27)	
<GHC 500	85(71)	34(29)	119(45)	
Nutrition education				
Yes	186(81)	45(29)	231(87)	0.730, 0.393
No	26(74)	9(26)	35(13)	

Source: Field data, 2023 * Significant at $p < 0.05$

Observations from Table 5 indicates that ANC attendance (p=0.020), level of education (p = 0.009), level of income (p = 0.005) and occupational status (0.029) had significant relationship with MDD-W.

4.5 RQ 3: What is the Nutritional Status of Pregnant Women in the Krowor Municipality?

4.5.1 Nutritional Status of Respondents by MUAC Measurement

Table 6 presents the frequency distribution and summary statistics of N-Status using MUAC among respondents.

Table 6 Nutritional Status by MUAC Measurement

Variable	Frequency	Percentage
N-Status		
Malnourished	4	2
Nourished	262	99
Total	266	100.0
Mean (Std. Deviation)	**Minimum**	**Maximum**
29.32 (4.34)	21	42

Source: field data, 2023

Almost all respondents (n = 262, 99%) were nourished. The mean MUAC measurement of respondents was 29.32 cm (±4.34) with a minimum of 21cm and a maximum of 42cm.

4.5.3 Nutritional Status of Respondents by HB Measurement

4.5.3.1 Anaemia Status of Respondents

Table 7 presents the distribution of anaemia status among respondents.

Table 7 Anaemia Status among Respondents

Variable	Frequency	Percent
Anaemia Status		
Anaemic	84	32
Non-Anaemic	182	68
Total	266	100

Source: Field data, 2023

From Table 7, it was observed that about one third of the respondents were anaemic (n = 84, 32%).

4.5.4 Relationship between Socio-demographic Factors and Anaemia Status

The study assessed the relationship between socio- demographic factors and anaemia status among the respondents. Table 8 present the results of the assessment.

Table 8: Relationship between Socio-demographic Factors and Anaemia Status

Variable	Anaemia Status		Total (%)	χ^2, p -value
	Anaemic F (%)	Non-Anaemic F (%)		
Age (yearrs)				4.42, 0.17
20-30	65 (36)	115 (63)	180 (68)	
31-40	15 (23)	50 (77)	65 (24)	
Above 40	5 (24)	16 (76)	21 (8)	
Marital Status				
Married	46 (27)	123 (73)	169(64)	4.07, 0.03*
Single	38 (32)	59 (68)	97(37)	
Parity				
0-2	78(40)	115(60)	193(73)	26.30, 0.00*
3-5	6(9)	64(91)	70(26)	
6 and above	1(33.3)	2(67)	3(1)	
ANC Visits				
1-3	44(36.4)	77(63.6)	121(45)	4.32, 0.11
4-6	36(31)	79(68.7)	115(43)	
7-9	5(17)	25(83)	30(12)	
Level of education				
Basic	34 (34)	67 (66)	101(38)	0.59, 0.91
Non-Formal	7 (32)	15 (68)	22(8)	
Tertiary	12 (27)	32 (73)	44 (17)	
Voc./Sec.	31(31)	68 (69)	99 (37)	
Employment Status				3.021 0.08
Employed	62 (29)	151(71)	213(80)	
Unemployed	22 (42)	31(59)	53(20)	
Religion				
Christian	68 (34)	130 (66)	198(74)	4.44, 0.14
Muslim	16 (27)	43 (73)	59(22)	
Traditionalist	0 (0)	5 (100)	5(2)	
Others	0 (0)	4 (100)	4(2)	
Source of food				
Buy	77 (34)	153 (67)	230(85)	3.11, 0.36
Cook	0 (0)	1 (100)	1(0)	
Garden	0 (0)	1 (100)	1(0)	
Own farm	7 (21)	27 (79)	34(13)	
Income Level				
≥ GHC1,100.00	6 (12)	44 (88)	50(18)	15.11, 0.00*
GHC500-700	30 (41)	43 (59)	24(9)	
GHC800-1,000	5 (21)	19 (79)	73(27)	
<GHC500.00	43 (36)	76 (64)	119(45)	
Gestational Age				0.46,

1st trimester	22 (29)	55 (71)	77(29)	0.79
2nd trimester	36 (33)	73 (67)	109(41)	
3rd trimester	26 (33)	54 (68)	80(30)	
Nutrition Education				
No	10 (29)	25 (71)	35(13)	0.16, 0.68
Yes	74 (32)	157 (68)	231(87)	
Ethnicity				
Akan	35 (37)	61 (64)	96(36)	3.10, 0.53
Ewe	11 (23)	37 (77)	48(18)	
Ga-Adangbe	21 (33)	43 (67)	64(24)	
Others	17 (29)	41 (70)	58(22)	

Source: Field data, 2023 * Significant at $p < 0.05$

From Table 8, it was observed that marital status ($p = 0.03$), parity (0.00) and income level ($p = 0.00$) had significant relationship with anaemic status.

4.6 RQ4: What Factors Influence the Nutritional Status of Pregnant women in the Krowor Municipality?

Bivariate and multivariate binary logistic regressions were used to determine the factors that predict N-Status of respondents (Table 9).

Table 9: Bivariate and Multivariate Analysis of Anaemia status

	Non-Anaemic					
Variable	**OR**	**95% CI**	**P-value**	**AOR**	**95% CI**	**P-value**
Parity			0.00*			0.00*
0-2	0.36	(0.040-3.360)	0.37	0.34	(0.040-3.160)	0.35
3-5	2.58	(0.247-26.981)	0.42	2.38	(0.220-25.150)	0.47
6 and above	1			1		
Marital Status						
Single	0.55	(0.328-0.944)	0.030*	1.02	(0.570-1.790)	0.96
Married	1			1		
Income Level			0.009*			0.040*
GHC500 -700	0.23	(0.093-0.588)	0.002*	1.09	(0.518-3.290)	0.307
GHC800 -1000	0.61	(0.174-2.199)	0.458	1.57	(0.810-3.049)	0.182
<GHC500	0.28	(0.119-0.695)	0.006*	2.06	(0.686-6.194)	0.198
≥ GHC 1,100	1			1		

Nutrition Knowledge				0.909			0.978
High Knowledge	1.004	(0.482	- 2.091)	0.992	0.919	(0.399-2.117)	0.842
Moderate Knowledge	0.892	(0.500	- 1.593)	0.700	0.989	(0.519-1.888)	0.974
Poor Knowledge	1				1		
Meal Frequency							
Less than 4 times	1.312	.778	2.213	0.308	1.291	(0.702-2.372)	0.411
4 times/Above	1				1		
Meal Skipping				0.297			
Breakfast	0.500	0.088	2.841	0.434	0.399	(0.066-2.410)	0.316
Lunch	1.259	0.216	7.326	0.798	0.942	1(0.152-5.825)	0.948
Don't Skip	0.667	0.131	3.403	0.626	0.482	(0.088-2.628)	0.399
Supper	1				1		
MDD-W							
Adequate	1.626	.877	3.015	0.123	1.520	(0.773-2.988)	1.520
Inadequate	1				1		

Source: Field Data * Significant at p < 0.05 **AOR:** Adjusted Odds Ratio. **OR:** Odds Ratio. **CI:** Confidence Interval**. GHC**: Ghana Cedi. **MDD-W**: Minimum Dietary Diversity for Women.

It was observed from Table 9 that parity had significant influence on anaemia status (p= 0.00). Those with 0-2 births presented lower odds of being non-anaemic (p=0.00, OR=0.34, CI 0.040-3.160). Pregnant women who were single were 45% less likely to be non-anaemic compared with pregnant women who were married (p=0.030, OR=0.55, CI 0.401-1.245). However, this significance was lost after adjusting for the influence of other covariates. Respondents with income group GHC500 -700 had 77% likelihood of being non-anaemic as compared with those respondents in income group ≥ GHC 1,100 (p=0.002, OR=0.23, CI 0.093-0.588). Also, respondents with income group <GHC500 were 72% less likely to be non-anaemic as opposed to respondents in income group ≥ GHC 1,100 (p=0.006, OR=0.28, CI 0.119-0.695). However, these significances were lost when adjusted for covariates.

It was also observed that although there is lack of statistical significance for any of the nutritional knowledge levels, generally, respondents with high level of nutritional knowledge had about 80% likelihood of being non-anaemic when other covariates are controlled in the adjusted model.

Discussion of Results

This study sought to investigate the nutritional knowledge, dietary habits, and associated factors influencing the N-Status of pregnant women attending ANC in public health facilities in the Krowor Municipality. This section discusses results in the context of existing literature.

4.7 Socio-demographic Background of Respondents

Findings of this study revealed that most participants belonged to the age cohort of 20-30 years (67.7%). One possible reason for this is that as women's fertility peaks is in their early twenties it makes it easier to conceive. Another possible reason is that most cultures and societies in Ghana encourage women to marry and start families in their twenties. This finding contrasts with the study in Ghana by Armah-Mensah and Armah-Mensah (2024) which reported that most of the participants were within 15-19 years (18.7%). It is also in contrast to the findings of another study in Ghana which found most (22.14%) of pregnant women were aged 20–29 years (Boadi *et al*., 2023). One implication is that women in this age group may be more likely to follow modern dietary trends, relying on convenience foods and skipping meals, which can lead to inadequate nutrient intake and potentially affect foetal development.

With regards to marital status, the study demonstrated that most participants were married (63.7%). In Ghana, and Greater Accra Region in specific, marriage is highly

valued, and it is often expected that couples will formalise their union through marriage, especially when they have children. This cultural and social pressure may have contributed to the high percentage of married pregnant women in the study. In addition, Ghana is a religious country, and many religious traditions emphasise the importance of marriage and family. This religious influence might explain the high percentage of married participants in the study. The finding of this study is lower than the 81.2% reported by Bedaso *et al*. (2022) in a study in New South Wales, the 82.9% reported by Nyarko (2019) in a study in Ghana and the 83.1% reported in a study in Malawi (Ng'ambi *et al*., 2022). The finding is however similar to the 62.9% reported by a study in Tanzania (Elia & Ayungo, 2023).

This study revealed that most participants had only basic education (38%). The probable reason for this finding is that in coastal communities, such as the Ledzokuku municipality, many families may rely on fishing and other marine-related activities for their livelihood, therefore, education may not be seen as a priority since traditional livelihoods and skills may have been passed down through generations, making formal education seem less relevant. Also, the finding could be attributed to the poverty level in the municipality. In Ledzokuku Municipal, 11.3% of the population live in multidimensional poverty and the average intensity of poverty is 43.3% (GSS, 2021). It has been established that individuals with low SES tend to prioritise employment over pursuing further studies after completing lower levels of education (Vadivel *et al*., 2023). The observation aligns with the study by Ng'ambi *et al*. (2022) which demonstrated that majority of pregnant women in Malawi had primary education and Jordan *et al*., (2024) which reported that 58.8% of participants

completed only grades 11–12. However, the finding is different from that of Elia and Ayungo, (2023) which reported that 44.7 % of participants had secondary education.

In relation to employment, this study observed that majority of participants were employed (79%). The finding can be attributable to a multitude of factors. The Ledzokuku Municipality is located in the Greater Accra Region which stands out as the most urbanised and economically active regions in Ghana. Being the national capital, it accommodates several governmental bodies, commercial enterprises, and industrial establishments which provides variety of job avenues from different fields including commerce, services, manufacturing, and public administration. It was also found that most employed participants were into trading (39%) which may be due to the fact that most of them have only basic level of education which would not allow employment into the formal sector. This finding is congruent with that of Nyarko (2019) which indicates that 74% of pregnant women were employed. However, the finding is higher than that reported by Jordan *et al*. (2024) where only 30.0% and 11.3% of respondents were employed full-time or part-time, respectively and the 50.3% reported by Mohammed and Awal (2020) in a study in Ghana.

In terms of religious composition of respondents, it was revealed that a majority of the participants were Christians (74%). This finding corresponds to the estimation from the 2021 population census by GSS which highlighted that 71% of the Ghanaian population follow the Christian faith. It is also not too different from the findings of a study in Ghana by Nyarko (2019) which indicate that 76% of the pregnant women were Christians. For pregnant women who hold Christian beliefs, religious dietary guidelines, such as those observed during fasting periods or special religious occasions, may influence their dietary choices. Additionally, religious communities

frequently provide social support networks that can impact dietary behaviours during pregnancy. Church groups, for instance, may offer resources, advice, and communal meals that shape the dietary habits of pregnant individuals within the Christian community. These networks may serve as sources of encouragement for adhering to healthy nutritional determinations recommended in the course of pregnancy, as well as platforms for sharing knowledge about nutrition and concerns related to pregnancy.

Regarding ethnicity, it was found that most of the participants were from the Akan ethnic group (36.1%). Considering that most study participants belonged to the Akan ethnic group is remarkable, particularly when considering the ethnic demographics revealed by the 2021 population and housing census in the Greater Accra Region, which estimates the Akan population to be 39.8 percent. While the Greater Accra Region is recognised for its cultural diversity, the Akan ethnic group, including subgroups such as the Ashanti, Fante, and Akuapem, constitutes a significant proportion of the region's population. The prominence of Akan respondents in the study reflects the demographic predominance of this ethnic group within the region. This finding is however lower than the 47.2% found in a previous study in the Greater Accra Region (Maya *et al*., 2023).

This study found that most of the expectant mothers were low-income earners earning less than GHC 500 monthly (44.7%). This may be explained by respondents' low level of education revealed in the study. Education and income are commonly acknowledged as crucial elements in both social and individual economic progress. It is widely accepted within academic circles that individuals who attain higher levels of education tend to have enhanced access to improved job prospects, advancement in their careers, and increased potential for income growth (Li, 2023). This outcome is

quite similar to what was reported by Manortey and Taylor (2020) where most of the respondents earn less than GHS 500 (39.7%). It is also like a study which reported that majority (44%) of respondents were from poor households (Ng'ambi *et al*., 2022). The finding highlighted a significant socio-economic factor that could greatly impact the N-Status of respondents. Pregnant women with low-income may face financial limitations that may restrict their ability to access a diverse and nutritious diet that is crucial for the health of the mother and her unborn child.

Regarding access to nutritional education, findings from this study suggest that 86.8% of respondents received nutrition education prior to the study. This observation might be explained by usual nutrition education and counselling given to pregnant women during ANC visits at health centres and hospitals in Ghana (Abubakari *et al*., 2019). This finding supports the report of a study among pregnant women in Tanzania which indicates that 84% of respondent have had nutritional education prior to the study (Mruma & Mkhai, 2022). This outcome highlights a promising opportunity to have a favourable impact on the N-Status during pregnancy. The implication of this finding is that respondents will be empowered knowledge-wise to make informed nutritional decisions that support the healthiness of the mother and the foetus. In addition, this study also found that approximately 87% of respondent had nutritional education from healthcare workers. This aligns with a Somalian study which found that participants overwhelmingly received health information from healthcare workers (Haji *et al*., 2022).

With regards to parity, the study found the average number of children to be two with a majority of respondents having between 0-2 children (72.6%). This is not unexpected because a majority (67.7%) of the respondents are relatively young, aged

between 20-30 years. This observation is congruent with that of Wang *et al*. (2022) in a study in China where most of the respondents have two parities (48.5%). The finding is however higher than revealed in the study by Nyarko (2019) where over half (55.9%) of the respondents had between 1-3 children. This finding indicates a context where respondents may already possess knowledge about pregnancy and maternal healthcare. This previous experience has the potential to impact their N-Status during subsequent pregnancies, as the participants may draw upon past knowledge and practices concerning diet and prenatal care.

In terms of ANC visits, it was found that the average ANC visits was four. This may be attributable to the quality of ANC services rendered at the facilities. It has been established by previous research that women who perceived ANC quality as good were three times more likely to have four or more ANC visits than those who perceived quality as poor (Osei Asibey *et al*., 2019). This finding suggests a relatively regular involvement with maternal healthcare services since most of the participants were in the second trimester (41%) of pregnancy. This is promising for monitoring and addressing nutritional requirements during pregnancy and would create opportunities for healthcare providers to evaluate N-Status, offer dietary guidance, and address any concerns or challenges that may affect maternal nutrition and pregnancy outcomes of respondents.

4.8 Nutrition Knowledge of Pregnant Women in the Krowor Municipality

This study found that majority of the respondent had moderate nutritional knowledge (45.1%). It was also found that income level, level of education, gestational age, employment status, and religion were related with nutritional knowledge. This

outcome disputes a study by Appiah *et al*., (2021) in LEKMA in Ghana which demonstrated that a minority of the participants had high nutritional knowledge. However, the finding is higher than what was found in a study by Adylbekova, (2024) in the USA where 55% of the participants were reported to have moderate nutritional knowledge.

The disparity in the finding of this study and that of Appiah *et al.,* (2021) may stem from the difference in the study population. Whilst this study included adults who may have had more access to nutrition information, that of Appiah *et al.,* (2021) included only adolescents who have less access to nutrition information. The disparities may also be as a result of the effectiveness of the nutritional education provided by nurse and midwives. The moderate level of knowledge exhibited by respondents may be an indication of the effectiveness of the nutritional education provided by midwives and nurses at the various health facilities in the Krowor municipality.

Nutritional knowledge was found to be related with the level of education, as anticipated ($p=0.007$). The significant association identified between education level and respondents' nutritional knowledge highlights the crucial role that education plays in shaping individuals' understanding of dietary principles and practices. Previous researches have also established the link between educational attainment and knowledge about nutrition and diet (Egg *et al*., 2020; Mazurkiewicz, & Raczkowska, 2024; Xu *et al*., 2020). People with higher education levels tend to have greater health literacy, actively look for dietary information to support their well-being, interpret

nutritional content from mass media more effectively, and are better equipped to differentiate factual information from deceptive advertising (Xu *et al*., 2020).

Furthermore, this association emphasises the potential for education to be a key contributor to the N-Status of expectant mothers. Those with higher levels of education tend to possess more nutritional knowledge which can lead to better dietary choices, improved access to resources, and enhanced health-seeking behaviours during pregnancy. Conversely, individuals with lower levels of education may face obstacles in acquiring and applying nutritional information effectively, which could impact their ability to maintain optimal N-Status. It is crucial to address the disparities in nutritional knowledge across different educational backgrounds in order to promote equal access to maternal healthcare services and enhance pregnancy outcomes. Tailored educational interventions that are accessible, culturally sensitive, and tailored to the literacy levels of diverse populations can help bridge the gap in nutritional knowledge and empower all pregnant women to make informed decisions about their dietary habits.

This study also observed a significant association between income level and nutritional knowledge among respondents. This is aligns with prior research which observed a discrepancy in nutritional knowledge between different income groups and has reached the conclusion that individuals with higher incomes are more inclined to possess higher levels of dietary knowledge (Xu *et al*., 2020). It is also congruent with a study which found that household income was significantly correlated with nutritional knowledge among expectant mothers in Malaysia (Lim *et al*., 2018). The association between income level and nutritional knowledge among participants emphasises the significance of socio-economic factors to the availability of nutrition education and awareness. The reasonable explanation of this discovery is that higher

income earners are more prone to having more extensive knowledge pertaining to nutrition in comparison to those with lower incomes. There are several factors that may contribute to this association. Individuals with higher incomes may have greater access to educational resources, such as formal programs, workshops, or classes that specifically focus on nutrition. Additionally, they may possess the financial resources to acquire healthier food options and have access to healthcare professionals who provide guidance on nutrition.

The present study found significant association between gestational age and nutrition knowledge (p=0.042). This is inconsistent with the study by Lim *et al*. (2018) which showed no association between gestation age and nutrition knowledge. The influence of gestational age on nutrition knowledge can be attributed to a variety of factors. As the pregnancy advances, the women may have actively sought out information and resources regarding nutrition in order to support the developing foetus and address their own evolving nutritional requirements. Healthcare providers may have also contribute to the promotion of nutritional education during prenatal visits, thus providing opportunities for pregnant individuals to gain insights into the significance of dietary choices and receive guidance on how to meet their nutritional needs.

4.9 Dietary Habit of Pregnant Women in Krowor Municipality

The study's findings indicated that most of the individuals surveyed had 0-3 meals a day (59.8%). The study also found that 32% of participants skipped meals and lunch was the most skipped meal. The average MDD-W score was 5.46 and about 80% of participants had MDD-W score greater than the threshold of five. Income, education and employment status had significant relationship with MDD-W. Starchy staples

were the most consumed (97.7%) and pulses was the least consumed food group (28.9%).

The observation that the majority (59.8%) of participants consumed food 0-3 times a day is comparable to the outcomes of a study in Nigeria, which indicated that a majority (52%) had three meals a day (Olatona *et al*., 2021). It is also in alignment with the findings of Abdulai *et al*. (2023) in a study which revealed that approximately, 53% of the respondents ate 3 meals a day. This finding also meets the recommendation of UNICEF (2023) which requires that pregnant women eat three meals daily. The increased frequency of eating revealed in this study can be attributed to the heightened demand for nutrients by the body during pregnancy, in order to meet the requirements of the foetus and sustenance the physical changes in the mother. Consequently, having more frequent meals enables pregnant women to evenly distribute their nutrient intake throughout the day, ensuring a consistent supply of essential nutrients.

The finding that 32% of participants skipped meals aligns with a study that revealed a 36% rate of meal skipping among pregnant women (Loo *et al*., 2022). This significant finding may be attributed to several factors. Firstly, symptoms of pregnancy such as nausea, vomiting, and food aversions may greatly impact a woman's appetite and desire to eat, resulting in missed meals. Moreover, the demands of busy schedules, work commitments, giving that most of the respondents were in to trading, can cause pregnant women to neglect regular meal times. Additionally, cultural or societal beliefs regarding dietary restrictions during pregnancy may influence some expectant mothers to skip meals or limit their food intake. Furthermore, financial constraints

could contribute to meal skipping among pregnant women giving that most of the respondents in the study earn below GHC 500.00 monthly.

The finding that 10% of participants experienced cravings for clay during pregnancy has potential adverse consequences for mother and the foetus. This phenomenon, known as pica, involves an intense desire for and consumption of non-food substances such as clay, chalk, or ice, and can be associated with various factors. Pica cravings are often linked to iron deficiency anaemia, which is prevalent among pregnant women, as the body may seek alternative sources of iron. It may also be due to morning sickness and nausea (Madziva & Chinouya, 2020). Additionally, cultural or psychosocial factors can influence pica cravings during pregnancy. While the consumption of clay itself may not be harmful, it may hinder the body's ability to absorb essential nutrients and potentially lead to complications.

In this study, fruit consumption (32.7%) and vegetable consumption (32%) among participants were notably low. This is concerning, given that Ghana's Ministry of Health, through the Regenerative Health and Nutrition Programme, advocates for daily intake of vegetables and fruits to promote healthiness and avert diseases, particularly in the course of pregnancy (Amo-Adjei & Kumi-Kyereme, 2015). Several factors may explain this low intake, including socio-demographic characteristics, environmental, personal and cultural influences, as well as broader macrosystem factors (Kaur, 2023).

4.10 Nutritional Status of Pregnant Women in the Krowor Municipality

This study revealed that 2.5% of respondents were malnourished in relation to MUAC. This is inconsistent with prior studies which reported 22.7% (Kpewou,

2020), 13.9% (Wakwoya *et al*., 2022) and 27.3% (Vasundhara *et al*., 2020). The differences in these findings may be attributed to a variety of factors. The role of SES is often significant, as financial resources affect the ability to obtain nutritious foods. Cultural practices can vary greatly among different populations, influencing the adequacy of nutrient intake in the course pregnancy. The type of occupation engaged in by pregnant women has also been found to influence their N-Status (Ayele *et al*., 2020; Guevara-Romero *et al*., 2022). For instance, a study in Ethiopia found that pregnant women whose occupation is agriculture were more likely to have undernutrition (Ayele *et al*., 2020). Furthermore, access to healthcare services such, as regular prenatal care may also explain the differences in N-Status reported by the studies. The difference could also be due to implementation of strategies including MVMS, nutritional counselling, deworming and, environmental and personal hygiene promotion (Wakwoya *et al*., 2022).

This study highlighted that 31% of participants were anaemic. This proportion is lower than proportions reported by prior studies by Wemakor (2019) in Northern Ghana which reported anaemia prevalence of 50.8% and Tibambuya et al. (2019) in the West Gonja District of Ghana which reported anaemia prevalence at 56%. However, the proportion is considerably higher than observed by Akowuah *et al*. (2022) which reported a prevalence of 11.4% in the Kwabre East Municipality in Ghana but similar to the study by Kofie *et al*. (2019) which identified a prevalence of 33% in the Hohoe Municipality of Ghana. The variations across these studies may be ascribed to the disparities in broader healthcare systems and interventions aimed at the well-being of expectant mothers. It may also be attributed to the enhancement in living standards, encompassing personal hygiene, and the planned endeavour of the Ghanaian government to attain Sustainable Development Goal 3 by the year 2030. In

2002, the GHS implemented the Focused Antenatal Care programme, which incorporates maternal healthcare, enabling pregnant women to receive healthcare from a designated healthcare provider throughout their entire pregnancy (Baffour-Awuah *et al*., 2015). Furthermore, the disparities may also be explained by the differences in the settings which may have different socio-cultural and economic characteristics.

4.11 Factors Influencing Nutritional Status among Pregnant Women

The presents study revealed that anaemia status was highly influenced by parity (p =0.00). This finding is corroborated by studies in Southern Ghana (Awuni et al., 2022; Owusu et al., 2022) in Nigeria (Eze et al., 2024) and Saudi Arabia (Khanet et al., 2023). This observation in the present study can be ascribed to the continual depletion of iron reserves due to higher parity (Eze et al., 2024). Eze et al. (2024) further posited that persistent undernutrition and maternal depletion resulting from closely timed pregnancies not only engenders a deteriorated nutritional condition for both women and their progeny but also expedites the aging process and diminishes the health status of women.

The study found that marital status (p=0.030) significantly influenced anaemic status of respondents. This can be attributed to the enhanced social assistance available to pregnant women who are in a marital partnership. Furthermore, it appears that pregnant women who are married, particularly those engaged in entrepreneurial activities or gainfully employed, may have greater financial means at their disposal due to the pooling of resources with their spouses. The assertion regarding the significance of marital status as a significant determinant of anaemia during pregnancy has previously been validated by studies conducted in Ghana (Tettegah,

2022) and Nigeria (Adeyemi *et al*., 2023) which emphasised the crucial role that being in a union plays in providing support and resources to pregnant women, ultimately impacting their health outcomes during pregnancy positively.

The study also found that income level (p=0.009) significantly influenced anaemic status of respondents. Reasonably, persons with higher income may have better access to nutritious diet necessary to prevent anaemia. This finding aligns with the study by Tetteghah (2022) and Mostafa *et al*. (2022) which reported income level as a significant predictor of anaemic status. It is however inconsistent with the study by Noviyanti (2019) which reported no association between income level and anaemia.

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CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECMMENDATIONS

5.0 Overview

This chapter presented the summary, conclusions and recommendations for policy, practice and further research.

5.1 Summary of Findings

The purpose of the study was to investigate the nutritional knowledge, dietary habit, and associated factors influencing the N-Status of pregnant women attending ANC clinic in public health facilities in the Krowor Municipality. In line with this purpose, the study had the following specific objectives:

1. To evaluate the level of nutrition knowledge of pregnant women in the Krowor Municipality.
2. To assess the dietary habit of pregnant women in the Krowor Municipality
3. To determine the nutritional status of pregnant women in the Krowor Municipality.
4. To investigate the factors that influence nutritional status of pregnant women in the Krowor Municipality.

To achieve the objectives of the study, a total of 266 pregnant women aged 20-45 years receiving ANC services in the two main public health facilities, Clean Town Health Centre and LEKMA polyclinic, at the Krowor Municipality were selected using the random sampling procedure to participate in the study from February to March 2023. A questionnaire was used to collect data from participants. Data were analysed descriptively and inferentially using SPSS version 22.

5.1.1 Socio-demographic Background of Respondents

Most of the participants were aged 26-31 years (38.3%). Over sixty-three percent (63.5%) of respondents were married and 38% had basic education. Over, seventy-four percent (74.4%) of respondents were Christians whilst 1.5% were traditionalist. Most of the respondents were from the Akan ethnic group (36.1%) and most earns a monthly income less than GHC 500.00 (44.7%). Forty-one percent (41%) of the participants were in their second trimester and majority (86.8%) had received nutritional education prior to the study. Most of the participants were into trading (39%) and a majority (86.5%) presented buying as their source of food.

5.1.2 Research Question One: What is the Level of Nutrition Knowledge of Pregnant Women in the Krowor Municipality?

Most of the respondents had received nutritional education before the study was conducted (86.8%). About 13% percent of respondent had not received any nutritional education prior to the study. About 84% of respondents received nutritional education from health workers whilst 9% had nutritional education from friends and family members. Most of the participants had moderate level of nutritional knowledge (45%) whilst 35% had poor nutritional knowledge. Twenty percent (20%) of participants had high level of nutritional knowledge. Income level ($p = 0.00$), occupational status ($p = 0.007$), education ($p = 0.007$), gestational age ($p= 0.042$) and religion ($p = 0.005$) had significant association with nutritional knowledge.

5.1.3 Research Question Two: What is the Dietary Habit of Pregnant Women in the Krowor Municipality?

About 60% of participants had less than four meals a day whilst 40.2% had four or more meals in a day. Furthermore, 67.7% of participants did not skip meals. Over sixteen percent of participants skipped lunch (16.2%). Starchy staples were the most consumed food among participants (97.7 %) and Pulses were the least consumed by participants (28.9%). Gestational age ($p = 0.002$) and income level (0.005) had significant relation with meal frequency of respondents. Employment status ($p = 0.030$), gestational age ($p = 0.003$) and income level ($p = 0.045$) had significant relationship with meal skipping among respondents. About four fifth of participants had MDD-W score equal to or greater than five (79.7%). The level of education ($p = 0.009$), level of income ($p = 0.005$) and occupational status ($p = 0.029$) were significantly related to MDD-W.

5.1.4 Research Question Three: What is the Nutritional Status of Pregnant Women in the Krowor Municipality?

Majority of the participant were nourished (98.5%) and the mean MUAC measurement was 29.3cm. About one third of the respondents were anaemic (31.6%) whilst the remaining were non-anaemic (68.4%) based on Hb measurement. Marital status ($p = 0.03$) and income level ($p = 0.00$) were associated with anaemic status among participants.

5.1.5 Research Question Four: What factors Influence Nutritional Status of Pregnant Women in the Krowor Municipality?

Marital status (p=0.030) and income level (p=0.009) significantly predicted N-Status of respondents in relation to anaemia. Respondents who are single presented a lower odd (OR=0.55, p=0.030, CI 0.328-0.944) of being non-anaemic compared with those married. Respondents with income group GHC500 -700 has 77% reduced likelihood of being non-anaemic as compared with those respondents in income group ≥ GHC 1,100 (p=0.002, OR=0.23, CI 0.093-0.588). Respondents with income group <GHC500 are 72% less likely to be non-anaemic as opposed to respondents in income group ≥ GHC 1,100 (OR=0.28, p=0.006, CI 0.119-0.695).

5.2 Conclusions

The following conclusions were drawn from the findings of the study. They are presented based on the research questions.

1. Most of the pregnant women in the Krowor Municipality had moderate level of nutritional knowledge.
2. Dietary practices of pregnant women in the Krowor Municipality were acceptable.
3. Pregnant women in the Krowor Municipality had good N-Status.
4. Parity, marital status, and income level significantly influenced anaemic status of pregnant women in the Krowor Municipality.

5.3 Recommendations

The following recommendations were made to improve the N-Status of pregnant women in the Krowor Municipality.

1. It is recommended that management of Clean Town Health Centre and LEKMA Polyclinic implement at the facility level evidenced based health education strategies to improve the nutritional knowledge of pregnant women who receive care in the facilities.
2. The Municipal Health nutrition education initiatives at the community level should raise awareness about the importance of selecting foods based on their nutritional content, thereby promoting and improving the community's overall N-Status.
3. The Ghana Health Service should ensure regular supply of folic acid in healthcare facilities and that pregnant women be encouraged to always increase their intake of folic acid along with fruits. Furthermore, education on promoting maternal health should incorporate the practice of sleeping under bed nets treated with insecticides. Additionally, since marital status and income levels are associated with anaemia prevalence, initiatives and policies aimed at reducing anaemia during pregnancy should specifically target pregnant women who are low-income earners and unmarried.

5.4 Suggestion for Future Research

1. This study revealed that 35% of participants were anaemic although 98.5% of participants were classified as nourished based on MUAC measurement. There is the need for future studies to assess the comparative effectiveness of MUAC and Hb assessment of N-Status.
2. This study did not utilise biochemical data to determine the micronutrient status of pregnant women. Consequently, it was unfeasible to ascertain their micronutrients status. Therefore, it would be crucial for future research to incorporate pregnant women's biochemical data, with a specific focus on the

nutritional aspects of micronutrients, as this would facilitate the identification of cases of micronutrient deficiencies.

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APPENDICES

APPENDIX A

QUESTIONNAIRE

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF HOME EONOMICS EDUCATION

STUDY TOOLS

QUESTIONNAIRE FOR PREGNANT WOMEN ON "NUTRITIONAL KNOWLEDGE, DIETARY HABITS AND ASSOCIATED FACTORS OF NUTRITIONAL STATUS OF PREGNANT WOMEN IN THE KROWOR MUNICIPALITY OF THE GREATER ACCRA REGION OF GHANA"

INTRODUCTION

Dear Respondent,

I am a postgraduate student of the University of Education, Winneba. As part of the requirement in obtaining my degree, I am investigating the topic "Nutritional Knowledge, dietary habits and Associated Factors of Pregnant Women in the Krowor Municipality of the Greater Accra Region of Ghana".

I therefore need you to answer the following questions to the best of your ability. Your responses will be used for academic purpose only and you are guaranteed of confidentiality and anonymity. Thank you for your willingness to partake in this study.

I give my full consent to take part in this study YES [ ] NO [ ]

Instruction

Please (√) or respond where applicable. All responses will be treated confidentially.

Section A: Socio - demographic Characteristic of Respondents		
1	Age range	20-30 years 31-40 years Above 40
2	Marital status	Single Married Widowed Divorced Separated
3	Is this your first pregnancy?	Yes

	If "Yes" skip to question 5.	☐ No
4	How many children do you have?	☐ 1 ☐ 2. ☐ 3 ☐ Others (specify) ……
5	Level of education	☐ Non formal ☐ Basis ☐ Vocational/Secondary Tertiary
6	Occupation	☐ Farming ☐ Trading ☐ Nursing ☐ Civil servant ☐ Others (specify) ……..
7	Religious affiliation	☐ Christian ☐ Muslim ☐ Traditionalist
8	Your ethnicity.	☐ Ga-Adangbe ☐ Akan ☐ Ewe ☐ Other (specify)……
9	Your income per month.	☐ Less than GHC500.00 ☐ GHC500.00-GHC700.00 ☐ GHC800.00-GHC1,000.00 ☐ GHC1,100.00 and above
10	Gestational age (check from maternal health book)	☐ First trimester ☐ Second trimester ☐ Third trimester
11	How many ANC have you attended?	☐ Specify ……..
12	Have you been given nutrition education during ANC?	☐ Yes ☐ No
	Section B: Nutrition knowledge of respondents'	
13	The nutritional needs of women during pregnancy are different from others?	☐ Yes ☐ No
14	Do you agree that pregnant women should eat from the six food groups (a variety of foods) daily?	☐ Yes ☐ No
15	If yes, identify some food sources under the three main food groups	☐ 1…… ☐ 2…… ☐ 3……
16	During pregnancy, a woman needs more folic acid and iron than a woman who is not pregnant.	☐ Yes ☐ No

17	What are the health risks when pregnant women's diet lacks iron?	☐ Anaemia ☐ Low birth weight ☐ General weakness ☐ No idea
18	What enhances iron absorption when taken with meals?	☐ Vitamin-C-rich foods, such as fresh citrus fruits ☐ No idea
19	Tea and coffee reduce your ability to absorb iron	☐ Yes ☐ No
20	What do you think are the nutrition-based prevention measures of anaemia?	☐ Eat iron-rich foods ☐ Take Iron-Folic Tablets ☐ No idea
21	Nutrients deficiency during pregnancy could affect health status of mothers and baby	☐ Yes ☐ No
22	Obese women are at an increased risk of several pregnancy problems	☐ Yes ☐ No
23	Underweight mother can affect fetal well-being and growth	☐ Yes ☐ No
24	Anaemia is caused by a deficiency in iron	☐ Yes ☐ No
25	What do you think are the causes of malnutrition?	☐ Inadequate food intake ☐ Empty caloric food intake ☐ Diseases ☐ No idea
26	Source of nutrition information	☐ Health workers Family/ Neighbours ☐ Media ☐ None
Section C: Dietary Habits of Respondents		
27	How many times do you usually eat in a day (meal frequency)?	☐ ≤ 4 (0-3) ☐ ≥ 4 (4 and above)
28	Do you normally skip meals?	☐ Yes ☐ No
29	If yes in question 29, which meal do you usually skip?	☐ Breakfast ☐ Lunch ☐ Supper
30	Do you crave for other items other than food?	☐ Yes ☐ No
31	If yes, list them	☐ Yes ☐ No

Section D: Assessing the Dietary Intake of Respondents

Dietary Diversity Questionnaire

Please describe all the foods and drinks you consumed yesterday, both in the day and at night, at home or away. Begin with the first item you ate or drank in the morning. Record every meal and snack mentioned by the respondent. Once the respondent finishes, ask follow-up questions to identify any meals or snacks they may have forgotten to mention. After the recall is complete, classify the items into their respective food groups based on the recorded information. For any food group not represented, ask the respondent if they consumed any item from that group.

Question number	Food group	Examples	Yes = 1 No = 0
1	Cereal	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products), kooko, banku, kenkey, tua zaafi.	
2	White roots and tubers	white potatoes, white yam, white cassava, cocoyam, white sweet potato or other foods made from roots	
3	Vitamin A rich vegetables and tubers	pumpkin, carrot, squash, or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g.red sweet pepper)	
4	Dark green leafy vegetables	dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such alefu, ayoyo, cassava leaves, spinach, cocoyam leaves	
5	Other vegetables	other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables	
6	Vitamin A rich fruits	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits, palm nut fruits	
7	Other fruits	other fruits, including wild fruits and 100% fruit juice made from these	
8	Flesh meats and Organ meats	beef, pork, lamb, goat, rabbit, game, snail, chicken, duck, other birds, insects, liver, kidney, heart or other organ meats or blood-based foods	

9	Eggs	Quail eggs, chicken eggs, turkey eggs, duck eggs, guinea fowl or any other egg	
10	Fish and seafood	fresh or dried fish or shellfish	
11	Pulses	Beans, peas and lentils, soy milk	
12	Nuts and seeds	groundnuts, 'werewere' or foods made from these (eg.peanut butter)	
13	Milk and milk products (dairy)	milk, cheese, yogurt or other milk products	

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) score guide

Question number (s)	Food group	1 = Yes 0= No
1,2	Starchy staples	
4	Dark green leafy vegetables	
3, 6	Other vitamin A rich fruits and vegetables and red palm oil	
5	Other vegetables	
7	Other fruits	
8,10	Organ meats, flesh foods, fish and seafood	
9	Eggs	
12	Nuts and seeds	
13	Milk and milk products	
14	Pulses	

MDD-W Score = ……

Section E: Anthropometric Measurement

MUAC measurement ……

Classification: ……..

Section F: Biochemical Biomarker

Iron Level / Hb Level (g/dl) …… (Check from Maternal health books).

Classification: ……..

THANK YOU FOR YOUR COOPERATION!

APPPENDIX B

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

My Ref: GHS-RDD/ERC/Admin/app/22/567
Your Ref: No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3161
Mob: +233-50-3539896
Tel: +233-302-681109
Email: ethics.research@ghs.gov.gh
16th December, 2022

Mary Nkansah
University of Education, Winneba, Faculty of Home Economics,
Department of Food and Nutrition,
P.O. Box 25, Winneba, Ghana

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 050/09/22**
Study Title	Factors Contributing to Dietary Habits and Diversity among Pregnant Women in the Krowor Municipality
Approval Date	16th December, 2022
Expiry Date	15th December, 2023
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may always reserve to observe all procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approval protocol

SIGNED.....
Dr. Nii-Korkor Allotey
(Ag. Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra