ENSIGN GLOBAL UNIVERSITY

KPONG, EASTERN REGION, GHANA

DEPARTMENT OF COMMUNITY HEALTH

FACTORS CONTRIBUTING TO MALNUTRITION IN CHILDREN UNDER 5 IN THE TONGOR SUB-DISTRICT, SOUTH DAYI DISTRICT, VOLTA REGION, GHANA

BY

LARRY ELORM VIVIE

APRIL, 2025

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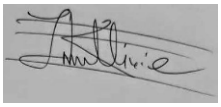
A THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH, FACULTY OF PUBLIC HEALTH, ENSIGN GLOBAL COLLEGE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF PUBLIC HEALTH DEGREE

APRIL, 2025

DECLARATION

I hereby declare that this submission is my work for the master's degree in public health and that, to the best of my knowledge, it does not contain any material previously published by any person or material accepted for the granting of any other degree from this university, except where proper attribution has been indicated in the text.

Larry Elorm Vivie

(247100278) …  … …04/06/25…

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(Head of Academics Program) Signature Date

DEDICATION

I dedicate this work to God Almighty for His endless grace and guidance. To the Vivie Family, for their unwavering love and support. To Mr. Richard Atiemo Ganyo, E.P Health Service Director, Mr. Jonas Timbire Kolog, District Health Director, and Mr.Dei Tutu Newton, for their mentorship and encouragement. To Yayra Yao Tasiame, Tongor Sub-District Nutrition Officer, for her valuable guidance and assistance throughout this journey.

Thank you all for being instrumental in the completion of this work.

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ABSTRACT

Background: Malnutrition remains a significant public health challenge, particularly among children under five years of age in developing regions. In the Tongor Sub-District of South Dayi District, Volta Region, Ghana, various factors contribute to the prevalence of malnutrition, adversely affecting child health and development.

Aim: This study seeks to identify the socio-economic, dietary, healthcare, and environmental factors contributing to malnutrition among children under five in the Tongor Sub-District, to inform targeted interventions and policies.

Methodology: A quantitative cross-sectional approach was employed, utilizing a structured questionnaire administered via KoboCollect on tablet devices. The questionnaire was divided into socio-demographic information, dietary intake, anthropometric information, environmental and sanitation factors, and maternal and caregiver practices. Participants were selected using a stratified multistage sampling technique, where five key healthcare facilities serving the community will be identified as strata.

Results: The study revealed varying dietary diversity among children under five years in the Tongor Subdistrict. Fish and seafood were the most commonly consumed protein sources (60.5%), followed by vegetables (55.5%) and cakes or biscuits (44.8%). Less than 30% of children consumed dark green leafy vegetables, meat, or starchy staples, while the least consumed food groups included groundnuts, dairy products, and organ meats. Additionally, children aged 48–59 months were significantly more likely to be underweight (AOR = 5.61, p=0.015), and reliance on unimproved water sources was associated with higher odds of underweight status (AOR = 2.62, p=0.028).

Conclusion: Nutritional status was significantly associated with child age and household water sources, highlighting the need for targeted interventions to improve dietary practices and access to safe water. Strengthening nutrition education and addressing environmental factors are critical to reducing undernutrition among young children in the subdistrict.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients, or impaired nutrient utilization, according to the World Health Organization (WHO, 2024) . Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), micronutrient deficiencies (inadequate vitamins or minerals), and overnutrition, which encompasses overweight and obesity resulting in diet-related non-communicable diseases (WHO, 2024). It is known worldwide that children under 5 are vulnerable and susceptible to many problems in the aspect of nutrition (Amoah *et al.*, 2024). Even children who may survive malnutrition are likely to be at risk of a cycle of repeated infection and malnutrition, as well as experiencing learning disability, which reduces their ability to develop to their full potential and contribute positively to economic development (UNICEF, 2024). Malnutrition has always been a critical public health challenge affecting children and leading to child morbidity and mortality, especially in developing countries (Akhtar, 2016).

Globally, malnutrition plays a major role in the deaths of almost 16,000 young children every day, with most of them in the developing world (Feng et al., 2022). In 2022 worldwide, 149 million children under 5 were estimated to be stunted, 45 million were estimated to be wasted (WHO, 2024). Malnutrition in children under the age of 5 years emanates from a complex interaction of availability, accessibility, and utilization of food and healthcare services. Nutrition-specific factors include inadequate food intake, poor caregiving and parenting, improper food practices, and infectious comorbidities (Akhtar, 2016). Other nutrition-sensitive factors include food insecurity,

and insufficient economic resources at the individual, household, and community levels. Limited access to education, healthcare services, infrastructure, and a poor hygienic environment are also nutritional-sensitive factors that adversely affect children under 5-year nutritional status (Drammeh, Hamid and Rohana, 2019).

Undernutrition remains high, impacting the growth, development, and survival rate of children under 5 years, particularly in low- and middle-income countries, resulting in substantial increases in mortality and overall disease burden (Global Nutrition Report, 2018). Additionally, undernourished children are always prone to infections and easily succumb to diseases such as diarrhea, lower respiratory tract infections, measles, and malaria (Gombart, Pierre and Maggini, 2020).

Wasting is defined as having low weight-for-height. It usually indicates recent and severe weight loss, although it can also persist for long. It often occurs when a child has not had food of adequate quality and quantity and/or they have had frequent or prolonged illnesses (WHO, 2024). Stunting is defined as poor linear growth among under-five-year children (Hoddinott et al., 2013) It is usually the result of chronic or recurrent undernutrition, normally associated with poverty, poor maternal health and nutrition, frequent illness and/or inappropriate feeding and care in early life (WHO, 2024). Underweight is, defined as weight for age less than minus two standard deviations (-2SD) from the reference population median (Canadian Paediatric Society., 2021). Underweight is a composite extraction of both stunting and wasting, meaning, an underweight child may be stunted, wasted, or both (Govender *et al.*, 2021).

Sustainable Development Goal 2.2 focuses on ending all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, as well as addressing the nutritional needs of adolescent girls, pregnant and lactating

women, and older persons. Despite some achievements being made in part of the world, there is still much to be done in low- and middle-income countries which include Ghana. Therefore, this study aims to assess the factors contributing to malnutrition among children under 5 years in Tongor Sub-district.

1.2 Problem statement

Malnutrition is a major burden on health in developing countries, including Ghana. According to the 2022 Ghana Demographic and Health Survey, 17% of children under 5 in the country are stunted, indicating chronic undernutrition. Additionally, 6% are wasted, 12% are classified as underweight, and 2% of children under five are reported as overweight (GDHS, 2022).

Ghana has seen little improvement in childhood malnutrition despite some investment in the health sector. Malnutrition will not only increase the rate of mortality but will also predispose children to infections, impaired physical and cognitive development, and reduce their ability to learn and thrive later in the future. Putting measures in place to address this issue will not only improve the health of children but will also offer a long-term societal benefit. The numerous benefits this study will provide was the reason for conducting the study.

Despite numerous interventions from the United Nations International Children's Emergency Fund (UNICEF), World Health Organization (WHO), and World Bank towards meeting nutritional freedom, the Sub-Sahara African region is still far from the world without malnutrition. The WHO report published in March 2020 revealed insufficient progress towards the World Health Assembly targets set for 2025 and the SDG set for 2030 (WHO, 2020). According to the WHO 2020 report, about 144 million children under 5 years have stunted growth, 47 million children are wasted and 14.3 million are severely wasted, whilst 38.3 million are overweight or obese. The global view is that malnutrition rates remain alarming. It is observed that Africa and Asia bear the

greatest share of all forms of malnutrition with more than half of all stunted children under 5 living in Asia and two out of five living in Africa. (UNICEF, WHO and Bank, 2020). In 2019, it was observed that more than two-thirds of all wasted children under 5 lived in Asia, and more than one-quarter lived in Africa, according to data from UNICEF. Stunting is declining too slowly while wasting still impacts the lives of far too many young children. The Sub-Saharan African region is leading the world in terms of stunting with a rate of 43% among children and has shown little improvement over the past years(UNICEF, WHO and Bank, 2020). In the period between 2017 and 2018, the prevalence of stunting, wasting, and underweight among children under five years of age was 18, 7, and 13 percent, respectively (USAID, 2021). According to the Ghana Nutrition Surveillance Survey 2023, the prevalence rate for underweight was 12.2%, 9.9% and stunting 14.9% for 2023 in the Volta region. In the South Dayi District, the prevalence rate for underweight was 14.2%, wasting was 13.7% and stunting was 11.7% for 2023 (Survey, 2023). According to the district health directorate, in 2018, the proportion of children underweight was 14.2% in the South Tongu District (District Health Report, 2019)

Despite several interventions from policymakers like school feeding programs, improved primary health care, and many more, malnutrition is still a major concern in Ghana.

1.3 Rationale of the study

Resolving undernutrition has significant gains. For example, it has been estimated that … deaths could be averted. These gains are higher in Africa where undernutrition is endemic.

Conducting this study will be very beneficial to children under 5 years. The study will help unravel the numerous factors contributing to malnutrition in Tongor Sub-district. Factors such as dietary habits, maternal education levels, access to health care, sanitation, and how they interact to contribute to malnutrition will be uncovered. Conducting this study will inform policymakers like

the District Health Directorate, Non-Governmental Organizations, and opinion leaders about the right measures to take to improve malnutrition with the relevant resources available.

Also, this study will serve as a baseline or reference for future research work about malnutrition in the Sub-district. It will also contribute to academic literature by providing specific insight for future reference in similar contexts.

1.4 Conceptual framework

Figure 1 is adapted from the UNICEF Conceptual Framework on Maternal and Child Nutrition (2020). The framework organizes the factors contributing to malnutrition in children under 5 years in Tongor Sub-district into three determinants: enabling, underlying, and immediate. The immediate determinants consist of diets (dietary intake and feeding practices) and care (healthcare utilization and childcare practices).

Immediate Determinants (Diets and Care): Data on dietary intake and feeding practices (Diets) are collected through Section B of the questionnaire, which documents the types, frequency, and diversity of foods and liquids consumed by children. For instance, questions on breastfeeding practices, complementary feeding, and consumption of nutrient-rich foods align with assessing dietary adequacy. Anthropometric measurements (weight, height, MUAC) directly evaluate nutritional outcomes (stunting, wasting, underweight). Care-related factors, such as healthcare utilization (e.g., vaccination status, antenatal visits) and childcare practices (e.g., hygiene during feeding), are captured through caregiver interviews in Sections A and C.

Underlying Determinants (Food, Practices, Services): Household food security and quality (Food) are assessed via questions on income levels, food sources, and meal frequency in Sections A and B. Environmental and sanitation factors (Services), including water sources, waste disposal, and

toilet facilities, are detailed in Section A's sanitation subsection. Hygiene practices, such as water treatment methods and handwashing, are included to evaluate behavioral practices linked to infection prevention. Access to healthcare services is further explored through questions on proximity to health facilities and utilization patterns.

Enabling Determinants (Governance, Resources, Norms): Socioeconomic status (Resources), including maternal education, occupation, and household income, is captured in Section A to analyze how economic constraints or cultural norms influence feeding choices. Questions on maternal education levels and ethnicity indirectly reflect societal norms and beliefs (Norms) that may prioritize certain foods or caregiving practices

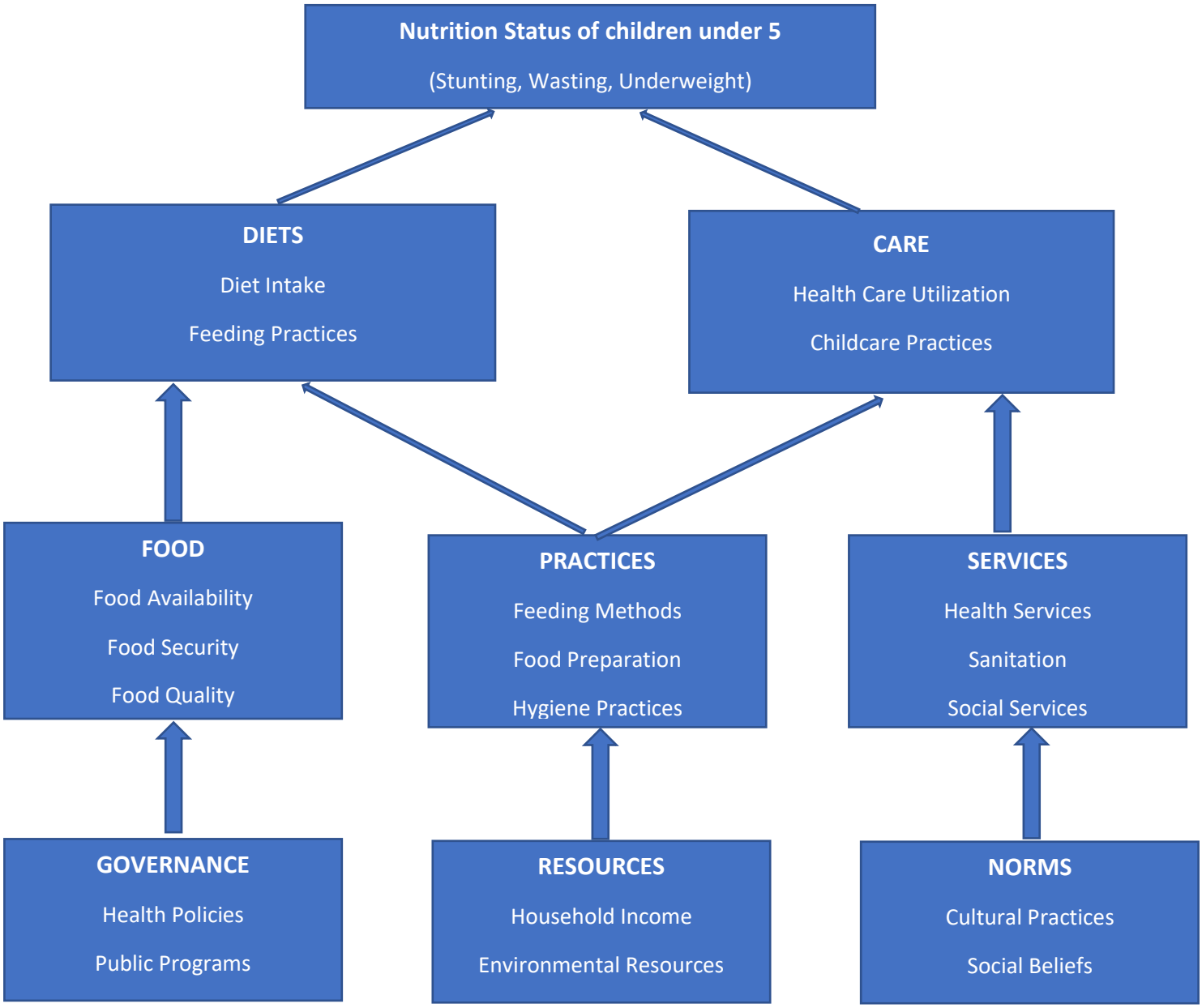

Figure 1Conceptual framework for malnutrition among children under 5 years in Tongor Sub-district.

1.5 Research Questions

1. What are the dietary patterns and nutritional intake levels of children under 5 in the Tongor Sub-district?

2. Which socioeconomic and demographic factors affect the nutritional status of children under 5 in the Tongor Sub-district?
3. How do environmental and sanitation factors contribute to malnutrition in children under 5 in the Tongor Sub-district?

1.6 General Objectives

This study aims to assess the factors contributing to malnutrition among children under 5 years old in Tongor Sub-district.

1.7 Specific Objectives

1. To assess the dietary patterns and nutritional status of children under 5 in Tongor Sub-district.
2. To assess the environmental and sanitation factors contributing to malnutrition in children under 5 in Tongor Sub-district
3. To evaluate the socioeconomic and demographic factors affecting the nutritional status of children under 5 in Tongor Sub-district.

1.8 Profile of study area

The study was conducted in the Tongor Subdistrict within the South Dayi District of the Volta Region of Ghana. The South Dayi District was carved out of the then Kpando District and inaugurated on August 24, 2004, with Kpeve as its capital. The South Dayi District lies within latitudes 3020'N and 3.5005'N and on longitudes 0017 E and 0027'E. It shares boundaries with North Dayi and Afadzato South Districts to the north, Ho West District to the east and Asougyaman District in the south, while the Volta Lake forms the western boundary. The district covers a total

land area of 358.3 square kilometers, which is 1.7 percent of the total land area of the Volta Region with about 20 percent of its land covered by the Volta Lake.

The population of South Dayi District, according to the 2021 Population and Housing Census, is 57526; children 0-14 years form 33.5% of the population, majority, 60.2%, are 14-64 years with the rest being more than 65 years old. The district is predominantly rural as 61.2 percent of its population resides there compared to urban areas inhabited by 38.8 percent. The district's population is youthful with more than one-third (39.0%) of the population below 15 years. About 83.0 percent of the population of the district (11 years and older) are literate. Of this proportion, males constituted 49.6 percent of the literate population whereas that of females stands at 50.4 percent.

The predominant ethnic group is the Ewe forming 93.9%, the Ga-Adangbe 2.1%, followed by the Gurma, then the Akans 1.2% with the rest being other ethnic groups. Christians form the majority of the population (88.3%), followed by the African Tradition Religion (3.8%), and Islam (3.3%), with other religions forming 0.6%. The district health management system has five subdistricts namely Dzake, Peki, Kpalime Duga, Kpeve, and Tongor. The study area, Tongor is the biggest subdistrict within the South Dayi district in terms of population. It has Kpalime Duga Subdistrict and Asuogyaman district bounded to its North and the rest of its boundaries are surrounded by the Volta Lake.

The Tongor Subdistrict has a population of 23,070, with children five years, about 4268. The majority of the natives are subsistence farmers, followed by those who engage in trading and fishing activities. This community hosts the biggest market in the district, the Dzemeni market, which is hosted every Thursday week. The community is heterogeneous, with the majority being Ewes from various tribes; Christianity dominates the community, with African Traditional

Religion being the next, followed by the Islamic Religion. The Tongor community can boast of five health facilities, namely Tsanakpe Health Center, E.P. Health Center, Living Oasis Medical Center, Kings and Queens Teaching Hospital, and Kpongboni CHPS Compound that serves community members and others who come from overbank communities.

Malnutrition in Tongor is critically important due to persistently high rates that exceed national and regional averages. According to the Ghana Nutrition Surveillance Survey (2023), the South Dayi District recorded alarming malnutrition indicators: underweight (14.2%), wasting (13.7%), and stunting (11.7%) among children under five all higher than the Volta Regional averages (underweight 12.2%, wasting 9.9%, stunting 14.9%) and national figures from the 2022 GDHS (underweight 12%, wasting 6%, stunting 17%). These conditions impair physical and cognitive development, increase susceptibility to infectious diseases like malaria and diarrhea (endemic in this lakeside community), and perpetuate cycles of poverty through reduced educational attainment and future productivity.

1.9 Scope of Study

This study focuses on assessing factors contributing to malnutrition among children under 5 years in Tongor Sub-District, South Dayi District, Ghana. It employs a quantitative cross-sectional design, utilizing structured questionnaires and anthropometric measurements to evaluate dietary patterns, nutritional status (underweight, stunting, wasting, overweight), socioeconomic determinants (maternal education, household income), demographic factors (child age, caregiver age), and environmental conditions (water sources, sanitation facilities). Data were collected from 248 caregiver-child pairs across five healthcare facilities, with analysis identifying key predictors of malnutrition to inform targeted interventions. The geographical scope is confined to Tongor Sub-District, emphasizing localized determinants and outcomes.

1.10 Organization of report

This chapter establishes the global and local context of malnutrition, defining it through its forms undernutrition, micronutrient deficiencies, and overnutrition and highlights its devastating consequences on child survival, growth, and development. The problem statement underscores Ghana's persistent malnutrition rates despite national and international interventions, emphasizing the urgency of addressing this issue to mitigate long-term health and socioeconomic impacts. The rationale for the study stresses its potential to inform targeted policies, guide resource allocation, and contribute to academic discourse. A UNICEF-derived conceptual framework organizes determinants of malnutrition into immediate (dietary intake, care practices), underlying (food security, sanitation, healthcare access), and enabling (socioeconomic status, cultural norms) factors, which guide the study's data collection and analysis. The chapter outlines the general objective to assess contributing factors to malnutrition and specific objectives focusing on dietary, environmental, and socioeconomic determinants.

Figure 2 Map of South Dayi (GSS, 2021)

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter provides an assessment of the literature on the prevalence, implications and determinants of childhood malnutrition. Some topics covered include literature on the dietary patterns and socioeconomic and demographic factors affecting the nutritional status of children.

Global, regional and national trends in malnutrition

Globally, malnutrition remains a significant public health challenge. The WHO estimates that approximately 149 million children under five are stunted, while 45 million are wasted (WHO, 2021). In Sub-Saharan Africa, the burden of malnutrition is particularly pronounced. The region has the highest rates of stunting and wasting globally, with socioeconomic and demographic factors exacerbating the situation (FAO, 2019; United Nations, 2016). With these statistics presented above, a gloomy situation of poor nutrition is projected in the future, and sub-Saharan Africa and many developing countries may continue to be the worst victims. According to WHO, 42 million children are said to be overweight, and of this number, 35 million are living in developing countries (WHO, 2025). In parts of Africa such as Cameroon, Egypt, Ghana, and Nigeria, the prevalence of malnutrition and other related illnesses among children still remains high. In their study of the nutritional status of under-5 children of low-income earners in a South-Western Nigerian Community, Amosu et al., (2011:578) recorded a high prevalence of underweight to 82.13% and wasting 85.15% while stunting is 33.52%.

In Ghana, the prevalence of stunting (28%) is more pronounced than underweight (14%) (UNICEF, 2013). A study conducted in the Northern Region of Ghana found that one in ten

children in Ghana is reported to be severely stunted. Stunting is an indicator of chronic malnutrition, and it reflects a failure to receive adequate food intake over a long period (Iddrisu & Gyabaah, 2023).

In Ghana, malnutrition remains a public health issue, particularly among children under five (Ghana Statistical Service [GSS], 2021). The country has made strides in reducing the burden of stunting and wasting, but challenges persist (GSS, 2021). Ghana's government has implemented various policies to combat malnutrition, including the National Nutrition Policy and the Ghana School Feeding Programme. These initiatives aim to improve food security and promote better dietary practices (Ministry of Health [MOH], 2020).

Malnutrition is a leading cause of mortality among children globally. The staggering statistic that 6.3 million deaths, accounting for 54% of young child mortality in developing countries, are associated with malnutrition underscores the urgent need for intervention (Adedokun & Yaya, 2021). Children suffering from malnutrition are more susceptible to infections and diseases, as their immune systems are compromised. This vulnerability not only increases the risk of acute illnesses but also contributes to a higher likelihood of mortality from otherwise treatable conditions. The WHO estimates that malnutrition contributes to nearly half of all deaths in children under five years of age, highlighting its critical role in child mortality (WHO, 2021). Malnutrition significantly impacts children's growth and cognitive development. Stunted growth, a common consequence of chronic malnutrition, affects not only physical stature but also cognitive abilities. Research indicates that children who are stunted are more likely to experience delays in cognitive development, which can lead to poor educational outcomes and reduced economic productivity in adulthood (Iddrisu & Gyabaah, 2023). The effects of malnutrition on cognitive function are profound; children who experience malnutrition during the crucial early years of development may

face lifelong challenges, including lower IQ levels and diminished learning capacities. These cognitive impairments can perpetuate the cycle of poverty, as affected individuals may struggle to attain higher education and secure better employment opportunities (UNICEF, 2023).

The prevalence rate of stunting and being underweight were found to be 42.22% and 6.67% respectively among children under age five in Bangang rural community, Cameroon in 2014 documented that, "out of 11.6 million deaths among under-five children in 1995 in developing countries, it is estimated that 6.3 million or 54% of young child mortality were associated with malnutrition" (Adedokun & Yaya, 2021). Studies have associated the distribution of protein energy malnutrition and micronutrient deficiencies among populations with socioeconomic, education, sanitation, environment, season, and climatic conditions (Agostoni et al., 2023).

2.2 Dietary patterns and nutritional status of children under 5

The dietary patterns and nutritional status of children under five in Tongor Sub-District are shaped by a confluence of socioeconomic, cultural, and environmental factors, which collectively influence the prevalence of malnutrition. Four critical dietary dimensions dietary diversity, sugar-sweetened beverage (SSB) intake, fruit and vegetable consumption, and breastfeeding practices are pivotal in understanding the dual burden of undernutrition and overnutrition observed in this region (Iddrisu & Gyabaah, 2023).

Dietary diversity, a key determinant of nutritional adequacy, remains suboptimal in Tongor, with only 52% of children meeting the Minimum Dietary Diversity (MDD) threshold (UNICEF/WHO, 2021). Reliance on starchy staples such as cassava, gari, and maize, coupled with infrequent consumption of nutrient-dense foods like legumes, eggs, and dark green leafy vegetables, perpetuates micronutrient deficiencies and energy-protein malnutrition (Amoah et al., 2024; FAO, 2021). This aligns with findings from similar low-resource settings, where limited access to diverse

foods correlates strongly with stunting and underweight (Global Nutrition Report, 2018). In Ghana, the 2022 Demographic and Health Survey highlights that households in rural areas like Tongor often prioritize calorie-dense over nutrient-rich foods due to economic constraints, exacerbating growth faltering and cognitive impairments in children (GDHS, 2022).

Sugar-sweetened beverage (SSB) intake introduces a paradoxical dimension to malnutrition trends. Despite high rates of undernutrition, 21.8% of children consume sweets, chocolates, or FanYogo, reflecting shifts toward processed, energy-dense diets influenced by urbanization and market accessibility (FAO, 2019). Such dietary transitions, documented in the Global Nutrition Report (2018), contribute to early-onset overweight and metabolic disorders, creating a dual burden where undernutrition coexists with overnutrition. In Tongor, caregivers often perceive SSBs as affordable luxuries, inadvertently displacing breastmilk or nutrient-rich complementary foods (Gebremichael et al., 2025). This pattern mirrors national trends, where SSB consumption among under-fives has risen by 15% over the past decade, linked to aggressive marketing and poor regulatory frameworks (Ghana Nutrition Surveillance Survey, 2023).

Fruit and vegetable intake remains alarmingly low, with only 25% of children consuming fruits and 29.4% eating dark green leafy vegetables. This deficit in vitamin A, iron, and folate intake directly contributes to anemia, xerophthalmia, and compromised immune function (Atuna et al., 2022; WHO, 2024). Cultural preferences for starchy staples, seasonal variability, and limited caregiver awareness of nutrient-rich indigenous plants further restrict consumption (Drammeh et al., 2019). For instance, cocoyam leaves and amaranth locally available and nutrient-dense are underutilized despite their potential to mitigate micronutrient gaps (Atuna et al., 2022). The Ghana School Feeding Programme's failure to integrate locally sourced fruits and vegetables into meals exacerbates this gap, as noted in the National Nutrition Policy review (MOH, 2020).

Breastfeeding practices are foundational to early nutrition, yet suboptimal in Tongor. Early introduction of complementary foods, driven by maternal work demands and misconceptions about breastmilk adequacy, leaves infants vulnerable to infections and nutrient deficiencies (Victora et al., 2016). Exclusive breastfeeding rates in Ghana's Volta Region lag behind national targets, with only 43% of infants under six months exclusively breastfed (GDHS, 2022). This aligns with findings by Akhtar (2016), who emphasizes that interrupted breastfeeding disrupts immune development and heightens susceptibility to diarrheal diseases, a leading cause of wasting. Community-based studies in Northern Ghana further underscore that maternal education and workplace support are critical to improving breastfeeding duration and quality (Iddrisu & Gyabaah, 2023).

2.3 Socioeconomic and demographic factors affecting the nutritional Status of children under 5.

Socioeconomic factors such as poverty, education, and employment status significantly contribute to malnutrition (Hoddinott & Bassett, 2008). Poverty is a primary determinant of nutritional status, as families with limited financial resources often struggle to provide adequate food, leading to undernutrition (Hoddinott & Bassett, 2008). Studies show that children from low-income households are more likely to experience stunting and wasting (Hoddinott & Bassett, 2008; Ghosh, 2018).

Maternal education is another critical factor influencing child nutrition. Educated mothers are more likely to understand the nutritional needs of their children and adopt better feeding practices (Ghosh, 2018). Research indicates that higher maternal education levels correlate with improved child nutritional outcomes (Ghosh, 2018; Victora et al., 2016).

Research indicates a strong correlation between socioeconomic status and child nutrition in Sub-Saharan Africa, where families with higher income levels can afford a more diverse and nutritious diet, while those in poverty often rely on starchy staples, lacking essential nutrients (Alderman et al., 2016). Gender inequality also affects child nutrition (Ghosh, 2018)

In many Sub-Saharan African countries, women have limited access to education and economic opportunities, impacting their ability to provide adequate nutrition for their children (Mason et al., 2018). Empowering women through education and economic support can lead to improved nutritional outcomes for children (Mason et al., 2018). Furthermore, there are significant disparities in nutritional status between urban and rural areas in Sub-Saharan Africa. Rural families often face challenges such as food insecurity, limited access to healthcare, and inadequate sanitation, which contribute to higher rates of malnutrition (FAO, 2019).

Despite progress in addressing malnutrition, many countries still face significant challenges (Bourne et al., 2019). Cultural beliefs and practices can influence dietary choices and child feeding practices (Bourne et al., 2019). In some cultures, certain foods may be deemed inappropriate for young children, leading to imbalanced diets (Bourne et al., 2019). Additionally, the structure of food systems in Africa affects nutrition. Many regions rely on subsistence farming, which may not provide sufficient variety or quantity of food (Gelli et al., 2017). Market access can be limited, particularly in rural areas, making it difficult for families to obtain nutritious foods (Gelli et al., 2017).

2.4 Environmental and sanitation factors contributing to malnutrition in children Under 5

The problem of malnutrition in children is not only related to food availability or access but also driven by environmental sanitation aspects (Oginawati et al., 2023). Environmental factors indirectly influence children's growth and development (Yenita et al., 2021), which can ultimately

lead to poor nutritional status in children (Ainy et al., 2021). In Indonesia, environmental factors that threaten children come from exposure to contaminated water, air, food, and soil (Haryanto, 2020). These sources of exposure indicate the importance of implementing hygiene and sanitation. Good environmental sanitation can reduce the potential for a history of infectious diseases in children (Bliznashka et al., 2021). In Indonesia, the proportion of households with access to adequate sanitation services reached 80.92 percent (%) in 2022. This percentage increased by 0.63% compared with that in 2021 (BPSRI, 2022). Environmental sanitation factors include water, sanitation, and hygiene (WASH), which is a factor that explains most (24.0%) of the difference in the incidence of chronic malnutrition in children living in urban and rural areas. Poor WASH access and behavior causes 1.6 million deaths annually (Chirgwin et al., 2021), and it is a determinant of chronic malnutrition in children (Lin et al., 2023). The incidence of malnutrition becomes more frequent in low-income families. Low-income family environmental sanitation increases the potential for children to experience chronic malnutritionchronic malnutrition 1.979 times compared with children from families with good sanitation (Oginawati et al., 2023). Healthy environmental sanitation needs to be continuously maintained by involving families (Ainy et al., 2021).

Good environmental sanitation can reduce the potential for a history of infectious diseases in children (Bliznashka et al., 2021). Efforts to avoid chronic malnutrition can be made in the first 1000 days of life, which is a critical period for children's growth and development (Shirisha et al., 2022). In the first 1000 days of a child's life, the child's body is in a dynamic stage of body development, so it is vulnerable to exposure to environmental factors. Exposure to these sources can increase the risk of potential diseases, such as acute hepatitis A, diarrhea, dengue fever, and malaria, due to lack of water supply and sanitation, vectors, parasites, and others (Haryanto, 2020;

Truong et al., 2023). Infectious diseases can have implications for poor nutritional conditions in children. When a child suffers from an infectious disease, the child's appetite becomes poor. The absorption of nutrients into the child's body becomes less than optimal. Insufficient supply of essential substances needed by the body can result in weight loss among children, resulting in nutritional and energy intake that is less than what the child should need. In the long term, infection with infectious diseases can encourage child malnutrition due to decreased appetite and absorption of nutrients in the intestine (Fadjriah et al., 2021). The most significant proportion of children's nutritional problems is chronic malnutrition (Lefebo et al., 2023). Chronic malnutrition chronic malnutrition is a failure in a child's anthropometry, resulting in a disproportionate body due to weight loss (Li et al., 2020). For Sub-Saharan Africa, the Comprehensive Climate Change scenario studies carried out by the International Food Policy Research Institute (IFPRI) predict consistently higher temperatures and mixed precipitation changes for the 2050 period. Compared to historic climate scenarios, climate change will lead to changes in yield and area growth, higher food prices and therefore lower affordability of food, reduced calorie availability, and growing childhood malnutrition in Sub-Saharan Africa (Ringler et al., 2017). In 2005 a popular study conducted by the World Bank in Ethiopia found that the impact of access to basic environmental services, such as water and sanitation on the probability children are stunted and underweight (Silva & World Bank, Environment Department, 2005). n rural areas, where only 15% of households have improved sanitation (Ghana Demographic and Health Survey [GDHS], 2017), children are particularly vulnerable to infections that hinder nutrient absorption (Victora et al., 2016). Moreover, maternal education plays a critical role; educated mothers are more likely to implement better hygiene practices and provide nutritious meals (Ghosh, 2018). In communities like Tongor Sub-District, addressing these sanitation challenges through improved water quality

and hygiene education is essential for breaking the cycle of malnutrition. Comprehensive strategies targeting these environmental factors are crucial for enhancing child health outcomes in Ghana (FAO, 2019).

2.5 Healthcare Access and practices related to child nutrition

Access to healthcare services, including maternal and child health programs, is essential for providing nutritional education and support, which can significantly affect dietary practices and health outcomes in children (Victora et al., 2016). In Sub-Saharan Africa, the situation is particularly dire, with malnutrition rates among the highest in the world. The region faces numerous challenges, including inadequate healthcare infrastructure, high poverty rates, and limited access to essential services (FAO, 2019). A study by Gelli et al. (2017) emphasizes that inadequate healthcare access contributes to poor nutritional practices, as families may lack the necessary information and resources to provide adequate nutrition for their children. Furthermore, the prevalence of infectious diseases, often exacerbated by poor healthcare access, leads to increased vulnerability among children, further complicating efforts to improve nutrition (Alderman et al., 2016). As we narrow the focus to the African continent, it becomes clear that healthcare access varies significantly across countries. In many African nations, healthcare systems are underfunded and overstretched, limiting the availability of services related to child nutrition (Mason et al., 2018). Additionally, cultural beliefs and practices can influence dietary choices and healthcare-seeking behavior, leading to suboptimal nutrition for children (Ghosh, 2018). For instance, traditional beliefs may prioritize certain foods over others, impacting the diversity and quality of diets available to children.

Access to healthcare services also plays a vital role in child nutrition. Families with limited access to healthcare are less likely to receive necessary interventions for malnutrition (Victora et al.,

2016). Regular health check-ups can help identify nutritional deficiencies early and provide appropriate guidance (Victora et al., 2016).

In Ghana, the challenges surrounding healthcare access and child nutrition are pronounced. Despite notable progress in reducing malnutrition rates, the country still faces significant barriers, particularly in rural areas. The Ghana Demographic and Health Survey (GDHS, 2017) indicates that many households lack access to healthcare facilities, which limits their ability to seek nutritional guidance and support. This lack of access is often compounded by socioeconomic factors, such as low maternal education levels and poverty, which further hinder families' ability to provide nutritious meals for their children (Ghosh, 2018). Moreover, healthcare practices related to child nutrition in Ghana are influenced by the availability and accessibility of health services. Research shows that mothers who attend antenatal and postnatal care are more likely to adopt recommended feeding practices, such as exclusive breastfeeding and timely introduction of complementary foods (Alderman et al., 2016). However, the GDHS (2017) highlights that only a fraction of mothers receives adequate healthcare during pregnancy and after childbirth, which limits their access to vital nutritional information and support. Community-based interventions and programs aimed at improving healthcare access and nutritional practices are essential for addressing these challenges in Ghana. Initiatives that promote maternal education, enhance healthcare infrastructure, and provide nutritional counseling can significantly improve child nutrition outcomes (Mason et al., 2018).

2.6 Conclusion

This literature review highlights the multifaceted determinants of malnutrition among children under five, emphasizing its persistent prevalence in Sub-Saharan Africa and Ghana despite global and national interventions. Key findings reveal that socioeconomic disparities, such as poverty,

low maternal education, and household income, significantly hinder access to nutritious diets and healthcare services. Environmental factors, including poor sanitation and limited access to clean water, exacerbate risks of infection and nutrient absorption deficits, perpetuating cycles of undernutrition. Dietary patterns in low-resource settings often lack diversity, with reliance on starchy staples and insufficient intake of micronutrient-rich foods, contributing to stunting, wasting, and micronutrient deficiencies. While healthcare access and maternal practices are critical, gaps persist in service utilization and culturally tailored nutrition education. Regional studies highlight progress, yet localized data from areas like Tongor Sub-District remain sparse, masking context-specific challenges.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter outlines the methods employed to investigate the factors contributing to malnutrition among children under 5 years in the Tongor Sub-district, South Dayi, Volta Region, Ghana. The methodology is designed to address the objectives outlined in this study. The chapter provides an overview of the study design, site, population, sampling techniques, data collection procedures, analytical methods, ethical considerations, and dissemination plans.

3.2 Study site

The study was conducted as a multicenter study in the Tongor Sub-district, located in the South Dayi District of the Volta Region, Ghana. The research covers five key healthcare facilities that serve as primary points of care for the community: E.P. Health Center, a mission facility operating under the Christian Health Association of Ghana; Tsanakpe Health Center, operated by the Ghana Health Service; and three outreach posts- Pigfarm, Dzakiti, and Market. The E.P. Health Center and Tsanakpe Health Center represent the main healthcare providers in the area, while the outreach posts, established by the respective health centers, focus on monitoring the growth and health of children under 5 years on designated days or during market days. This study site was chosen because the rate of malnutrition exceeds national and regional averages.

3.3 Research methods and design

A quantitative cross-sectional study method was utilized to assess the factors contributing to malnutrition in children under five years of age in the Tongor Sub-District of South Dayi District, Volta Region, Ghana. This design is suitable for identifying the prevalence of malnutrition and its

associated factors at a specific point in time. A structured questionnaire was administered to gather data from primary caregivers of children under five years. The questionnaire was divided into sections covering socio-demographic information, dietary intake, anthropometric information, environmental and sanitation factors, and maternal and caregiver practices. Participants with no formal education, who had difficulties to read and understand where provided with a translator, who explained the context of the questionnaire and their responses where noted. Participants were selected using a stratified multistage sampling technique, where five key healthcare facilities serving the community were identified as strata. Within each facility's catchment area, clusters (villages or communities) were randomly selected, and households with children under five were systematically sampled. Data collection was conducted over a month by a team of trained researchers. The team did undergo training on survey administration, anthropometric measurement techniques, and ethical considerations. Data was collected using KoboCollect on tablet devices, ensuring efficient and accurate data entry. Anthropometric measurements, including weight, height, and mid-upper arm circumference (MUAC), were taken to assess the nutritional status of the children. The Breoselow tape and the Seca (a portable stadiometer and digital scale) were used to measure the height and weight of children. Ethical considerations were strictly adhered to, including obtaining informed consent from the participants and ensuring confidentiality.

3.4 Data collection techniques and tools

A survey technique was employed to collect data for this study. Surveys collected information by interviewing a sample of respondents from a well-defined population. The questionnaire used was divided into three (3) different sections. Section A (Sociodemographic), Section B (Dietary Patterns and Nutritional intake of the child) and Section C (Anthropometric information of the

child). The survey was self-administered, and each respondent was given 25 to 40 minutes to complete the questionnaire.

This study evaluated child malnutrition through anthropometric measurements aligned with World Health Organization (WHO) protocols, though Body Mass Index (BMI) was not directly calculated for children under five. Instead, weight and height measurements were used to derive three WHO-recommended indices essential for this age group. Weight was precisely measured using digital scales (Seca brand), while height/length was obtained through portable stadiometers and Breoselow tapes. These core measurements were then transformed into standardized z-scores by comparing each child's weight-for-age, height-for-age, and weight-for-height against the WHO Child Growth Standards median reference population.

Nutritional categories were determined through specific deviation thresholds from WHO medians: underweight was classified when weight-for-age fell below -2 standard deviations (SD), stunting when height-for-age was <-2 SD, wasting when weight-for-height was <-2 SD, and overweight when weight-for-height exceeded +2 SD.

3.5 Study population

The study population consisted of children under five (5) years of age and their mothers/caregivers in the Tongor Sub-District of the South Dayi District, Volta Region, Ghana.

3.9 Sampling size and sampling procedures

The study employed a simple random sampling technique to recruit participants. The estimated total population of children under five years of age in the Tongor Sub-District is 23,070, with approximately 4,268 children under the age of five.

Given the multicenter nature of this study, a stratified multistage sampling technique was employed. The five healthcare facilities (E.P. Health Center, Tsanakpe Health Center, and the three outreach posts) served as the primary strata. First, the sample size was proportionally allocated to each of the five healthcare facilities based on their catchment population. Within each healthcare facility's catchment area, clusters (villages or communities) were randomly selected.

Finally, households with children under 5 were systematically sampled within these clusters. The overall sample size was calculated using the Cochran sample size formula (Cochran 1977).

$$n_0 = \frac{(Z)^z (p) \times (1-p)}{(e)^2}$$

Where:

n_0 = initial sample size

Z = Z-score for the desired confidence level (1.96 for 95% confidence)

p = estimated proportion of the population with the characteristic of interest (0.17, based on the national stunting prevalence), (Ghana Demographic Health Survey, 2022).

e = desired level of precision (0.05)

Using a 17% prevalence of stunting from the 2022 Ghana Demographic Health Survey, and a margin of error of 5% at a 0.05 significance level.

$n_0 = (1.96)^2 * 0.17 * (1-0.17) / (0.05)^2$

$n_0 = 3.8416 * 0.17 * 0.83 / 0.0025$

$n_0 = 0.54175888 / 0.0025$

$n_0 = 216.70$ (rounded to 217)

Including a 10% non-responding rate, the final sample size is 248 Children/caregivers. A total of 248 participants were selected to participate in the study.

3.6 Inclusion criteria

All children under five (5) years of age and their mothers/caregivers in the Tongor Sub-District who gave consent and were willing to participate were included in the study.

3.7 Exclusion criteria

Participants who failed to give their consent were not included in the study. Additionally, children over five years of age, as well as mothers/caregivers without a child under five (5) years of age, were excluded from study.

3.8 Study variables

Table 3.1: Description of Dependent Variable of Interest

Variable	Operational Definition	Scale of Measurement
Malnutrition in Children under Five	This includes underweight, stunting, wasting, and overweight.	Categorical (Ordinal)
Underweight	Weight for age < -2 standard deviations (SD) of the WHO Child Growth Standards median.	
Stunting	Height for age < -2 SD of the WHO Child Growth Standards median	
Wasting	Weight for height < -2 SD of the WHO Child Growth Standards median.	
Overweight	Weight for height > +2 SD of the WHO Child Growth Standards median	

Table 3.2: Description of Independent Variables of Interest

Variable	Operational Definition
Place of Birth	The place of birth is the location where a child was born, often used in legal documents.
Age (In months)	Age category at the last birthday of the child.
Gender	Sex of the child (Binary: male or female).
Birth Weight of Child	Child's weight recorded at birth.
Age of Mother	Mother's age category at her last birthday.
Mother's Marital Status	The current spousal relationship status of the mother.
Child Guardian Relationship	The type of relationship between the guardian and the child.
Occupation of Mother/Guardian	Mother's or guardian's usual or principal work or business, especially as a means of earning a living. e.g. Civil servant, entrepreneur, Artisan, and Farmer.
Mother/Guardian's Educational Qualification	The highest level of educational qualification attained by the mother or guardian.

Table 3.3: Additional Independent Variables of Interest

Variable	Operational Definition	Scale of Measurement
Guardian's Educational Level	The highest level of education attained by the mother or guardian.	Categorical (Ordinal)
Family Size	The total number of individuals living in the household.	Categorical (Ordinal)
Socioeconomic Status	The social and economic position of the family, often assessed through income and education levels.	Categorical (Ordinal)
Access to Healthcare	Availability of healthcare services to the family, including distance to the nearest healthcare facility.	Categorical (Nominal)
Nutritional Knowledge	The level of understanding regarding nutrition and dietary needs of children.	Categorical (Ordinal)

3.10. Pre-testing

Before data collection, a pretest of all data collection instruments was conducted in the North Dayi sub-district which has similar characteristics to the study area. A sample of 30 caregiver-child pairs were recruited for the pretest. The process assessed the clarity of questions, cultural appropriateness, logical flow, and time required for questionnaire completion and anthropometric measurements. Additionally, inter-rater reliability for anthropometric measurements was evaluated. Based on the pretest results, necessary adjustments were made to the questionnaire and data collection procedures. These adjustments included revisions to ambiguous questions, such as replacing vague dietary frequency terms like "often" or "rarely" with more specific time-based descriptors (e.g., "daily" or "weekly"), and substituting culturally unfamiliar food examples (e.g., "agushi stew") with locally recognized dishes to improve comprehension. The hygiene practices section was expanded to include explicit examples of behaviors like handwashing before feeding, while redundant or repetitive sections were streamlined to reduce interview duration from 40 to 25 minutes. Anthropometric protocols were standardized, particularly for mid-upper arm circumference (MUAC) measurements, with additional training provided to enumerators to ensure consistency. Finally, key terms in the translated Ewe version of the questionnaire were refined to align with community vernacular, ensuring linguistic accuracy and cultural relevance. These modifications enhanced the tool's validity, reliability, and usability prior to full-scale data collection.

3.11 Data handling

All collected data were stored securely on encrypted, password-protected servers with restricted access with daily backups performed to prevent data loss. Personal identifiers were removed from

the main dataset and stored separately with limited access. Data cleaning was conducted regularly during the collection phase to identify and rectify any inconsistencies or errors. Only authorized research team members had access to the data, and all team members signed confidentiality agreements.

3.12 Data analysis

Data analysis was performed using STATA version 18.0. Descriptive statistics was computed for all variables, with continuous variables presented as means (± standard deviation) or medians (interquartile range) depending on their distribution, and categorical variables as frequencies and percentages. The nutritional status of children was assessed using WHO growth standards, with z-scores calculated for weight-for-age, height-for-age, and weight-for-height. Bivariate analysis was conducted using chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables, as appropriate. Multivariate logistic regression models were constructed to identify factors independently associated with malnutrition, adjusting for potential confounders. A p-value < 0.05 was considered statistically significant.

3.13 Ethical consideration

Ethical approval for this study was sought from the Institutional Review Board of Ensign Global University (ethics number attach as an appendix), as well as institutional approval from the South Dayi district health directorate, Tsanakpe Health Center and E.P Health Center. Informed consent was obtained from all participants, with information provided in written format and was explained to participants in the local language. For children under 5, parental consent was obtained. Participants were informed of their right to withdraw from the study at any point during data collection without consequences. All data was de-identified to ensure confidentiality. In cases where severe malnutrition was identified, participants were referred to appropriate health services.

The study adhered to the principles outlined in the Declaration of Helsinki and the Council for International Organizations of Medical Sciences (CIOMS) guidelines. The dataset will be kept for a duration of three years to facilitate its use as a point of reference in publications produced within that time frame.

3.14 Limitations of study

The use of a cross-sectional study design in which both the nutritional status and associated determinants were assessed at the same time implied that a cause-effect relationship cannot be established to increase the internal validity of the results. All the requirements expected of the statistical models will be met.

3.15 Study Assumption

Malnutrition among children under five in the Tongor Sub-District is believed to stem from a complex interplay of dietary, socioeconomic, environmental, and healthcare-related factors. These factors include inadequate dietary diversity due to limited access to nutrient-rich foods, socioeconomic constraints such as household poverty and low maternal education, environmental challenges like reliance on unimproved water sources and poor sanitation, along with barriers to healthcare access and nutritional education. The interconnections between these determinants are likely to perpetuate cycles of undernutrition and emerging overnutrition. The study also posits that these factors are quantifiable through cross-sectional analysis and that identifying their specific contributions will enable targeted, multisectoral interventions to improve child health outcomes.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

The result of this study was presented based on the following objectives of the study: (i) assess the dietary patterns and nutritional status of children under five in Tongor Sub-district; (ii) evaluate environmental and sanitation factors contributing to malnutrition; and (iii) analyze socioeconomic and demographic determinants affecting nutritional outcomes. Structured to address these aims, the analysis section first examines dietary diversity and anthropometric measures (e.g., underweight, stunting, wasting, overweight) to characterize nutritional status. Subsequent sections explore household water sources, sanitation practices, and waste disposal methods to identify environmental risks.

4.2 Socio-demographic and socioeconomic characteristics, environmental and sanitation factors of respondents in Tongor Subdistrict

A total of 248 under-five children in the Tongor Subdistrict within the South Dayi District of the Volta Region of Ghana were recruited for the current study. The majority of the children 131(52.8%) were females and a relative majority 69(27.8%) were between the ages of 6 and 11 months. The majority of the mother's/caregiver's 88 (35.5%) were between the ages of 15 and 24 years and 100 (40.3%) had a primary level of education. Akan/Guan was the least ethnic group represented 9 (3.63%) and people who belonged to Ewe ethnic group formed a relative majority 205 (82.7%). Most of the respondents were Christians 212 (85.5%). The majority of the mother's/caregiver's 153(61.7%) occupations were informal and a relative majority 153 (61.7%) earn less than GHS 500 per month. Most of the respondents 127(51.2%) got the water they use daily from unimproved sources (bottled water, river, sachet water, other). A majority of the

respondents' households, 227(91.5%) has less than four children and majority 199 (80.2) has access to improved toilet facilities (KVIP, Flushing, pit latrine with slaps). The primary method of refuse disposal in most households was unimproved 190(76.6%) as indicated in Table 4.1.

Table 4.1: Socio-demographic and socioeconomic characteristics, environmental and sanitation factors of respondents (n=248)

Variable	Frequency	Percent
Sex of child		
Male	117	47.2
Female	131	52.8
Age of child (in months)		
0 – 5	44	17.8
6 – 11	69	27.8
12 – 23	65	26.2
24 – 35	34	13.7
36 – 47	12	4.8
48 – 59	24	9.7
Mother's/Caregiver's age in years		
15 – 24	88	35.5
25 – 29	67	27
30 – 34	53	21.4
35 – 39	29	11.7
≥40	11	4.4
Mother's/Caregiver's educational level		
No formal education	43	17.4
Primary education	100	40.3
Secondary education	92	37.1
Tertiary education	13	5.2
Mother's/Caregiver's religion		
African Traditional Religion	5	2
Christianity	212	85.5
Islam	31	12.5
Mother's/Caregiver's ethnic group		
Akan/Guan	9	3.63

Ewe	205	82.7
Ga/Dangme	24	9.7
Other	10	4
Mother's/Caregiver's occupation		
Informal	153	61.7
Formal	15	6.1
Unemployed	80	32.2
Household income per month (GHS)		
<500	142	57.3
500 – 999	56	22.6
1,000 – 1,499	29	11.7
1,500 – 1, 999	9	3.6
≥2,00	12	4.8
Number of children under 5 in the household		
Less than 4 children	227	91.5
4 or more children	21	8.5
Household's main source of drinking water		
Improved water	121	48.8
Unimproved water	127	51.2
Household's toilet facility		
Improved	199	80.2
Unimproved	49	19.8
Household's primary method of disposing refuse		
Improved	58	23.4
Unimproved	190	76.6

4.3 Dietary Diversity of Children Under 5 years in Tongor Subdistrict

The data shows varying consumption patterns of different food groups among children under five years. Fish, dried fish, koobi, anchovies, smoked herring, crab, and shrimp 150(60.5%) represents

the most commonly consumed protein source. Other vegetables such as tomatoes, okro, garden eggs cabbage and mushroom 138(55.5%) were the only vegetable category consumed by more than half of the children. Cakes, biscuits rock bun, toogbee and bofrot were consumed by 111(44.8%) of children. Eggs were included in 93(37.5%) of children's diets. Dark green leafy vegetables such as cocoyam leaves, amaranth leaves were consumed by 73(29.4%) of children, while 74(29.8%) consumed meat sources like beef, goat, sheep, pork, grasscutter, chicken, and guinea fowl. Fufu, gari, kokonte, cassava, yam, cocoyam, plantain, and white sweet potato were part of the diet for 71(28.6%) of children. Beans or Bambara beans were consumed by 44 (25%), and other fruits, such as banana, pineapple, avocado, pear, watermelon, and orange were included in the diets of 62(25%) children. Other food group least consumed by children include groundnuts, kuli kuli, groundnut paste, groundnut soup, agushi stew and neri products 59 (23.8%), toffees, chocolates, ice cream, and FanYogo 54(21.8%), packaged yellow plantain chips or potato chips, indomie, franch fries, fried potato, atomo, and spring rolls 35(14.1%), ripe mango, ripe papaya, or African star apple 31(12.5%), carrots, or sweet potatoes that are yellow and orange inside 28 (11.3%), brukina and youghurt 27(10.9%). Cheese, curd and wagashi products18(7.3%), Gizzard and liver 15(6.1%), sausage and corned beef 13 (5.2%) and termites 4(1.6%).

Table 4.2 Dietary Components of the children

Selected food groups	**Yes (n%)**	**No (n%)**
Brukina or youghurt?	27(10.9)	221(89.1)
Carrots, or sweet potatoes that are yellow or orange inside?	28(11.3)	220(88.7)
Fufu, gari, kokonte, cassava, yam, cocoyam, plantain, or white sweet potato?	71(28.6)	177(72.4)
Any other dark green leafy vegetables, such as cocoyam leaves, amaranth leave?	73(29.4)	175(70.6)

Any other vegetables, such as tomatoes, okro, garden eggs, cabbage, mushroom?	138(55.5)	110(44.5)
Ripe mango, ripe papaya, or African star apple?	31(12.5)	217(87.5)
Any other fruits, such as banana, pineapple, avocado, pear, watermelon, orange?	62(25.0)	186(75.0)
Fish, dried fish, koobi, anchovies, smoked herring, crab, or shrimp?	150(60.5)	98(39.5)
Gizzard or liver?	15(6.1)	233(93.9)
Sausages or corned beef?	13(5.2)	235(94.8)
Any other meat, such as beef, goat, sheep, pork, grasscutter, chicken, or Guinea fowl?	74(29.8)	174(70.2)
Eggs?	93(37.5)	155(62.5)
Beans or Bambara beans?	44(25.0)	204(75.0)
Groundnuts, kuli kuli, groundnut paste, groundnut soup, agushi stew or neri?	59(23.8)	189(76.2)
Cheese curd or wagashi?	18(7.3)	230(92.7)
Termites?	4(1.6)	244(98.4)
Cakes, biscuits, rock bun, toogbee or bofrot?	111(44.8)	137(55.2)
Toffees, chocolates, ice cream, or FanYogo?	54(21.8)	194(78.2)
Packaged yellow plantain chips or potato chips, indomie, Franch fries, fried potato, atomo, or spring rolls?	35(14.1)	213(85.9)
Red palm oil?	91(37)	157(63.3)

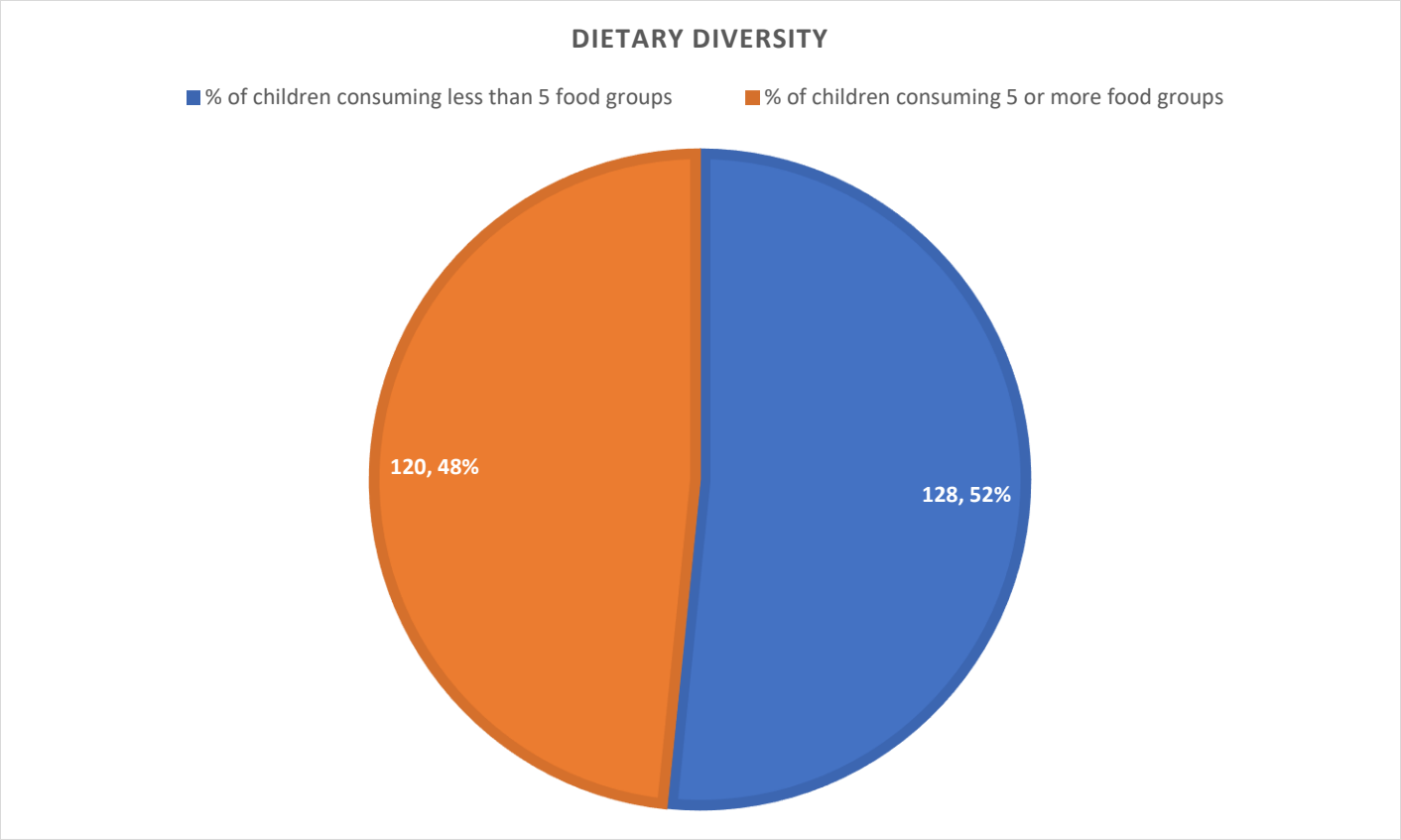

Figure 3 Dietary Diversity

Among the 248 children under five years examined, 52% met the criteria for Minimum Dietary Diversity (consumption of at least 5 or more food groups), while 48% did not achieve minimum dietary diversity (consumed less than 5 food groups).

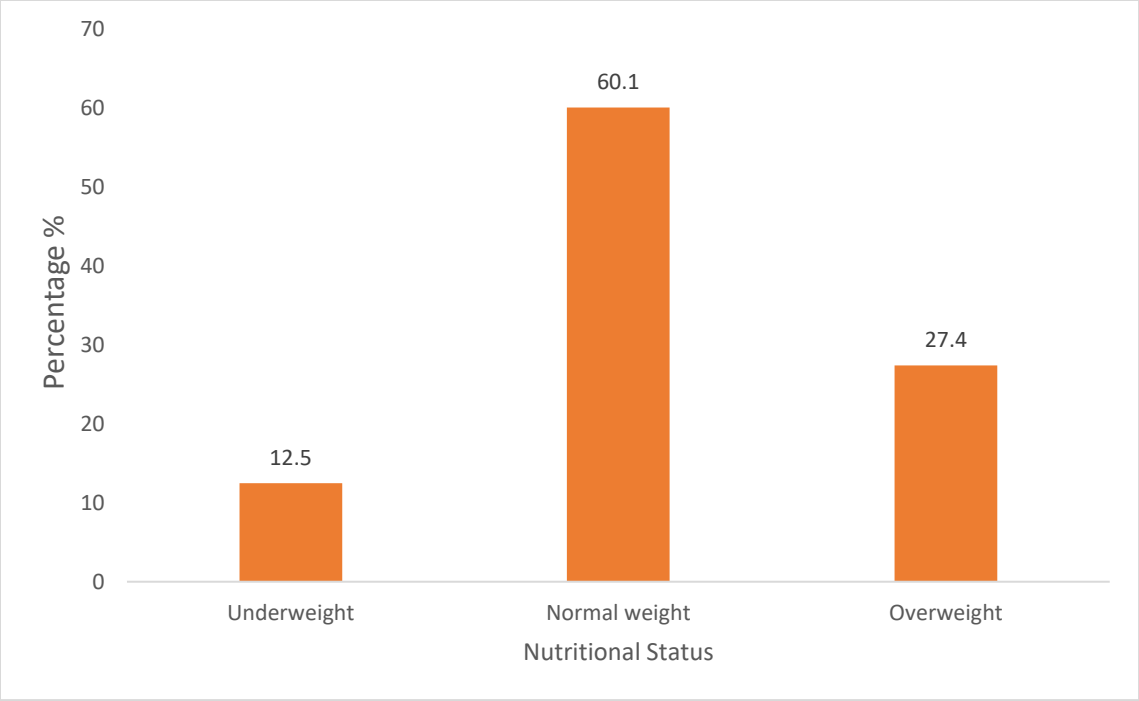

Figure 4 Nutritional status of children under 5 in Tongor Sub-district

Nutritional status of children under 5 in Tongor Sub-district.

Overall, from Figure 4.1, 149(60.1%) of children had normal weight. While 31 (12.5%) and 68(27.4%) of the children were underweight and overweight, respectively.

4.4 Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to underweight, normal weight and overweight nutritional status in children under 5 in Tongor Sub-district

The association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to underweight in children under 5 is shown in Table 4.3. After adjusting for confounding variables, children aged 48-59 months were over 5 times more likely of being underweight [AOR= 5.61; p=0.015)]. Also, children from households using unimproved water sources are significantly more likely to be underweight [2.62; p=0.028]. Mother's/caregiver's religious affiliation showed a statistically significant association with child underweight status overall (p=0.046), though individual religious comparisons did not reach statistical significance in the adjusted analysis. Other factors including sex of child, mother's/caregiver's age, education level, occupation, household income, number of children in the household, toilet facilities, and refuse disposal methods did not show statistically significant associations with underweight status in children (Table 4.3).

Table 4. 2: Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to underweight in children under 5 in Tongor Sub-district

Variable	Underweight		Chi-square (X2) (p-value)	COR (95%C. I) (P-value)	AOR (95%C.I)(p-value)
	Non-underweight	Underweight			
Sex of child					
Male	98(83.8)	19(16.2)		1.92(0.89, 4.15) (0.096)	2.51(0.97, 6.47) (0.057)
Female	119(90.8)	12(9.2)	2.83(0.092)	Ref	Ref
Age of child (in months)					
0 – 5	40(90.9)	4(9.0)		Ref	Ref
6 – 11	60(87.0)	9(13.0)		1.50 (0.43, 5.20) (0.523)	1.27(0.31, 5.26) (0.739)
12 – 23	59(90.8)	6(9.2)		1.02 (0.27, 3.83) (0.980)	1.02(0.22, 4.65) (0.979)
24 – 35	30(88.2)	4(11.8)		1.33 (0.31, 5.77) (0.700)	0.98(0.18, 5.33) (0.980)
36 – 47	12(100.0)	0(0.0)		0.04 (0.04, 0.28) (0.518)	1
48 – 59	16(66.7)	8(33.3)	**12.38(0.030)**	5.00 (1.32, 18.96) (0.018)	**7.02(1.22, 40.58) (0.029)**
Mother's/Caregiver's age in years					
15 – 24	78(88.6)	10(11.4)		Ref	
25 – 29	58(86.6)	9(13.4)		1.21(0.46, 3.17) (0.697)	1.90(0.59, 6.13) (0.286)
30 – 34	47(88.7)	6(11.3)		1.0(0.34, 2.92) (0.994)	0.83(0.18, 3.81) (0.808)

35 – 39	23(79.3)	6(20.7)		2.03(0.67, 6.20) (0.211)	2.45(0.55, 10.84) (0.238)
≥40	11(100.0)	0(0.0)	3.57(0.467)	1	1
Mother's/Caregiver's educational level					
No formal education	36(83.7)	7(16.3)		Ref	Ref
Primary education	91(91.0)	9(9.0)		0.51(0.18, 1.47) (0.211)	0.64(0.15, 2.65) (0.534)
Secondary education	78(84.8)	14(15.2)		0.92(0.34, 2.48) (0.874)	0.91(0.23, 3.54) (0.890)
Tertiary education	12(92.3)	1(7.7)	2.58(0.461)	0.43(0.05, 3.85) (0.449)	0.49(0.02, 12.76) (0.668)
Mother's/Caregiver's religion					
African Traditional Religion	4(80.0)	1(20.0)		Ref	Ref
Christianity	190(89.62)	22(10.4)		0.46 (0.05, 4.33) (0.500)	0.81(0.05, 12.01) (0.876)
Islam	23(74.2)	8(25.8)	**6.15(0.046)**	1.39 (0.13, 14.36) (0.782)	3.06(0.17, 55.79) (0.450)
Mother's/Caregiver's ethnic group					
Akan/Guan	8(88.9)	1(11.1)		Ref	Ref
Ewe	182(88.8)	23(11.2)		1.01(0.12, 8.45) (0.992)	3.35(0.18, 63.06) (0.420)
Ga/Dangme	18(75.0)	6(25.0)		2.67(0.27, 25.94) (0.398)	4.53(0.22, 91.36) (0.324)
Other	9(90.0)	1(10.0)	3.80(0.283)	0.89(0.05, 16.66) (0.937)	1.51(0.05, 48.60) (0.817)
Mother's/Caregiver's occupation					
Informal	136(88.9)	17(11.1)		Ref	Ref

Formal	14(93.3)	1(6.7)		0.57(0.07, 4.62) (0.600)	0.50(0.18, 13.70) (0.678)
Unemployed	67(83.8)	13(16.3)	1.77(0.414)	1.55(0.71, 3.39) (0.269)	1.14(0.35, 3.67) (0.827)
Household income per month (GHS)					
<500	122(85.9)	20(14.1)		2.21(0.49, 10.04) (0.303)	1.38(0.21, 9.27) (0.738)
500 – 999	50(89.3)	6(10.7)		1.62(0.31, 8.58) (0.571)	1.22(0.17, 8.97) (0.847)
1,000 – 1,499	27(93.1)	2(6.9)		Ref	Ref
1,500 – 1, 999	8(88.9)	1(11.1)		1.69(0.13, 21.12) (0.685)	3.70(0.19, 74.02) (0.392)
≥2,000	10(83.3)	2(16.7)	1.53(0.822)	2.7(0.33, 21.83) (0.352)	13.88(0.81, 237.92) (0.070)
Number of children in the household					
Less than 4 children	199(87.7)	28(12.3)		Ref	Ref
4 or more children	18(85.7)	3(14.3)	0.07(0.796)	1.18(0.33, 4.28) (0.796)	0.48(0.08, 2.86) (0.422)
Household's main source of drinking water					
Improved water	111(91.7)	10(8.3)		Ref	Ref
Unimproved water	106(83.5)	21(16.5)	**3.88(0.049)**	2.20 (0.99, 4.89) (0.053)	**3.58(1.18, 10.85) (0.024)**
Household's toilet facility					
Improved	177(88.9)	22(11.1)		Ref	Ref
Unimproved	40(81.6)	9(18.4)	1.92(0.166)	1.81(0.78, 4.23) (0.170)	1.23(1.21, 11.17) (0.085)

Household's primary method of disposing refuse					
Improved	47(81.0)	11(19.0)		Ref	Ref
Unimproved	170(89.5)	20(10.5)	2.89(0.089)	0.50(0.23, 1.12) (0.093)	0.40(0.14, 1.17) (0.093)

4.5 Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to normal weight in children under 5 in Tongor Sub-district

No statistically associations ($p<0.05$) were found between normal weight status in children under 5 years and any of the examined sociodemographic characteristics, socioeconomic characteristics, environmental, or sanitation factors (age of child, sex of child, mother's/caregiver's age, education level, religion, occupation, household income, number of children in the household, main source of drinking water toilet facilities, and refuse disposal methods).

Table 4.4: Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to normal weight in children under 5 in Tongor Sub-district.

Variable	**Normal weight**		**Chi-square (X2) (p-value)**	**COR (95%C. I) (P-value)**	**AOR(95%C.I)(p-value)**
	Non-normal weight	**Normal weight**			
Sex of child					
Male	50(42.7)	67(57.3)		0.80(0.48, 1.33) (0.392)	0.79(0.44, 1.42) (0.438)
Female	49(37.4)	82(62.6)	0.73(0.392)	Ref	Ref
Age of child (in months)					
0 – 5	18(40.9)	26(59.1)		Ref	Ref
6 – 11	24(34.8)	45(65.2)		1.29(0.60, 2.83) (0.511)	1.46(0.61, 3.50) (0.396)
12 – 23	24(36.9)	41(63.1)		1.18(0.54, 2.59) (0.675)	1.20(0.5, 2.87) (0.690)
24 – 35	13(38.2)	21(61.8)		1.12(0.45, 2.80) (0.811)	1.50(0.54, 4.16) (0.437)
36 – 47	6(50.0)	6(50.0)		0.69 (0.19, 2.49) (0.574)	0.70(0.18, 2.76) (0.609)
48 – 59	14(58.3)	10(41.7)	4.96(0.421)	0.49 (0.18, 1.36) (0.172)	0.68(0.20, 2.32) (0.541)
Mother's/Caregiver's age in years					
15 – 24	37(42.1)	51(58.0)		Ref	Ref

25 – 29	25(37.3)	42(62.7)		1.22(0.64, 2.34) (0.552)	1.13(0.54, 2.33) (0.750)
30 – 34	26(49.1)	27(50.9)		0.75(0.38, 1.49) (0.418)	1.03(0.43, 2.49) (0.945)
35 – 39	10(34.5)	19(65.5)		1.38(0.57, 3.31) (0.472)	2.03(0.72, 5.72) (0.179)
≥40	1(9.1)	10(90.9)	6.92(0.140)	7.25(0.89, 59.17) (0.064)	16.15(1.58, 164.62) (0.019)
Mother's/Caregiver's educational level					
No formal education	21(48.8)	22(51.2)		Ref	Ref
Primary education	32(32.0)	68(68.0)		2.03 (0.98, 4.21) (0.058)	2.09(0.86, 5.06) (0.102)
Secondary education	42(45.7)	50(54.4)		1.14(0.55, 2.35) (0.730)	1.35(0.56, 3.22) (0.504)
Tertiary education	4(30.8)	9(69.2)	5.76(0.124)	2.15 (0.57, 8.05) (0.257)	0.92(0.13, 6.66) (0.935)
Mother's/Caregiver's religion					
African Traditional Religion	3(60.0)	2(40.0)		Ref	Ref
Christianity	78(36.8)	134(63.2)		2.58 (0.42, 15.76) (0.306)	1.93(0.23, 15.95) (0.543)
Islam	18(58.1)	13(41.9)	5.96(0.051)	1.08 (0.16, 7.44) (0.935)	0.98(0.10, 9.79) (0.986)
Mother's/Caregiver's ethnic group					
Akan/Guan	6(66.7)	3(33.3)		Ref	Ref

Ewe	76(37.1)	129(62.9)		3.39(0.83, 13.97) (0.090)	2.25(0.47, 10.83) (0.311)
Ga/Dangme	11(45.8)	13(54.2)		2.36(0.48, 11.73) (0.293)	2.42(0.42, 14.02) (0.325)
Other	6(60.0)	4(40.0)	5.41(0.144)	1.33(0.20, 8.71) (0.764)	1.06(0.14, 8.11) (0.956)
Mother's/Caregiver's occupation					
Informal	60(39.2)	93(60.8)		Ref	Ref
Formal	4(26.7)	11(73.3)		1.77(0.54, 5.83) (0.345)	2.75(0.44, 17.26) (0.281)
Unemployed	35(43.8)	45(56.3)	1.62(0.445)	0.83(0.48, 1.43) (0.504)	0.88(0.42, 1.84) (0.729)
Household income per month (GHS)					
<500	55(38.7)	87(61.3)		0.97(0.42, 2.20) (0.936)	2.17(0.76, 6.21) (0.148)
500 – 999	24(42.9)	32(57.1)		0.81(0.33, 2.04) (0.662)	1.28(0.44, 3.65) (0.648)
1,000 – 1,499	11(37.9)	18(62.1)		Ref	Ref
1,500 – 1, 999	4(44.4)	5(55.6)		0.76(0.17, 3.47) (0.662)	0.96(0.16, 5.85) (0.966)
≥2,000	5(41.7)	7(58.3)	0.42(0.980)	0.86(0.22, 3.37) (0.824)	0.49(0.07, 3.51) (0.480)
Number of children under 5 in the household					
Less than 4 children	89(39.2)	138(60.8)		Ref	Ref

4 or more children	10(47.6)	11(52.4)	0.57(0.451)	0.71(0.29, 1.74) (0.453)	0.58(0.19, 1.71) (0.321)
Household's main source of drinking water					
Improved water	47(38.8)	74(61.2)		Ref	Ref
Unimproved water	52(40.9)	75(59.1)	0.11(0.735)	0.92(0.55, 1.52) (0.735)	0.80(0.47, 1.38) (0.426)
Household's toilet facility					
Improved	75(37.7)	124(62.3)		Ref	Ref
Unimproved	24(49.0)	25(51.0)	2.09(0.148)	0.63(0.34, 1.18) (0.150)	0.63(0.30, 1.32) (0.219)
Household's primary method of disposing refuse					
Improved	29(50.0)	29(50.0)		Ref	Ref
Unimproved	70(36.8)	120(63.2)	3.21(0.073)	1.71(0.95, 3.10) (0.075)	**2.29(1.12, 4.69) (0.063)**

4.6 Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to overweight in children under 5 in Tongor Sub-district

Based on the data presented, there were no statistically significant associations between any of the examined factors including age of child, sex of child, mother's/caregiver's age, education level, religion, occupation, household income, number of children in the household, main source of drinking water toilet facilities, and refuse disposal methods and overweight status in children under 5 years old. All p-values were greater than 0.05, indicating that none of the relationships reached the conventional threshold for statistical significance.

Table 4.5: Association between sociodemographic and socioeconomic characteristics, environmental and sanitation factors contributing to overweight in children under 5 in Tongor Sub-district.

Variable	Overweight		Chi-square (X2) (p-value)	COR (95%C. I) (P-value)7	AOR(95%C.I)(p-value)
	Non-overweight	Overweight			
Sex of child					
Male	86(73.5)	31(26.5)		0.92(0.52, 1.60) (0.758)	0.82(0.43, 1.55) (0.534)
Female	94(71.8)	37(28.2)	0.0949(0.758)	Ref	Ref
Age of child (in months)					
0 – 5	30(68.2)	14(31.8)		Ref	Ref
6 – 11	54(78.3)	15(21.7)		0.60(0.25, 1.40) (0.234)	0.58(0.23, 1.51) (0.266)
12 – 23	47(72.3)	18(27.7)		0.82(0.35, 1.89) (0.643)	0.77(0.30, 1.04) (0.578)
24 – 35	25(73.5)	9(26.5)		0.77(0.29, 2.08) (0.608)	0.66(0.22, 1.98) (0.455)
36 – 47	6(50.0)	6(50.0)		2.14(0.59, 7.84) (0.250)	2.23(0.55, 9.09) (0.265)
48 – 59	18(75.0)	6(25.0)	4.71(0.452)	0.71(0.23, 2.19) (0.556)	0.43(0.11, 1.66) (0.221)
Mother's/Caregiver's age in years					
15 – 24	61(69.3)	27(30.7)		Ref	Ref
25 – 29	51(76.1)	16(23.9)		0.71(0.34, 1.46) (0.350)	0.66(0.29, 1.48) (0.313)
30 – 34	33(62.3)	20(37.7)		1.37(0.67, 2.80) (0.390)	0.93(0.37, 2.37) (0.883)
35 – 39	25(86.2)	4(13.8)		0.36(0.11, 1.14) (0.083)	0.22(0.06, 0.82) (0.064)

≥40	10(90.9)	1(09.1)	8.29(0.082)	0.23(0.03, 1.85) (0.166)	0.15(0.14, 1.52) (0.108)
Mother's/Caregiver's educational level					
No formal education	29(67.4)	14(32.6)		Ref	Ref
Primary education	77(77.0)	23(23.0)		0.62(0.28, 1.36) (0.234)	0.47(0.18, 1.21) (0.119)
Secondary education	64(69.6)	28(30.4)		0.91(0.42, 1.97) (0.804)	0.66(0.26, 1.65) (0.369)
Tertiary education	10(76.9)	3(23.1)	2.10(0.553)	0.62(0.15, 2.62) (0.517)	1.22(0.13, 11.51) (0.859)
Mother's/Caregiver's religion					
African Traditional Religion	3(60.0)	2(40.0)		Ref	Ref
Christianity	156(73.6)	56(26.4)		0.54(0.09, 3.31) (0.857)	0.135(0.27, 1.52) (0.343)
Islam	21(67.7)	10(32.3)	0.87(0.647)	0.71(0.10, 4.98) (0.734)	0.60(0.35, 2.84) (0.561)
Mother's/Caregiver's ethnic group					
Akan/Guan	4(44.4)	5(55.6)		Ref	Ref
Ewe	152(74.2)	53(25.9)		0.28(0.07, 1.08)(0.064)	0.25(0.05, 1.23) (0.088)
Ga/Dangme	19(79.2)	5(20.8)		0.21(0.04, 1.09)(0.063)	0.17(0.03, 1.10) (0.063)
Other	5(50.0)	5(50.0)	6.92(0.075)	0.80(0.13, 4.87)(0.809)	1.12(0.15, 8.30) (0.909)
Mother's/Caregiver's occupation					
Informal	110(71.9)	43(28.1)		Ref	Ref
Formal	12(80.0)	3(20.0)		0.64(0.17, 2.38)(0.505)	0.47(0.07, 3.37) (0.456)
Unemployed	58(72.5) 22(27.5)		0.45(0.798)	0.97(0.53, 1.78)(0.922)	1.03(0.45, 2.34) (0.946)
Household income per month (GHS)					
<500	107(75.4)	35(24.7)		0.73(0.30, 1.74) (0.475)	0.36(0.12, 1.12) (0.077)

500 – 999	38(67.9)	18(32.1)		1.05(0.40, 2.77) (0.917)	0.78(0.26, 2.35) (0.656)
1,000 – 1,499	20(69.0)	9(31.0)		Ref	Ref
1,500 – 1, 999	6(66.7)	3(33.3)		1.11(0.23, 5.47) (0.897)	0.70(0.11, 4.69) (0.715)
≥2,000	9(75.0)	3(25.0)	1.56(0.816)	0.74(0.16, 3.40) (0.700)	0.59(0.07, 4.88) (0.623)
Number of children under 5 in the household					
Less than 4 children	166(73.13)	61(26.9)		Ref	Ref
4 or more children	14(66.7)	7(33.33)		1.36(0.52, 3.53) (0.527)	2.38(0.75, 7.56) (0.141)
Household's main source of drinking water					
Improved water	84(69.4)	37(30.6)		Ref	Ref
Unimproved water	96(75.6)	31(24.4)	1.18(0.276)	0.73(0.42, 1.28) (0.277)	1.0(0.52, 1.92) (0.995)
Household's toilet facility					
Improved	146(73.4)	53(26.6)		Ref	Ref
Unimproved	34(69.39)	15(30.61)	0.31(0.576)	1.22(0.61, 2.40) (0.576)	1.27(0.57, 2.83) (0.075)
Household's primary method of disposing refuse					
Improved	40(69.0)	18(31.0)		Ref	Ref
Unimproved	140(73.7)	50(26.3)	0.50(0.481)	0.79(0.42, 1.51) (0.481)	0.58(0.26, 1.25) (0.164)

CHAPTER FIVE

5.0 DISCUSSION

5.1 Introduction

This chapter discusses the key findings of the study on dietary diversity, nutritional status, and associated sociodemographic, socioeconomic, and environmental factors among children under five in Tongor Subdistrict, Ghana. The analysis evaluates the prevalence of malnutrition (underweight, normal weight, overweight), dietary diversity patterns, and the role of household characteristics, caregiver demographics, and environmental conditions in shaping nutritional outcomes. The discussion contextualizes these findings within existing literature on childhood malnutrition in low-resource settings, explores contradictions and consistencies with prior studies, and highlights implications for targeted interventions.

5.2 Summary of key findings

The study revealed critical insights into the dietary patterns, nutritional status, and underlying determinants of malnutrition among children under five in Tongor Subdistrict, Ghana. A dual burden of malnutrition was observed, with 60.1% of children classified as having normal weight, 12.5% underweight, and 27.4% overweight. This coexistence of undernutrition and overnutrition underscores the complexity of nutritional challenges in the region. Dietary diversity emerged as a significant concern, as only 52% of children met the Minimum Dietary Diversity (MDD) threshold, defined as consumption from at least five food groups, while nearly half fell short. Fish and seafood and vegetables like tomatoes and okra were the most commonly consumed food groups, reflecting reliance on locally available staples. However, nutrient-dense foods such as eggs, meat, and fruits were less prevalent, indicating limited dietary variety and potential micronutrient deficiencies. Age-specific vulnerabilities were pronounced, with children aged 48–

59 months facing 5.6 times higher odds of being underweight compared to younger age groups. The high prevalence of overweight children signals an emerging public health concern, potentially linked to shifts toward energy-dense, nutrient-poor diets or reduced physical activity. This dual burden of malnutrition aligns with regional trends in Sub-Saharan Africa, where undernutrition persists alongside rising obesity rates due to urbanization and dietary transitions.

5.3 Dietary patterns and nutritional status of children under 5

The dietary diversity and nutritional status of children under five years in Tongor Subdistrict reveal critical insights into feeding practices and their implications for child health. With 52% of children meeting the Minimum Dietary Diversity (MDD) threshold (≥5 food groups) and 48% falling below this benchmark, the findings underscore a polarized dietary landscape. While the majority consume fish/seafood (60.5%) and non-leafy vegetables (55.5%), significant gaps persist in the intake of nutrient-dense foods such as fruits (25%), legumes (25%), and vitamin-A-rich vegetables (11.3%). These patterns align with broader challenges observed in low-resource settings, where staple foods and locally available proteins dominate diets, often at the expense of micronutrient-rich options (FAO, 2021).

The low consumption of dark green leafy vegetables (29.4%) and dairy products (10.9%) contrasts with studies from similar agroecological zones in Ghana, where indigenous leafy vegetables and fermented dairy (e.g., brukina) are more widely utilized (Atuna et al., 2022). This discrepancy may reflect cultural preferences, seasonal availability, or caregiver knowledge gaps about the nutritional value of these foods. The high reliance on processed snacks (44.8% cakes/biscuits; 21.8% sweets/FanYogo) is concerning, as such foods are energy-dense but nutrient-poor, potentially contributing to the observed double burden of malnutrition: 12.5% underweight and 27.4% overweight. This phenomenon reveals trends in urbanizing regions of Sub-Saharan Africa,

where shifts toward processed foods coexist with persistent undernutrition (Gebremichael et al., 2025).

The dominance of fish/seafood as the primary protein source (60.5%) aligns with Ghana's coastal dietary patterns but highlights missed opportunities to diversify protein intake with other affordable options such as termites (consumed by only 1.6%) or legumes. While legumes like beans/Bambara beans are consumed by 25% of children, this figure is lower than national averages reported in Ghana's Demographic and Health Survey (Winichagoon & Margetts, 2017), which attributes higher legume consumption to their role as complementary foods. The underutilization of legumes in Tongor may stem from preparation time constraints or perceptions of digestibility in young children. The nutritional status data further amplifies concerns, 27.4% of children are overweight, a rate higher than Ghana's national average of 18% for under-fives (Owusu et al., 2017). This could be linked to excessive consumption of processed carbohydrates and sugars, compounded by sedentary lifestyles. Conversely, the 12.5% underweight prevalence suggests that food insecurity or inadequate dietary quality persists in subsets of the population. These dual burdens necessitate targeted interventions that address both over- and under nutrition, rather than treating them as mutually exclusive issues.

5.4 Environmental and sanitation factors contributing to malnutrition in children under 5

Environmental and sanitation conditions are important in shaping malnutrition outcomes among children under five, primarily through pathways that disrupt nutrient absorption and amplify disease burdens. inadequate access to clean water and poor sanitation infrastructure, common in many Ghanaian communities, can perpetuate cycles of infection and undernutrition. Contaminated water sources and open defecation practices increase exposure to enteric pathogens, leading to recurrent diarrheal diseases, which impair nutrient absorption and deplete energy reserves. This

aligns with findings from a study in rural Ghana by Belay et al. (2022), which identified a 30% higher risk of stunting among children in households relying on unimproved water sources, compared to those with access to piped water. Similarly, in Tanzania, children exposed to poor sanitation exhibited a 24% higher prevalence of underweight status, attributed to chronic gut inflammation from fecal-oral contamination (Modern et al., 2020).

The role of environmental enteropathy (EE), a subclinical condition caused by frequent fecal-oral pathogen exposure, is particularly salient. EE damages intestinal linings, reducing nutrient absorption even in the absence of overt diarrhea. In Tongor, where only 25% of children consumed legumes a key source of zinc and iron the combined effect of poor micronutrient intake and EE could worsen deficiencies. This is in line with observations in Bangladesh, where children in communities with open defecation had significantly lower height-for-age Z-scores, independent of dietary intake (Rukambile et al., 2020).

In Malawi, communities with poor waste disposal systems reported 40% higher rates of severe acute malnutrition among children during peak malaria seasons (Chilanga et al., 2020). While malaria data specific to Tongor were not reported, Ghana's endemic malaria zones show similar trends, suggesting that environmental factors like stagnant water may indirectly worsen nutritional outcomes.

Household air pollution from biomass fuels, commonly used for cooking in low-resource settings, also intersects with malnutrition. Chronic exposure to smoke induces respiratory infections, elevating metabolic demands and reducing appetite. The lack of hygiene practices, such as inadequate handwashing, further mediates the sanitation-malnutrition nexus. In communities without soap or handwashing stations, fecal bacteria transmission into food and drinking water escalates. A study demonstrated that children in households with no handwashing facilities had

twice the odds of wasting compared to those with soap and water access (Gaffan et al., 2023). In contrast, another study showed that handwashing promotion reduced stunting by 12% over two years (Saxton et al., 2016).

While Tongor's coastal geography may reduce certain environmental risks (e.g., lower dust exposure compared to arid regions), its proximity to water bodies could heighten risks of water contamination from flooding or marine waste. This contrasts with another study, where drought and dust storms exacerbate food insecurity and respiratory infections, yet water scarcity limits diarrheal risks (Ebi & Bowen, 2015). However, some studies challenge the directness of these linkages. For example, a study in Zimbabwe found that improved latrine access alone did not reduce stunting, suggesting that broader environmental hygiene and dietary interventions are needed (Gough et al., 2020).

5.5 Socioeconomic and demographic factors affecting the nutritional status of children under 5

After adjusting for confounders, children aged 48–59 months exhibited a striking 5.6-fold increased odds of being underweight compared to younger age groups. This finding contrasts with studies, where younger children (6–23 months) are typically at higher risk due to weaning-related nutritional gaps (Taha et al., 2020; Ariyo et al., 2021). The heightened vulnerability of older children in Tongor may show the cumulative effects of prolonged inadequate dietary intake or delayed manifestations of early-life malnutrition. For instance, in Malawi, children aged 36–59 months with chronic undernutrition showed similar risks, attributed to persistent food insecurity and inadequate catch-up growth (Chilanga et al., 2020). This suggests that interventions targeting older children, such as school feeding programs or micronutrient supplementation, may be critical in Tongor to mitigate long-term deficits.

Mother's/caregiver's religious affiliation emerged as a statistically significant predictor of underweight status (p=0.046) in the overall model, though post-hoc comparisons between specific religious groups did not reach significance. This pattern reflects findings in Nigeria, where religious identity broadly influenced feeding practices, such as fasting or food restrictions, though denominational differences were not statistically distinct (Joy-Telu & Segi, 2023). In Tongor, religious practices may indirectly shape child nutrition through cultural norms, such as dietary taboos or meal-sharing customs, which require qualitative exploration to unravel. In the Northern Region of Ghana, Islamic fasting practices during Ramadan were linked to transient reductions in dietary diversity for young children (Ali & Abizari, 2018). While the mechanisms remain unclear in Tongor, the association underscores the need to engage religious leaders in nutrition education campaigns.

Traditional socioeconomic indicators, such as maternal education, household income, and occupation, showed no significant associations with underweight status, diverging from global evidence where maternal education often correlates strongly with child nutrition (Li et al., 2024). This discrepancy may reflect homogeneity in socioeconomic status within Tongor, where poverty levels are uniformly high, limiting variability to detect effects. Alternatively, structural barriers such as limited access to markets or healthcare may overshadow individual socioeconomic advantages. Similarly, the lack of association between household income and underweight aligns with studies in rural Bangladesh, where income gains did not translate to improved child nutrition due to inequitable intra-household food allocation (Ahmed & Khalid, 2023).

The absence of a significant relationship between maternal age, number of children, or child sex and underweight status contrasts with this finding; larger family size and maternal youth (<20 years) increased underweight risks (Čvorović, 2024).

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter serves as the culmination of this research, synthesizing the findings and insights derived from the investigation into the multifaceted determinants of malnutrition among children under five in the Tongor Sub-District, Ghana. It provides a comprehensive overview of the study's implications, situating the results within the broader context of child health, nutrition policies, and public health strategies in low-resource settings. The analysis highlights critical relationships between socioeconomic inequalities, environmental challenges, dietary inadequacies, and healthcare access gaps that perpetuate malnutrition in the region. Key challenges identified include the dual burden of undernutrition and overnutrition, persistent food insecurity linked to poverty, limited dietary diversity, and inadequate sanitation infrastructure that heightens infection risks. Additionally, disparities in maternal education and healthcare utilization underscore systemic barriers to effective interventions. Building on these findings, this chapter outlines targeted recommendations aimed at addressing these interconnected challenges through community-centered, multisectoral approaches. By bridging the gap between empirical evidence and practical policy action, the chapter seeks to contribute to ongoing efforts to achieve Sustainable Development Goal 2.2, ending all forms of malnutrition by 2030. Through actionable insights, this chapter aims to guide policymakers, healthcare practitioners, and local stakeholders in designing and implementing equitable, culturally sensitive strategies to improve child nutrition outcomes in Tongor and similar contexts across Ghana.

6.2 Conclusions

This study emphasizes the dual burden of malnutrition, undernutrition, and overnutrition among children under five in Tongor Sub-District, driven by interconnected socioeconomic, environmental, and healthcare challenges. Persistent poverty limited dietary diversity, inadequate sanitation, and gaps in healthcare access perpetuate poor nutritional outcomes. While the NHIS and other interventions aim to alleviate these issues, systemic barriers hinder equitable progress. Addressing these complexities requires holistic, community-centered strategies that integrate nutrition, healthcare, and economic empowerment to break the cycle of malnutrition and foster sustainable child health improvements.

6.3 Recommendation

Based on the findings of this study, the following recommendations are suggested:

1. The Ministry of Health should lead culturally tailored campaigns, utilizing local health workers to educate caregivers on balanced diets. These campaigns should emphasize affordable, nutrient-rich foods (e.g., legumes, fruits) and aim to reduce reliance on processed snacks.
2. The government must prioritize investments in clean water and improved sanitation facilities (e.g., boreholes, and hygienic toilets) to reduce infection risks and enhance nutrient absorption among communities.
3. Health facilities, supported by the Ministry of Health, should enhance antenatal and postnatal care services, including routine growth monitoring and nutrition counseling, to address gaps in service utilization and facilitate early detection of malnutrition.
4. The government and non-governmental organizations (NGOs) should collaborate to provide education to caregivers on proper nutrition and balanced diet to children.

5. The government must ensure that local interventions align with Ghana's National Nutrition Policy, promoting multisectoral coordination among the health, education, and agriculture sectors. Regular impact assessments should be conducted to refine strategies and ensure scalability.

6.4 Summary

This chapter concludes that malnutrition among children under five in the Tongor Sub-district of Ghana presents a significant burden, characterized by persistent undernutrition alongside an increasing prevalence of overnutrition. The root causes are interconnected, encompassing socioeconomic inequality (poverty limiting dietary diversity), environmental hazards (inadequate water and sanitation increasing infection risks), and gaps in healthcare (uneven access to services). Despite initiatives like Ghana's National Health Insurance Scheme (NHIS), systemic barriers hinder progress.

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APPENDICES

APPENDIX ONE

Ethical Clearance

ENSIGN GLOBAL
COLLEGE

OUR REF: ENSIGN/IRB/EL/SN-278/01
YOUR REF:

January 8, 2025

INSTITUTIONAL REVIEW BOARD SECRETARIAT

Larry Elorm Vivie
Ensign Global College
Kpong.

Dear Larry,

ETHICAL CLEARANCE TO UNDERTAKE POSTGRADUATE RESEARCH

At the General Research Proposals Review Meeting of the *INSTITUTIONAL REVIEW BOARD (IRB)* of Ensign Global College held on Wednesday, January 8, 2025, your research proposal entitled **"Factors Contributing to Malnutrition in Children Under 5 in the South Dayi Disctrict, Volta Region, Ghana"** was considered.

You have been granted Ethical Clearance to collect data for the said research under academic supervision within the IRB's frameworks and guidelines.

We wish you all the best.

Sincerely,

Dr. (Mrs.) Rebecca Acquaah-Arhin
IRB Chairperson

APPENDIX TWO

Approval letters

GHANA HEALTH SERVICE

Your Health - Our Concern

GHANA HEALTH SERVICE

P.O. Box 8, Kpeve
Digital Address: VE-0032-9946
south dayi district health directorate
My Ref No:
Your Ref No:
23rd December, 2024

INSTITUTIONAL REVIEW BOARD SECRETARIAT
LARRY ELORM VIVIE
ENSIGN GLOBAL COLLEDGE
KPONG
Dear Larry,

Reference is made to your letter **ENSIGN/IRB/EL/SN-278/01 dated 16th December 2024** asking permission to undertake research **ON FACTORS CONTRIBUTING TO MALNUTRITION IN CHILDREN UNDER FIVE (5) YEARS** in South Dayi District Health Directorate.

We write to inform you that permission is granted for you to conduct this research on the above topic

Thank you.

DISTRICT DIRECTOR OF HEALTH SERVICE
SOUTH DAYI DISTRICT DIRECTORATE
GHANA HEALTH SERVICE
KPEVE, V/R/

MR. JONAS T. KOLOG
THE DISTRICT DIRECTOR OF HEALTH SERVICE
SOUTH DAYI DISTRICT HEALTH DIRECTORATE
KPEVE
CC: ALL FACILITIES IN-CHARGES

EVANGELICAL PRESBYTERIAN HEALTH SERVICE

HEADQUARTERS

Tel: +233-3620-26755
Fax: +233-3620-28275

Our Ref:.....

Your Ref:.....

P. O. Box HP 18
Ho, Volta Region,
Ghana
Email: ephscoord@gmail.com

Date:.....December 19, 2024

TO WHO IT MAY CONCERN

APPROVAL TO DO RESEARCH-MALNUTRITION UNDER 5 TONGOR SUB-DISTRICT
REF: LARRY ELORM VIVIE

This is to indicate the Evangelical Presbyterian Health Service Directorate approval for the named staff (Lary Elorm Vivie) to do his research work in The Evangelical Presbyterian Health Center in Dzemeni.

The program is part of his further studies at the Ensign Global College.

Many thanks for your kind cooperation and support.

Your sincerely,

RICHARD GANYO ATIEMO
(DIRECTOR, EPHS)

CC
The Moderator of General Assembly, EPCG, Ho

The Clerk of General Assembly, EPCG, Ho

The Presbyter Executive of General Assembly, EPCG, Ho

The Executive Director, CHAG, Accra

MISSION STATEMENT: *BRINGING LIGHT TO WHERE THERE IS DARKNESS*