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DEPARTMENT OF NURSING

PREVALENCE AND INFLUENCING FACTORS TO MALNUTRITION AMONG CHILDREN 5–17 YEARS WITH SICKLE CELL DISEASE IN EASTERN UGANDA

BY

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A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT OF NURSING, FACULTY OF HEALTH SCIENCES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN NURSING OF BUSITEMA UNIVERSITY

JUNE 2026

DECLARATION

I declare that this research report is my original work and it has never been submitted to any university or institution of higher learning for any academic award or any other purposes.

Miss. MUKHOKOSI JANET

Signature_____ Date 22nd -06-2026

DEDICATION

I dedicate this research to everyone who supported me throughout my academic journey, especially during this research project. I give special thanks to the Almighty God, for keeping me alive and healthy. To my mother and father, and to my husband and beloved children, thank you. I also express my heartfelt gratitude to my supervisors, lecturers, the entire Department of Nursing, and my classmates and friends.

SUPERVISOR'S APPROVAL

This report entitled

''**Prevalence and Factors Influencing Malnutrition Among Children Aged 5–17 Years with Sickle Cell Disease in Eastern Uganda**'' has been prepared by **MUKHOKOSI JANET (BU/UP/2022/0944)** under our supervision. We have reviewed the Report and approved it for submission to **Busitema University Faculty of Health Sciences** in partial fulfillment of the requirements for the award of a Bachelor's degree of science in Nursing.

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Signature  Date 23rd-06-2026

OPERATIONAL DEFINITIONS

Malnutrition: Malnutrition is a serious condition that happens when your diet does not contain the right amount of nutrients.

Overnutrition: taking in excess of nutrients

Under-nutrition is when the body does not receive what is enough for its normal functioning.

LIST OF ABBREVIATIONS

BMI- Body Mass Index

MAM: Moderate Acute
Malnutrition MUAC: Mid Upper
Circumference

SAM: Severe Acute Malnutrition
SCD: Sickle Cell Disease

WHO: World Health Organization
MRRH: Mbale Regional Referral
Hospital HCF: Health Care Facilities

SGNA: Subjective Global Nutritional Assessment.

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ABSTRACT

Background

Globally, sickle cell disease (SCD) remains a public health concern, with an estimated burden of 7.74 million people living with sickle cell disease. SCD places a nutritional burden on individuals affected. Malnutrition is a prevalent issue among individuals with SCD, affecting patients of different age groups and disease severities. It remains a major cause of childhood morbidity and mortality in sub-Saharan Africa.

Despite the existence of this problem, there is limited literature about the prevalence and influencing factors of malnutrition among children 5-17 years with SCD at Mbale regional referral hospital

Methods: A descriptive cross-sectional study design was used, employing a quantitative approach. Data were collected at one point in time from 331 children with sickle cell disease and their caregivers attending Mbale Regional Referral Hospital. A structured questionnaire administered through KoboCollect was used as the main data collection tool. The tool was developed by the researcher with guidance and adaptation from existing validated tools commonly used in nutrition research, including WHO/UNICEF child nutrition guidelines. Data were analyzed using Stata version 18, and the findings were triangulated.

Results: Of the 331 children assessed, 46.83% were malnourished based on BMI-for-age classification, and 28.10% had a MUAC measurement below 14.9 cm, indicating risk of acute undernutrition. Age ($p=0.04$), breastfeeding status ($p=0.04$), and meal frequency ($p<0.001$) were significantly associated with malnutrition at the bivariate level. On multivariate analysis, hospitalization in the past six months (AOR=0.45, 95% CI: 0.21–0.94, $p=0.034$), severe shoulder muscle wasting (AOR=2.90, 95% CI: 0.10–8.49, $p=0.047$), and the presence of ascites (AOR=0.43, 95% CI: 0.19–0.99, $p=0.047$) remained independently associated with malnutrition.

Conclusion: The study established a high prevalence of malnutrition among children aged 5–17 years with sickle cell disease in Eastern Uganda and identified hospitalization history, severe shoulder muscle wasting, and ascites as the key independent predictors.

These findings can be used by MRRH to strengthen routine nutritional screening and inform policy makers on the burden of malnutrition among older children with SCD.

Keywords: *Malnutrition; Sickle cell disease; Children; Nutritional status; Eastern Uganda; Mbale Regional Referral Hospital.*

1.0 CHAPTER ONE: INTRODUCTION

1.1 Background

Global research reports that nutritional deficiencies, both macro- and micronutrients, are common in SCD individuals and worsen outcomes such as pain crises, infections, growth delays, and quality of life (Obeagu & Obeagu, 2024b). Research indicates that studies of children with SCD show a high prevalence of stunting, wasting, and underweight. For example, pooled studies reported 55.4% stunted, 9.1% wasted, 38.9% underweight in children with SCD in some settings (Islam et al., 2021). This places a nutritional burden on individuals affected with sickle cell (Boadu et al., 2018). A study showed that children 5–12 years with SCD attending a sickle cell clinic revealed Stunting 13.7% and wasting 11.4% (Asiimwe et al., 2019). Yet another study reported a 31.3 % prevalence of undernutrition, with 27.4 % stunted and 14.3 % underweight (Namubamba et al., 2024). Sickle cell disease is a chronic genetic blood disorder common among people of African descent (Boadu et al., 2018). SCD affects patients of different age groups and disease severities (Obeagu & Obeagu, 2024b). A 2024 study reported 65.6% prevalence of malnutrition among children with sickle cell anemia, with many cases being severe and more common in adolescents. There is a substantially high level of severe malnutrition in school-aged children with sickle cell disease (Djamila L Ghafuri et al., 2020; Yusufu et al., 2023), (Boadu et al., 2018).

Malnutrition remains one of the most critical health challenges for children in low and middle-income countries, contributing substantially to morbidity and mortality and poor developmental health outcomes (Otiti & Allen, 2021). Children with sickle cell anemia (SCA) in Sub-Saharan Africa face a higher risk of malnutrition, increasing morbidity and mortality rates (Brechko et al., 2025). The impact of malnutrition on disease outcome is significant, with associations between nutrient status and complications such as infections, pain crises, prolonged hospital stays, and impaired quality of life like wasting and stunting was found to be prevalent among older children (Asiimwe et al., 2019; Obeagu & Obeagu, 2024b; Ramesh et al., 2025). Furthermore, malnutrition is associated with complications such as increased risk of acute kidney injury and re-admission, ischemic stroke, myocardial infarction, and need for blood transfusion (Byfield et al., 2024).Because malnutrition among older children is crucial, understanding the factors influencing malnutrition in Eastern Uganda and Mbale will enable appropriate, specific

interventions by health care providers and caregivers to be identified to solve the problem of malnutrition among children 5-17 years with SCD.

Food insecurity is one of the influencing factors that has worsened malnutrition outcomes in African children with SCD (Ramirez-Cuebas et al., 2025). Frequent infection is also another factor (Obeagu & Obeagu, 2024b). Furthermore, feeding practices strongly contribute to malnutrition (Namubamba et al., 2024), and not forgetting poverty that affects most families in eastern Uganda (UNICEF)

Despite evidence from major referral centers, there is currently no published data that quantifies the prevalence of malnutrition among children aged 5–17 years with SCD in the Mbale region of Eastern Uganda. The absence of local estimates limits understanding of the magnitude of the problem and hampers targeted nutrition planning for this vulnerable population. Therefore, this study aims to determine the prevalence of malnutrition among children aged 5–17 years with SCD attending Mbale regional referral hospital, providing critical evidence to inform nutritional support strategies within the region.

1.2 PROBLEM STATEMENT

Children with Sickle Cell Disease have increased nutritional requirements due to chronic hemolysis, increased metabolic demands, and recurrent infections. When these nutritional needs are not met, affected children may experience impaired growth, weakened immunity, and increased disease complications. Although Uganda has implemented several nutrition programs through the Ministry of Health Uganda in collaboration with UNICEF and the World Health Organization to improve child nutrition, these interventions mainly focus on the general population and children under five years of age.

Children aged 5–17 years living with SCD remain a vulnerable group whose nutritional status is not routinely assessed. In Mbale, where many children with SCD receive care at the regional referral hospital, limited data exist on the prevalence and forms of malnutrition among this population. This lack of local evidence makes it difficult for health workers to design targeted nutritional interventions for children with SCD. Therefore, this study aims to determine the prevalence of malnutrition among children aged 5–17 years with SCD in Mbale, and generate evidence that can guide appropriate nutritional management for this high-risk group.

The study, therefore, seeks to assess the prevalence and factors influencing malnutrition among children 5-17 years with sickle cell disease at Mbale Regional referral eastern Uganda. The study will help to bridge the information gap, especially in Eastern Uganda, and also guide the health care providers and policy makers in making appropriate interventions to curb the burden of malnutrition among older children with SCD.

1.3 Objective of the study

1.3.1 General objective

1.To assess the prevalence and the factors influencing malnutrition among children 5-17 years with sickle cell disease.

1.3.2 Specific objective

1.To determine the prevalence of malnutrition among children 5-17 years with sickle cell disease.

2.To identify the factors influencing malnutrition among 5-17 years with SCD

1.3.3 Research questions.

1.What is the prevalence of malnutrition among children 5-17 years with sickle cell disease?

2.What are the factors influencing malnutrition among children 5-17 years with sickle cell disease?

1.4 Justification

Children living with Sickle Cell Disease are at increased risk of poor nutritional status due to chronic hemolysis, increased metabolic demands, recurrent infections, and frequent illness episodes that may reduce appetite and nutrient absorption. Poor nutritional status in children with SCD may worsen disease outcomes, contribute to delayed growth, increase vulnerability to infections, and reduce overall quality of life.

Although Uganda has implemented several child nutrition interventions through the Ministry of Health Uganda, with support from partners such as UNICEF and the World Health Organization, most nutrition programs primarily focus on the general child population and children under five years of age. Consequently, older children living with chronic conditions such as SCD may not receive adequate attention regarding their nutritional needs.

In Eastern Uganda, many children with SCD receive specialized care at Mbale Regional Referral Hospital, which serves a large catchment population. However, there is limited documented evidence on the magnitude of malnutrition among children aged 5–17 years

with SCD attending this facility. Without such data, it is difficult for health care providers and policy makers to plan appropriate nutritional screening, prevention, and management strategies for this vulnerable group.

Therefore, this study is justified as it seeks to determine the prevalence of malnutrition among children aged 5–17 years with SCD attending Mbale Regional Referral Hospital. The findings will contribute to local evidence that can support improved nutritional assessment, clinical care, and targeted interventions aimed at improving the health outcomes of children living with SCD in Eastern Uganda.

1.5 Significance of the study.

To the policy.

Our study findings will help guide policymakers to strengthen regional and national strategies for the management of malnutrition. The study will aid in the development of policies that improve prevention strategies and management, and the supply chain consistency of the logistics necessary through the identification of the factors influencing malnutrition.

To research

To future research, our study will provide evidence-based knowledge on the influencing factors to malnutrition among older children living with sickle cell disease in Eastern Uganda, Mbale district. In return, this addresses the knowledge gap or the limited existence of local data. This serves as a reference point for future studies about malnutrition among older children living with sickle cell disease.

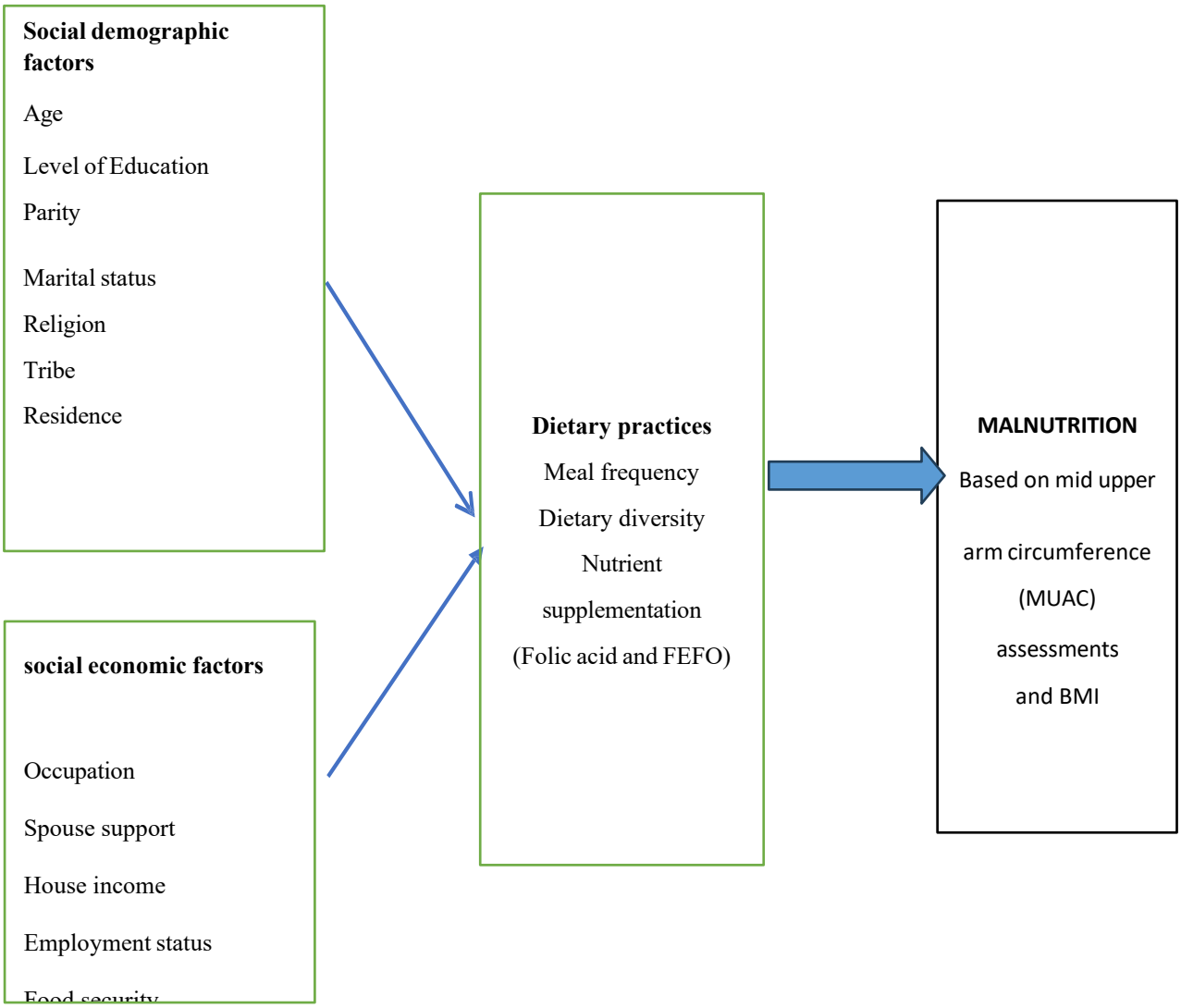
To the practice,

The results from our study will help inform health care providers about the influences malnutrition on older adults living with sickle cell disease. This will thus bring about improved outcomes, monitoring strategies, and targeted interventions to improve the treatment outcomes amongst this young population.

To health education

The study will support the development of training materials for continuous professional training of health care providers. This will ensure they are adequately equipped to explain the benefits and ways of malnutrition prevention. It will also enhance patient and caregiver education about the causes and prevention of malnutrition and help to improve their understanding and confidence in managing malnutrition, even at home, for the case of Moderate Acute Malnutrition (MAM) to prevent Severe Acute Malnutrition (SAM).

1.6 Conceptual framework



Narrative explanation

The above model shows that social demographic factors such as age, level of education, tribe, marital status, and socioeconomic factors like occupation, spouse support, house income affect dietary practices, which include meal frequency, dietary diversity, and nutrient supplementation that determine nutritional status

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction.

This chapter will focus on the prevalence factor influencing and the measures to overcome malnutrition among children 5-17 years living with SCD. This chapter will show studies that have been conducted on the factors influencing malnutrition among children of 5-17 years who are living with SCD. This existing literature will act as a baseline for our study. It will be obtained through a systematic search of Google Scholar, PubMed, Science Direct, and HINARI. Key words include: prevalence of malnutrition, sickle cell disease, and influencing factors. The Boolean operators include AND, OR.

2.2 Steps used for conducting the literature review

A systematic process was followed to identify the relevant literature for the review. An electronic search was conducted using databases like Google Scholar, PubMed, Science Direct, and HINARI. Key search terms like sickle cell disease, malnutrition, and older children were used in combination with Boolean operators (AND, OR). The titles and abstracts of different articles were also thoroughly assessed to ascertain their relevance to the study objectives. Articles in English were used. Use of Duplicated articles was checked by removing them. Studies that handled malnutrition among older children were included only if they were published between 2020-2025. The studies that focused on children under five and adults were excluded. The eligible studies were revised to develop the literature portion of this study.

2.2.1 Theoretical Review

Sickle cell disease (SCD) is a hereditary blood disorder characterized by the production of abnormal hemoglobin molecules (HbS) that cause red blood cells to take on a crescent or sickle shape (Elendu et al., 2023). Malnutrition has a negative influence on sickle cell disease. Sickle cell disease (SCD) refers to a group of hemoglobinopathies caused by inherited single-gene autosomal recessive disorders, which affect the structure of hemoglobin (Hb). Sickle cell anemia, or SS hemoglobinopathy (HbSS), is the result of sickle cell gene homozygosis. Of the other SCD variants, the most common is SC hemoglobinopathy (HbSC) (Paiva et al., 2023). Malnutrition refers to a state where

person's intake of energy or nutrients (protein, vitamins, minerals) is insufficient (or unbalanced) to meet the body's needs. This can impair growth, (Carandang et al., 2021) immune function, physical and cognitive development, and overall health. A cure for sickle cell anemia (SCA) is not available to all who have inherited this devastating genetically inherited disease so having the knowledge to maintain the nutrition can be of an advantage (Umeakunne & Hibbert, 2019). Malnutrition can be classified into 2 forms, undernutrition and over nutrition (Scrinis, 2020). When one eats food that is either insufficient or in excess its malnutrition (Govender et al., 2021). Malnutrition can complicate sickle cell disease and sickle cell disease can put a child at risk of developing malnutrition (Obeagu & Obeagu, 2024b).

2.2.2 Empirical Review

Prevalence of Malnutrition among older children with sickle cell disease Malnutrition is a serious condition that occurs when a person's diet doesn't have the right amounts of nutrients. It means poor nutrition and may refer to under nutrition not getting enough nutrients and over nutrition getting more nutrients than you need.

According to a study conducted in Ghana, the total sickle cell disease mortality burden was nearly 11-times higher at 376 000 (Thomson et al., 2023). Malnutrition is prevalent in children with SCD with high mortality attributed to it in Africa (Lauren J Klein et al., 2023). According to a study conducted in Cameroon to determine the nutritional status of sickle cell disease children and adolescents, it revealed that 7.1%, 9.1%, 3.6% and 3.3% of the total population were wasted, stunted, underweight, and overweight respectively. In patients aged 5 years and above, 10.5% were wasted, 9.0% were stunted, 5.9% were underweight and 2.2% were overweight. This resulted into growth deficit appearing higher in patients 5 years and above (E. E. Charlotte et al., 2022). A study to estimate the Prevalence of Severe Malnutrition in Children with Sickle Cell Anemia in Africa aged 5-

12 years, living in northern Nigeria, 28.6% of the total population recruited was malnourished using the WHO reference. This was a significantly higher prevalence compared to 6.4% using the sickle cell anemia specific reference population (D. L. Ghafuri et al., 2020). A study to determine Malnutrition and associated factors in school-

age children (5-17) with sickle cell anemia showed that, majority of the total population were

malnourished with a prevalence of 65.6%. 28.9% had acute malnutrition, 24.4% had chronic malnutrition (Okoi-obuli et al., 2025).

A study in Nigeria conducted in children with SCA, using the WHO-growth standards, demonstrated a high prevalence of wasting and severe wasting, as well as, stunting and severe stunting, 22.7% and 11.6%, respectively (Ghafuri et al., 2017). According to a study to determine the Vitamin D deficiency in a pediatric population with sickle cell disease, findings revealed that the prevalence of vitamin D deficiency was 46.7% (Vilela et al., 2025). The publication which gave a comprehensive view on malnutrition argued that Malnutrition is a prevalent issue among individuals with SCA, affecting patients of different age groups and disease severities (Ghafuri et al., 2017)

A study conducted in Tanzania showed that sickle cell anemia is associated with a high prevalence of malnutrition and growth retardation in patients of all ages, but particularly in adolescents. (Ukoha et al., 2020). Malnutrition is highly prevalent among children aged 5–17 years with sickle cell disease, with reports stating reporting rates ranging from approximately 13% to 66% where SAM was indicated at 6%–29% of school- children depending on assessment standards (Eposse Ekoube Charlotte et al., 2022; Namugerwa et al., 2023). It's however true that studies on malnutrition focusses on children under five leaving limited data available on prevalence of malnutrition among children 5-17 years in Mbale most particularly in MRRH which makes this study relevant in Eastern region

Influencing factors to malnutrition among children 5-17 years with sickle cell disease.

2.3 Social demographic factors and socioeconomic factors

According to a study done in Egypt, it indicated that 10-17year olds with sickle cell anemia had acute malnutrition than 5-9year old (Okoi-obuli et al., 2025). Findings of another study clarified that malnutrition affects a substantial portion of SCA population especially children and adolescents (Obeagu & Obeagu, 2024b). Findings from the study in Egypt also indicated that male children 10-17 were most severely stunted (Okoi-obuli et al., 2025). In a study carried out to assess the determinants of malnutrition among

children, maternal education, maternal nutritional status, household income, availability of sanitation facility at home were associated with malnutrition (Katoch, 2022). Some data indicate that males remain smaller and thinner than females through adolescence,

suggesting persistent nutritional vulnerability (Nartey et al., 2021). Some stories revealed that low caregiver education and low nutrition knowledge were associated with poorer nutritional practices and ineffective in implementing dietary measures when needed, suggesting that low education indirectly increases malnutrition risk by reducing effective home care and feeding practices for children with Sickle Cell Disease (Ohemeng et al., 2023). Stories indicates that caregivers who are unemployed or have unstable work often find challenges meeting the requirements for their children's dietary standards, increasing the risk of malnutrition because of limited abilities to buy them and greater stress on household food security (Clarke et al., 2021; Kipkoech Koross et al., 2023)

2.4 Environmental factors

Some studies showed that there is impact of droughts, flooding, and climate variability on malnutrition that included children also included older children pointing out that malnutrition among this population is due to effects of climate including drought, floods and general variation in climate (Lieber et al., 2022; Obeagu, 2025).

Environmental disruptions like extreme weather events reduce access to health services and stability in food supply, which is compounding malnutrition risk among already vulnerable children (Obeagu & Obeagu, 2024a).

A study that was conducted in Karimu on analysis of environmental factors on children's eating patterns and access to health services on the incidence of malnutrition revealed.

Some study found that deprivation in water, sanitation, and hygiene facilities leads to health vulnerabilities in children, which points malnutrition risk factors at household and community levels (Victor et al., 2025; Victor et al., 2024)

2.5 Dietary diversities and feeding practices

A study to assess the Feeding practices of children who are malnourished revealed that children were causing junk food. Breast feeding and complementary feeding were not appropriate. This is contrary to the strategies put across by United Nations International

Children Eme8rgency Funds which includes excusive breast feeding (EBF) for the first 6 months of life and provision of complementary feeds after 6 months (Hollis et al., 2020). A study conducted in Ghana to explore the Knowledge and nutrition-related practice among caregivers of adolescents with sickle cell disease showed that the most common feeding practices reported were provision of fruit juices and warm fluids such as soups and tea (Ohemeng et al., 2023).

Food insecurity is indicated to be directly responsible for the limited access to sufficient and nutritious food, which is very paramount for children with higher metabolic demands due to Sickle cell disease (Ramirez-Cuebas et al., 2025)

2.6 Intervention measures

A study to explore the Malnutrition in sickle cell anemia, Prevalence, impact, and a hint on interventions revealed that Nutritional counseling from registered dietitians which should include information on diet, nutrient rich food choice and hydration (Singh, 2020). Another study to assess the Role of Iron Overload on Oxidative Stress in Sickle Cell Anemia indicated that folate supplementation to support red blood production (Dos Santos et al., 2012), Another study to explore Current and novel therapies for the prevention of vaso-occlusive crisis (Thomson et al., 2023) in sickle cell disease showed adequate hydration to promote proper blood flow (Osunkwo et al., 2020).

2.7 Critical Review

According to study that was conducted in Ghana clearly pointed out the relationship between malnutrition and sickle cell disease, however it focused on children 5-12years (Thomson et al., 2023). This leaves other children of age category 13-17 years. Another study that was conducted based on middle income country where house hold income is not as low as that of low-income country households, we are going to study in Uganda a low-income country. Further still this study gave a generalized finding on national prevalence, mortality intervention in terms of resource allocation which may not provide an appropriate estimate and pressure of the burden, our study is going to be local in Mbale regional referral hospital.

According to study in Nigeria on risk factors, the researcher employed a cross-section study design which caters for only a quantitative arm. (Lauren Jane Klein et al., 2023).

We are going to employ the mixed parallel convergent method a stronger design to obtain data that is concrete. This study in Mbale regional referral is therefore relevant to provide satisfactorily data for reference.

(E. E. Charlotte et al., 2022) compared anthropometric measurement growth charts for the children and yet this are designed for normal population this WHO normal standards might not adequately reflect their expected growth especially for boys (Eposse Ekoube Charlotte et al., 2022). We intend to use Height-for-Age Z-score (HAZ) -to assess stunting, Body Mass Index-for-Age Z-score (BAZ) -to assess thinness or overweight/obesity, Weight-for-Age (WAZ (Onis et al., 2007).

In the Malnutrition and associated factors in school-age children with sickle cell anemia, children 5–17 years participated which included preadolescents (5–9-year-olds) and adolescents (10–17-year-olds) however their study had a sample size of ninety participants which is small to give a clear picture of the burden (Okoi-obuli et al., 2025). in our study we are going to use the sample size of 186 participants.

Comparative Study of Nutritional Status of Children and Adolescents with Sickle Cell Anemia in Enugu, Southeast Nigeria which employed only 175 subjects also used a cross section analytical study design includes children 1-5year, preschool and 6-18 school going children (Ukoha et al., 2020). This could have given a wide view if a bigger sample size was used and a stronger study design was employed just as the one planned to use in this study of prevalence and factors influencing malnutrition among children 5-17 year in Mbale regional referral.

2.7 Influencing factors to malnutrition among children 5-17 years

As much the study on determinant of malnutrition in children as provided consistent data on the factors, (Katoch, 2022). It had limitation like limited Database search which was exclusively relying on google scholar, comprehensive systematic review database like PubMed or MEDLINE, search Gate to minimize bias and missing searches. (Heselo & Prasetyo, 2025) also used cross section study design and the population of the study was 168participants and did not include health workers. The study also included the under 5s. in our study we are going to consolidate on the older children.

2.8 Nutritional feeding practices

In the study in Ghana that revealed juice and warm fluids as one of the interventions to malnutrition, the study had some gaps like use of a cross-sectional study yet study knowledge and practice of care givers required a qualitative study of both care givers and health

workers (Ohemeng et al., 2023) Since we are going to employed a descriptive cross section with more participants, we hope to better explain the findings.

2.9 Summary of Literature review

Sickle cell disease (SCD) is a hereditary blood disorder that increases the risk of malnu2.1.8trition due to higher nutritional needs, chronic inflammation, poor appetite, and recurrent illnesses. Malnutrition—both undernutrition and overnutrition—is common among older children with SCD and contributes to growth failure, weakened immunity, and increased disease complications.

Studies from various African countries, including Ghana, Nigeria, Cameroon, Egypt, and Tanzania, show high rates of wasting, stunting, underweight, vitamin deficiencies, and overall malnutrition among children aged 5–17 with SCD. Adolescents tend to be more affected than younger children. Several demographics, environmental, and nutritional factors contribute to malnutrition, such as low household income, poor caregiver education, inadequate feeding practices, climate-related food shortages, and disease-related complications.

Interventions recommended in existing research include nutritional counseling, diet optimization, hydration, and supplementation (e.g., folate). However, many studies have limitations such as small sample sizes, narrow age ranges, weak study designs, and reliance on general WHO growth charts that may not accurately reflect the growth patterns of children with SCD.

The reviewed literature showed major data gaps, especially on malnutrition among older children (5–17 years) in low-income settings such as Eastern Uganda particularly Mbale. This justifies the need for the proposed study at Mbale Regional Referral Hospital, which aims to use a larger sample size and a mixed-methods approach to provide more reliable and context-specific evidence.

Summary

Malnutrition is common among children 5–17 years with sickle cell disease, most especially adolescents. Key risk factors include age, sex, caregiver education and employment, household income, poor feeding practices, and environmental challenges like food insecurity and inadequate WASH. Interventions such as nutritional counseling, supplementation, and hydration help, but data from low-income settings like Eastern Uganda remain limited.

2.10 Conclusion

The literature review affirms that malnutrition among children 5-17 years still remains a public health concern mostly in low-income countries such as Uganda and the broader SSA. A significant proportion of global malnutrition is attributed to SCD because of the high nutrition burden the disease places on them. Despite this significant global and regional burden, there is lack of current understanding of the prevalence and associated factors of malnutrition among children 5-17 years with SCD. Therefore, with this study we intend to fill the gap by determining the prevalence and associated factors to malnutrition among children 5-17 years with SCD at Mbale regional referral hospital in eastern Uganda.

3.0 CHAPTER THREE: MATERIALS AND METHODOS

3.1 Introduction

This chapter presents the research study design, study setting and site, study population, sampling techniques, data collection methods, quality control measures, data analysis techniques, ethical considerations, dissemination of findings, and limitations of the study.

3.2 Study Design.

A descriptive cross-sectional study design was used with a quantitative approach. Data were collected at a single point in time. The design provided information on the prevalence and factors influencing malnutrition among children with sickle cell disease.

3.3 Study Setting

The study was conducted at Mbale Regional Referral Hospital (MRRH), located in Mbale City in Eastern Uganda, approximately 224.2 km northeast of Kampala. MRRH is a public hospital with a bed capacity of 500 and serves a population of over 4.6 million people from 16 districts. The hospital comprises five major departments: Obstetrics and Gynecology, Surgery, Pediatrics, Internal Medicine, and Psychiatry. Each department is staffed with qualified health workers including doctors, nurses, clinicians, midwives, and support staff. The study was conducted in the Pediatric Department, specifically at the Sickle Cell Clinic. During clinic days, nutrition assessment, health education, and routine folic acid supplementation were provided to children attending the clinic. Approximately 360 children attended the clinic monthly.

3.4 Study Population.

The study population consisted of children aged 5–17 years diagnosed with sickle cell disease and their caregivers attending the Sickle Cell Clinic at Mbale Regional Referral Hospital.

3.4.1 Eligibility Criteria.

Inclusion Criteria.

Children aged 5–17 years diagnosed with sickle cell disease and receiving care at MRRH Sickle Cell Clinic who provided assent and whose caregivers provided informed consent. - Caregivers who accompanied the children to the clinic and consented to participate in the study.

3.4.2 Exclusion Criteria

Children who were too sick

3.5 Sample Size Determination.

The sample size was determined using kish and Leslie formular of 1965:

$n = Z^2p(1-p)/d^2$

n=required sample, Z=z score=1.96(95%confidence value), p =estimated prevalence from previous studies (p==0.26), d= margin of error 0.05

n=3.8416x0.26(1-0.26)/0.0025

n=0.7391/0.0025

n=295.64

n=296

if the number of nonresponse n=296/1-0.10. n=296/0.9

n=328.88888

n=329+2

Final sample size is 331 participants.

3.6 Sampling Technique

A simple random sampling technique was used to recruit participants into the study. All eligible children and caregivers attending the sickle cell clinic were assigned numbers each clinic day. The required number of participants was then selected randomly from the allocated numbers. This approach minimized selection bias and ensured equal chances of participation.

3.7 Data Collection Tool

A structured interviewer-administered questionnaire was used as the primary data collection tool. The questionnaire was developed by the researcher and adapted from validated nutrition assessment tools, including WHO/UNICEF child nutrition guidelines.

Data were collected using Kobo Tool box.

3.7.1 Structure of the Questionnaire

Section A: Socio-demographic and Socioeconomic Factors.

This section collected information on age, sex, education level, residence, occupation, household income, and other socioeconomic characteristics.

Section B Child's health and nutritional history.

This captures the child's health and care in early child hood.

Section C: Anthropometric measurements for nutritional assessment including weight, height, MUAC, and Body Mass Index (BMI) to determine the nutritional status of participants.

Section D: Sickle cell disease

This captures the information about sickle cell and the care treatment.

Section E: Dietary Practices and Dietary Intake Assessment

This section assessed dietary diversity, meal frequency, nutrient supplementation, and food consumption patterns among children with sickle cell disease.

3.8 Study Variables

3.8.1Independent Variables

The independent variables included: - Socio-demographic factors (age, sex, residence, education level). - Socioeconomic factors (occupation, household income). - Disease-related factors (severity of anemia, frequency of hospitalization, infections). - Health service factors (source of healthcare, nutritional counseling). - Dietary factors (food source, meal frequency, dietary diversity). - Environmental factors (water source, sanitation, waste disposal, handwashing practices, household crowding).

3.8.2 Dependent Variable

The dependent variable was prevalence of malnutrition among children aged 5–17 years with sickle cell disease.

3.9 Data Collection Method.

Data were collected during the study period using an interviewer-administered questionnaire. Information on socio-demographic characteristics, socioeconomic status, dietary practices, and disease-related factors was obtained from caregivers and children. Anthropometric measurements including weight, height, and MUAC and BMI was determined using standard procedures to assess nutritional status.

Participants were selected through simple random sampling and enrolled after obtaining informed consent and assent.

3.10 Data Management

Data collected were checked daily for completeness and consistency.

Participants were assigned unique identification codes to maintain confidentiality.

Data were entered into Kobo Tool box and exported for analysis.

Data cleaning was conducted to identify and correct errors and inconsistencies. Anthropometric measurements were standardized according to WHO guidelines.

All electronic files were stored on password-protected computers and backed up regularly.

3.11 Data Analysis and PresentationPlan.

Data were analyzed using Stata software. Descriptive statistics including frequencies, percentages, means, and standard deviations were generated. Results were considered statistically significant at a p-value of less than 0.05. The findings were presented using tables, charts, and figures where appropriate.

3.12 Quality Control Measures

The data collection tools were pretested before the actual study to ensure validity and reliability. Research assistants received training on data collection procedures and anthropometric measurements, particularly MUAC assessment. Regular supervision was conducted throughout data collection to ensure adherence to study procedures.

3.13 Quality Assurance.

Data quality was maintained through the use of standardized and pretested tools, training of research assistants, and close supervision during data collection. Data were reviewed daily for completeness and accuracy. Triangulation of information sources was applied where appropriate to improve data quality. All study procedures were documented to ensure transparency and consistency throughout the research process.

3.14 Ethical Considerations.

Ethical approval was obtained from the relevant authorities before data collection commenced. Administrative permission was obtained from Mbale Regional Referral Hospital. Participation in the study was voluntary. Informed consent was obtained from caregivers, while assent was obtained from eligible children. Confidentiality and privacy of participants were maintained throughout the study. Participants were informed of their right to withdraw from the study at any time without any consequences.

3.15 Limitations of the Study

1. Some caregivers experienced difficulty recalling dietary intake, feeding practices, and previous illnesses, which may have affected the accuracy of information collected.

2. Limited financial resources restricted the performance of detailed laboratory investigations such as micronutrient assessments.

3. Minor errors may have occurred during anthropometric measurements despite efforts to standardize procedures and use calibrated equipment.

3.16 Dissemination of Findings

The findings of the study were shared with the Busitema University Department of Nursing, Mbale Regional Referral Hospital Sickle Cell Clinic, Pediatric Department, Nutrition Unit, and Mbale District Health Office. The results were also presented at scientific meetings and prepared for publication in relevant journals to facilitate wider dissemination and utilization of the findings.

4.0 CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the result of the study as shown below,

A total of 331 children with sickle cell disease (SCD) and their caregivers participated in the study.

4.1 Socio-demographic Characteristics of Respondents

Table 1 presents the socio-demographic characteristics of the study participants. Of the 331 respondents, 166 (50.15%) children were aged 5–10 years, while 165 (49.85%) were above 10 years. The sex distribution was almost equal, with females accounting for 167 (50.45%) and males 164 (49.55%). Nearly half of the caregivers were mothers (49.55%), followed by guardians (29.00%) and fathers (21.45%).

About educational attainment, the majority had primary education (40.79%), while 30.51% had no formal education. Only 19.94% had attained tertiary or university education. Most respondents were peasants (45.02%), followed by traders (23.87%), farmers (19.34%), and those in formal employment (11.78%).

The rest of the information are described in table below.

Table 1: Social demographics.

Variable	**Frequency (n)**	**Percentage (%)**
Age		
5-10	166	50.15
Above	165	49.85
SEX		
Male	**164**	**49.55**
Female	**167**	**50.45**
Relationship		
Mother	**165**	**49.55**
Father	**71**	**21.45**
Guardian	**96**	**29.00**
Education level		
None	**101**	**30.51**

Primary	**135**	**40.79**
Secondary	**29**	**8.76**
Tertiary/university	**66**	**19.94**
Occupation		
Farmer	**64**	**19.34**
Trader	**79**	**23.87**
Peasant	**149**	**45.02**
Formal job	**39**	**11.78**
Family type		
Nuclear	**190**	**57.40**
Extended	**80**	**24.17**
Single parent	**61**	**18.43**
Household income		
<100000/=	**230**	**69.49**
100,000-500,000/=	**52**	**15.71**
>50000/=	**49**	**14.80**
Address		
Urban	**114**	**34.44**
Rural	**217**	**65.56**

4.2 Child Health and Nutritional Characteristics

Table 2 shows the health and nutritional characteristics of children with sickle cell disease. More than half of the children (51.96%) had a birth weight above 2.5 kg, while 48.04% weighed less than 2.5 kg at birth. Most children had completed immunization schedules (75.23%), whereas 11.48% had not been immunized and 13.29% of caregivers were unsure of the child's immunization status.

Breastfeeding was reported among 55.89% of the children, while 23.87% had never been breastfed. Nearly half of the children (47.43%) consumed four meals per day, followed by 40.48% who consumed three meals daily. Only 6.34% consumed two meals per day.

A considerable proportion of children (44.41%) had experienced illness in the preceding two weeks. Food shortage was reported in 58.61% of households, highlighting household food insecurity. Most

families (62.24%) obtained food from markets and shops, while 37.76% depended on home food production. The table below represents that information.

Table 2: **Child's Health and Nutritional Status**

Variables	Frequency(n)	Percentage(%)
Birth weight		
<2.5KGS	159	48.04
>2.5KGS	172	51.96
Immunization		
No.	38	11.48
Yes	249	75.23
Not sure	44	13.29
Breast feeding		
No	79	23.87
Yes	185	55.89
Not sure	67	20.24
No of meals		
2	21	6.34
3	134	40.48
4	157	47.43
5	19	5.74
Been sick		
No	184	55.59
Yes	147	44.41
Food shortage		
No	127	41.39
Yes	194	58.61
Source of food		
Own production, garden	125	37.76
Market, shops	206	62.24

Yes

Figure 1: Types of Food Consumed During the Previous Day

Figure 1 illustrates the different food groups consumed by children during the previous day foods carbohydrates were the most commonly consumed food type, reported by 98.19% of respondents. Vitamin-rich foods were consumed by 37.76%, while only 25.38% reported consuming a combination of food groups. The findings suggest that carbohydrates intake was relatively common among the participants, although dietary diversity remained limited as represented in the table below.

Figure 1: A bar graph showing the percentages of the different food types consumed the previous day.

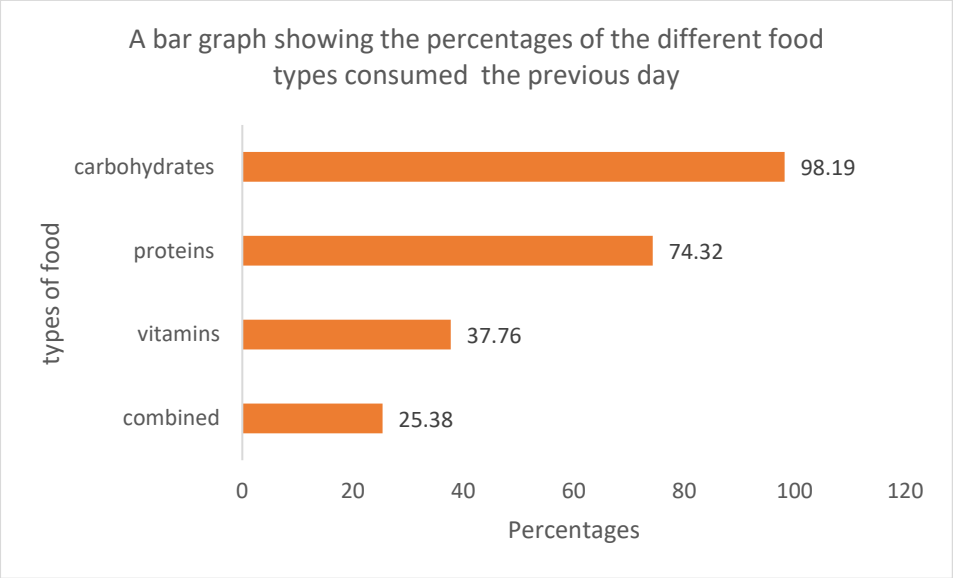


Figure 2: Illnesses Experienced in the Previous Two Months

Figure 2 presents the illnesses reported among children during the previous two months. Malaria was the most common illness, affecting 27.79% of the children. Respiratory tract infections accounted for 16.31%, followed by fever (13.29%) and bacterial infections (9.06%). Anaemia was the least reported illness at 4.23%. These findings indicate that infectious diseases remain a significant health burden among children with sickle cell disease.

Figure 2: A bar graph showing the percentages of illness suffered in the past 2 months.

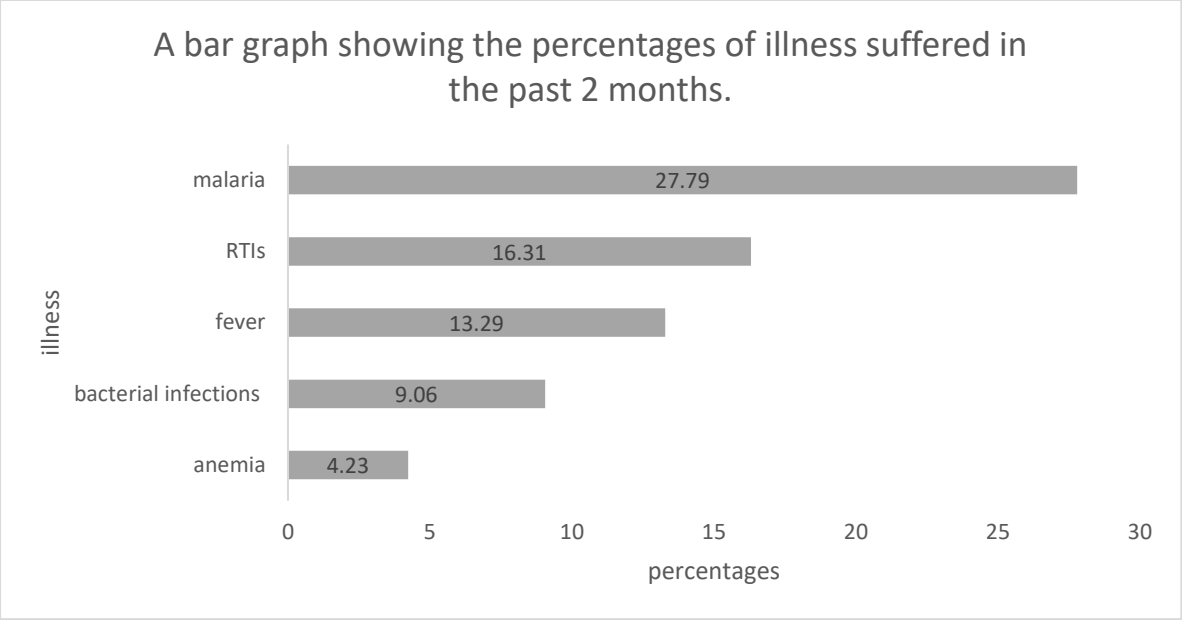


Figure 3: Sources of Household Water

Figure 3 shows the main sources of water used by the respondents. Nearly half of the households (47.73%) relied on tap water, tanks, or harvested rainwater. Boreholes were used by 33.84% of households, while 18.43% obtained water from wells and swamps. The findings indicate that although many households had access to relatively improved water sources, a substantial proportion still depended on potentially unsafe water sources**.**

Figure 3: A bar graph showing the percentages of the source of water.

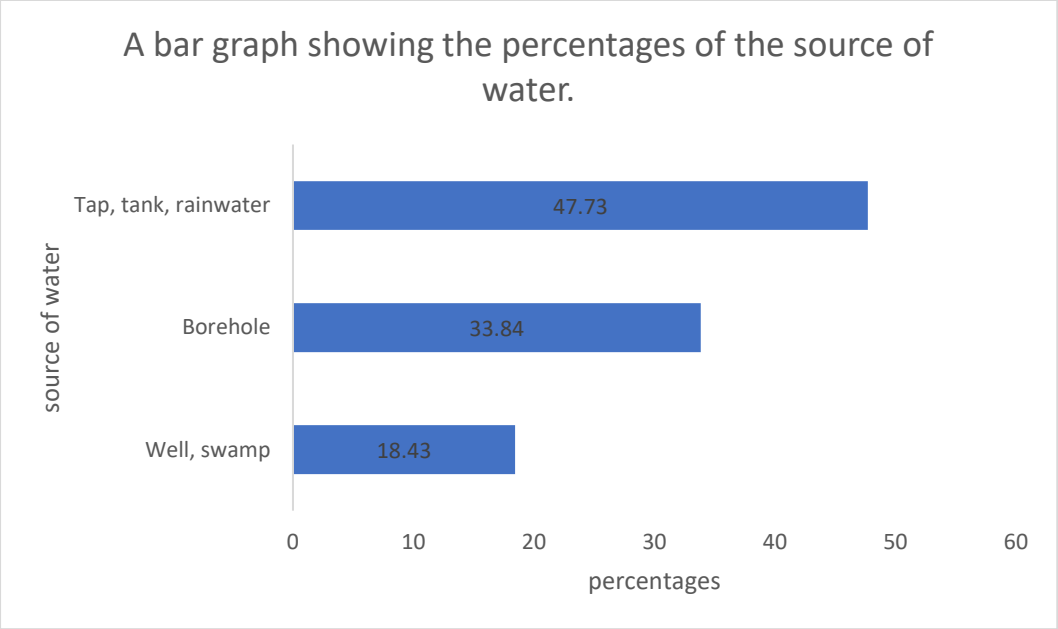


Figure 4: Types of Toilets Used by Households

Figure 4 presents the sanitation facilities used by respondents. Pit latrines were the most commonly used toilet facilities, accounting for 67.07% of households. Flush toilets were used by 25.98%, while Ecosan/Sato toilets were used by only 6.95% of respondents. These findings suggest that pit latrines remain the predominant sanitation facility in the study area.

Figure 4:A bar graph showing the percentages of the different types of toilets used.

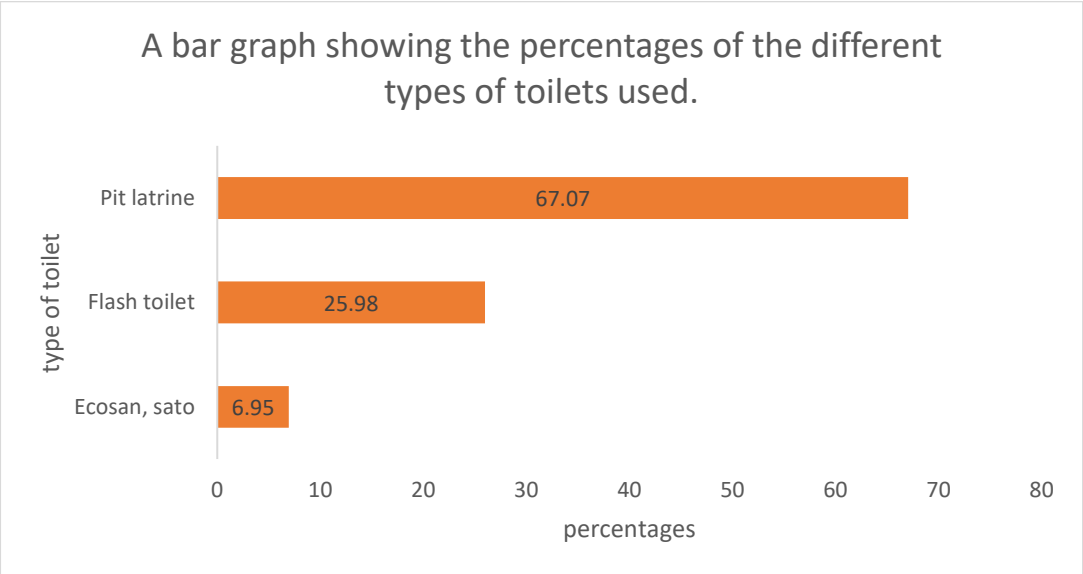


Figure 5: Methods of Waste Disposal

Figure 5 illustrates the methods used for household waste disposal. Burning was the most common method, reported by 38.97% of respondents. Disposal in rubbish pits accounted for 26.59%, while 24.17% used dustbins. The findings indicate that open burning remains a common waste management practice among households in the study area.

Figure 5: A bar graph showing percentages of how waste is disposed.

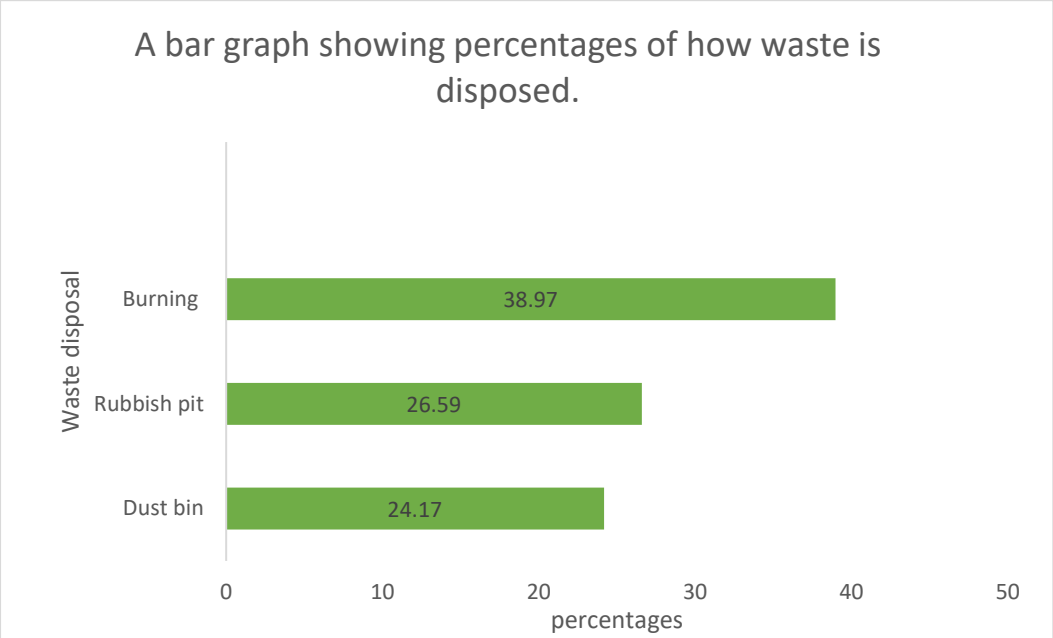


Table 3: Anthropometric Measurements for Nutritional Assessment

Table 3 presents anthropometric indicators used to assess the nutritional status of children with sickle cell disease. Regarding current body weight, 36.56% of children had moderate weight (25.1–40 kg), while 36.25% had low weight (15.1–25 kg). Children with very low weight and high weight each accounted for 13.60%.

MUAC assessment showed that more than half of the participants (56.50%) had measurements between 15 and 17 cm, while 28.10% had MUAC measurements below 14.9 cm, indicating possible undernutrition. Based on BMI classification, 176 (53.17%) children had normal nutritional status, whereas 155 (46.83%) were malnourished. This finding demonstrates that nearly half of the children with sickle cell disease were affected by malnutrition.

Table 3: **Anthropometric measurements for nutrition assessment**

Variables	Frequency (n)	Percentage (%)

Curren weight		
Very low(<15kgs)	45	13.60
Low (15.1-25kgs)	120	36.25
Moderate (25.1-40kgs)	121	36.56
High(<40kgs)	45	13.60
1	37	11.18
2	101	30.51
3	110	33.23
4	83	25.08
MUAC		
<14.9cm	93	28.10
15-17 cm	187	56.50
>18 cm	51	15.41
BMI		
Normal	176	53.57
Malnourished	155	46.83

Table 4: Clinical Characteristics of Children with Sickle Cell Disease

Table 4 represents disease-related characteristics of the participants. Most children (74.02%) were diagnosed with sickle cell disease before two years of age. Monthly crises were the most frequently reported pattern (41.69%), followed by rare crises (31.12%). Weekly crises were reported by 10.88% of participants.

Hospitalization was common, with 75.83% of children having been hospitalized. The majority were receiving folic acid supplementation (95.77%), hydroxyurea therapy (87.01%), and antimalarial prophylaxis (90.03%). Blood transfusion had been received by 45.62% of participants. These findings indicate a high burden of disease complications requiring continuous medical management.

Table 4: sickle cell disease

Variable	**Frequency(n)**	**percentage** (%)
Age at diagnosis		
<2 years	245	74.02

>2 years	86	25.98
Frequency of crisis		
Weekly	36	10.88
Monthly	138	41.69
Every 3 months	34	16.31
Rarely	103	31.12
Hospitalization		
No	80	24.17
Yes	251	75.83
Folic acid		
No	14	4.23
Yes	317	95.77
Hydroxyurea		
No	43	12.99
Yes	288	87.01
Blood transfusion		
No	180	54.38
Yes	151	45.62
Ant -malarial		
No	33	9.97
Yes	298	90.03

Figure 6: Frequency of Blood Transfusion

Figure 6 shows the frequency of blood transfusions among children who had received transfusions. The highest proportion of children (45.64%) had received blood transfusions twice, while 34.23% had received one transfusion. Only 20.13% had undergone blood transfusion three or more times. The results suggest that repeated blood transfusions are common among children with sickle cell disease.

Figure 6: A bar graph showing the percentage of the frequency of blood transfusion.

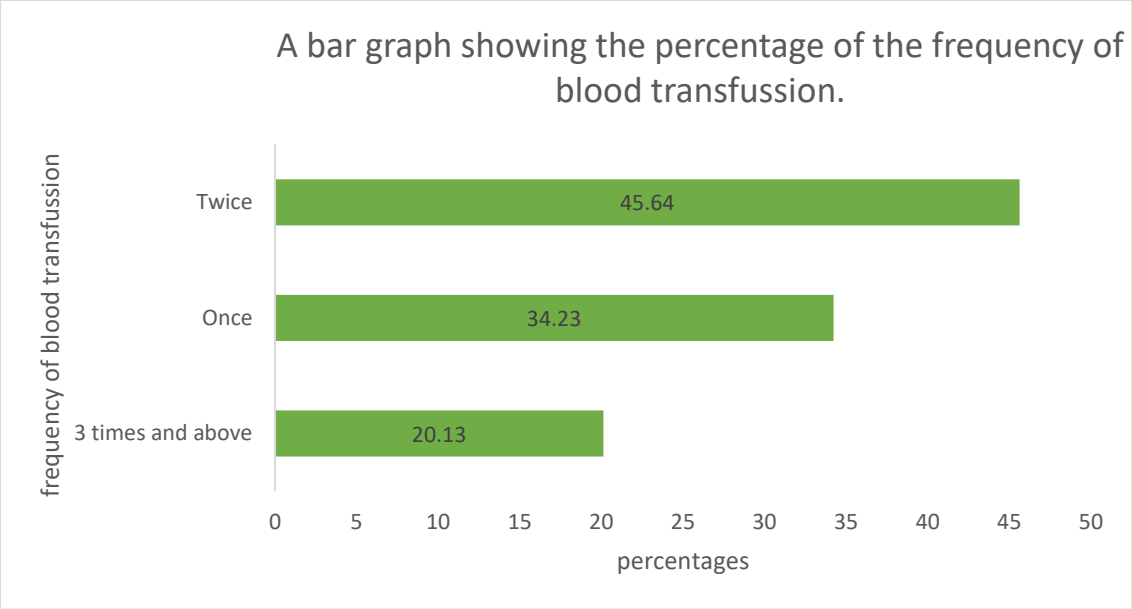


Table 5: Medical and Dietary History of Participants

Table 5 presents the medical and dietary history of children with sickle cell disease. More than half of the participants (55.29%) reported weight loss, with 64.48% experiencing mild weight loss and 35.52% severe weight loss.

Reduced food intake was reported by 46.83% of participants, while poor appetite was reported by 58.31%. Half of the participants (50.76%) reported no gastrointestinal symptoms. However, nausea and vomiting were reported by 32.93%, diarrhea by 11.48%, and constipation by 4.83%.

Assessment of physical activity revealed that 51.66% had reduced activity levels. Triceps muscle assessment showed that 55.76% exhibited mild to severe muscle wasting, while shoulder assessment revealed that 55.32% had varying degrees of wasting. Oedema and ascites were present among 13.03% and 17.27% of participants, respectively. These findings indicate substantial nutritional and clinical challenges among children with sickle cell disease

Table 5: Medical/Dietary history

	Frequency(n)	**Percentage** (%)

Weight loss		
No	148	44.71
Yes	183	55.29
Mild	118	64.48
Severe	65	35.52
Intake		
No	176	53.17
Yes	155	46.83
Appetite		
No	138	41.69
Yes	193	58.31
Gi symptoms		
None	168	50.76
Diarrhea	38	11.48
Vomiting and Nausea	109	32.93
Constipation	16	4.83
Activity		
Normal	160	48.34
Reduced	171	51.66
Triceps		
Normal	146	44.24
Mild	116	35.15
Severe	68	20.61
Shoulders		
Normal	147	44.68
Mild	117	35.56
Severe	65	19.76
Oedema		
None	283	86.96
Present	43	13.03
Ascites		
None	273	82.73

Present	57	17.27

Figure 7: Gastrointestinal Symptoms Experienced by Participants

Figure 7 illustrates the gastrointestinal symptoms experienced by the children. Half of the participants (50.76%) reported no gastrointestinal symptoms. Among those with symptoms, nausea and vomiting were the most common (32.93%), followed by diarrhea (11.48%) and constipation (4.83%). The findings suggest that gastrointestinal disturbances are common among children with sickle cell disease and may contribute to reduced dietary intake and poor nutritional outcomes.

Figure 7: A bar graph showing the percentage of the GIT symptoms experienced

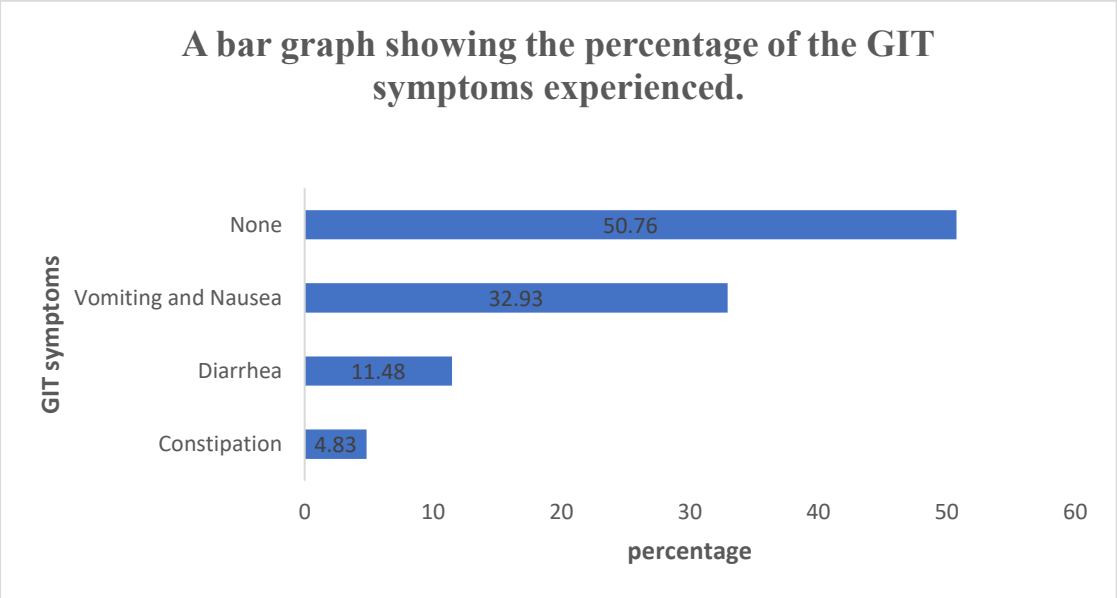


Table 6: Bivariate Analysis of Factors Associated with Malnutrition among Children with Sickle Cell Disease

Table 6 presents the association between selected socio-demographic, dietary, clinical, and anthropometric factors and nutritional status among children with sickle cell disease. Several factors were found to be significantly associated with malnutrition at the bivariate level.

Among the socio-demographic characteristics, age ($p=0.04$) was significantly associated with nutritional status, with children aged 5–10 years exhibiting a higher prevalence of malnutrition than older children. Breastfeeding status ($p=0.04$) and meal frequency ($p<0.001$) were also significantly

associated with malnutrition, with children consuming fewer meals per day showing poorer nutritional outcomes.

Clinical factors including recent illness (p=0.01), frequency of sickle cell crises (p<0.001), hospitalization (p<0.001), and history of blood transfusion (p<0.001) demonstrated significant associations with nutritional status. Similarly, anthropometric indicators such as current weight (p=0.001) and height (p=0.01) were significantly related to malnutrition.

Nutritional and functional indicators including weight loss, reduced dietary intake, poor appetite, gastrointestinal symptoms, reduced physical activity, triceps muscle wasting, shoulder muscle wasting, and ascites were all significantly associated with malnutrition (p<0.001). However, sex, caregiver education level, household income, residence, immunization status, age at diagnosis, hydroxyurea use, antimalarial use, MUAC, and oedema did not show statistically significant associations with nutritional status.

Overall, the findings suggest that dietary practices, disease severity, recent illness, and indicators of nutritional deterioration play an important role in the occurrence of malnutrition among children with sickle cell disease.

Table 6: Bivariate analysis.

Variable	Normal n(%)	Malnourished n(%)	P. VALUE
Age			
5-10	79(47.59)	87(52.41)	**0.04***
11-17	97(58.79)	68(41.83)	
Sex			
Male	87(53.05	77(46.95	0.96
Female	89(53.17)	78(46.83)	
Relationship			
Mother	82(50.00	82(50.00)	0.52
Father	40(56.34	31(43.75)	
Guardian	54(56.25)	42(43.75)	
Education level			
None	50(49.50	51(50.50)	0.78

Primary	73(54.07	62(45.93)	
Secondary	15(51.72)	14(48.28)	
Tertiary/university	38(57.58)	28(42.42)	
Occupation			
Farmer	37(57.81)	27(42.19)	0.69
Trader	4354.43)	36(45.57)	
Peasant	74(49.66)	75(50.34)	
Formal job	22(56.41)	17(43.59)	
Family type			
Nuclear	107(56.32)	83(43.68)	**0.09***
Extended	34(42.50)	46(57.50)	
Single parent	35(42.50)	26(42.62)	
Household income			
<1000000/=	119(51.74)	111(48.26)	0.72
100000-500000/=	29(55.77)	23(44.23)	
>5000000/=	28(57.14)	21(44.23)	
Address			
Urban	61(46.59)	53(46.49)	0.73
Rural	115(46.83)	102(47.00)	
Birth weight			
<2.5kgs	85(53.460	74(46.54)	0.92
>2.5kgs	919(52.91)	81(47.09)	
Immunization			
No	21(55.26)	17(44.74)	0.96
Yes	132(53.01)	117(46.99)	
Not sure	23(52.27)	21(47.73)	
Breast feeding			
Yes	34(43.04)	45(56.96)	**0.04***
No	99(53.51)	86(46.49	
Not sure	34(64.18)	24(35.82)	
No of meal2s			
2	2(9.52)	19(90.48)	**0.00***

3	79(58.96)	55(41.04)	
4	86(54.78)	71(45(22)	
5	9(47.37)	10(52.63)	
Been sick in 2 weeks			
No	110(59.78)	74(40.22)	
Yes	66(44.90)	81(55.10)	**0.01***
Current weight			
Very low (<15 kgs)	13(28.89)	32(71.11)	**0.001***
Low >15.1-25kgs	67(5583)	53(44.17)	
Moderate 25.1-40kgs	64(52.89)	57(47.11)	0000
High <40kgs	32(71.11)	13(28.89)	
Height			
>99.9	12((32.43)	25(67.57)	**0.01***
100-124	47(46.53)	54(53.47)	
125-149	71	39(35.45)	
150 and above	46	37(44.83)	
MUAC			
<14.9cm	**45(48.39)**	**48(51.61)**	**0.16***
15-17 cm	98(52.41)	89(47.59)	
>18 cm	33(64.71)	18(35.29)	
Diagnosis age			
<2 years	130(53.06)	115(64.94)	
>2 years	46(53.49)	40(46.51)	0.9.5
Frequency of crisis			
Weekly	9(25.00)	27(25.00)	.**001***
Monthly	54 (3913)	84(60.87)	
Hospitalization			
No	64(80.00)	16(20.00)	**0.001***

Yes	112(44.62)	139(55.38)	
Folic acid			
No	11(78.57)	3(21.43)	**0.052***
Yes	165(52.05)	152(47.95)	
Hydroxyurea			
No	18(41.86)	25(58.14)	**0.111***
Yes	158954.86)	130(45.14)	
Blood transfusion			
No	127(70.56)	53(29.44)	**0.001***
Yes	49(32.45)	102(67.55)	
No of times			
Once	29(56.86)	22(43.14)	**0.001***
Twice	15(22.06)	53(77.94)	
3 times and above	4(13.33)	26(86.67)	
Antimalarial			
No	14(42.42)	19(57.58)	**0.192***
Yes	162(54.36)	136(45.64)	
Weight loss			
No	106(71.62)	42(28.38)	**0.001***
Yes	70(38.25)	113(61.75)	
Intake			
Normal	127(72.16)	49(27.84)	**0.001***
Reduced	49(31.61)	106(68.39)	
Appetite			
No	101(73.19)	37(26.81)	**0.001***
Yes	75(38.86)	118(61.14)	
G.I symptoms			
None	114(67.86)	54(32.14)	**0.001***
Diarrhea	15(39.47)	23(60.53)	
Nausea and vomiting	40(36.70)	69(63.30)	
Constipation	7(43.75)	9(56.25)	

Activity			
Normal	117(73.13)	43(26.88)	**0.001***
Reduced	59(34.50)	112(65.50)	
Triceps			
Normal	111(76.03)	35(23.97)	**0.001***
Mild	55(47.41)	61(52.59)	
Severe	10(14.71)	58(85.29)	
Shoulders			
Normal	109(74.15)	38(25.85)	**0.001***
Mild	56(47.86)	61(52.14)	
Severe	10(15.38)	55(84.62)	
Oedema			
None	156(54.36)	20(46.51)	0.336
Present	131(45.64)	23(53.49)	
Ascites			
None	159(58.24)	17(29.82)	**0.001***
Present	114(41.76)	40(70.18)	

Table 7: Bivariate Logistic Regression Analysis of Factors Associated with Malnutrition

Table 7 presents the crude odds ratios (COR) obtained from bivariate logistic regression analysis. The analysis identified several factors that significantly influenced the likelihood of malnutrition among children with sickle cell disease.

Children aged above 10 years had significantly higher odds of malnutrition compared to younger children (COR=1.57, p=0.042). Breastfeeding uncertainty, meal frequency, recent illness, height, current weight, frequency of crises, hospitalization, blood transfusion, weight loss, reduced dietary intake, poor appetite, gastrointestinal symptoms, reduced activity level, muscle wasting, and ascites were also significantly associated with malnutrition.

Notably, indicators reflecting disease severity and nutritional compromise demonstrated the strongest associations. Children with a history of hospitalization, blood transfusion, frequent crises, weight loss, reduced food intake, poor appetite, and muscle wasting exhibited markedly different odds of malnutrition compared to their counterparts. These findings indicate that both disease-related

complications and nutritional factors contribute substantially to the risk of malnutrition among children with sickle cell disease.

Variables such as sex, hydroxyurea use, antimalarial use, source of food, and MUAC were not statistically significant predictors of malnutrition in the bivariate logistic regression model.

Table 7: Bivariate logistic regression.

VARIABLE	COR (95%CI)	P.VALUE
AGE		
5-10	Ref	
Above 10	1.57(1.02-2.43)	0.042*
Sex		
Male	Ref	
Female	1.01(0.661.56)	0.964
Family type		
Nuclear	Ref	
Extended	0.57(0.340.97)	0.39
Single parent	1.04(0.581.87)	0.884
Breast feeding		
Yes	Ref	
No	1.52(0.90-2.59)	0.12
Not sure	2.37(1.21-4.63)	0.011*
No of meal2s		
2	Ref	
3	13.65(0.53-60.98)	0.001*
4	11.51(2.59-51.08)	0.001*
5	8.55(1.54-47.41)	0.14
Been sick in 2 weeks		
No	Ref	
Yes	0.55(0.35-0.85)	0.007*
Height		
>99.9	Ref	
100-124	1.81(0.82-4.00)	0.141

125-149	3.18(1.72-8.37)	0.001*
150 and above	2.6(1.45-5.84)	0.022*
Food shortage		
No	Ref	
Yes	0.57(0.36-0.89)	0.013*
Source of food		
Food production, garden	Ref	
Market, shop	1.40(0.89-2.2)	0.142
Current weight		
Very low (<15 kgs)	Ref	
Low >15.1-25kgs	3.11(1.47-6.51)	0.003*
Moderate 25.1-40kgs	2.76(1.32-5.77)	0.007*
High (>40)	6.06(2.43-15.08)	0.000*
MUAC		
<14.9cm	Ref	
15-17 cm	1.17(0.71-1.93)	0.526
>18 cm	1.96(0.97-3.95)	0.062*
Frequency of crisis		
Weekly	Ref	
Monthly	2.41(1.88-3.09)	0.000*
Hospitalization		
No	Ref	
Yes	0.201(0.11-0.37)	0.000*
Folic acid		
No	Ref	
Yes	0.30(0.08-1.08)	0.066*
Hydroxyurea		
No	Ref	
Yes	1.69(0.88-3.23)	0.114
Blood transfusion		
No	Ref	
Yes	0.20(0.13-0.32)	0.000*

Antimalarial		
No	Ref	
Yes	1.62(0.78-3.34)	0.195
Weight loss		
No	Ref	
Yes	0.25(0.15-0.39)	0.000*
Intake		
Normal	Ref	
Reduced	0.18(0.11-0.29)	0.000*
Appetite		
No	Ref	
Yes	0.23(0.145-0.37)	0.000*
G.I symptoms		
None	Ref	
Diarrhea	0.31(0.15-0.64)	0.002*
Nausea and vomiting	0.27(0.17-0.46)	0.000*
Constipation	0.37(0.13-1.04)	0.060
Activity		
Normal	Ref	
Reduced	0.19(0.12-0.31)	0.000*
Triceps		
Normal	Ref	
Mild	0.28(0.17-0.48)	0.000*
Severe	0.54(0.25-0.12)	0.000*
Shoulders		
Normal	Ref	
Mild	0.32(0.19-0.54)	0.000*
Severe	0.63(0.29-0.14)	0.000*
Ascites		
None	Ref	
Present	0.31(0.17-0.56)	0.000*

Table 8: Multivariate Logistic Regression Analysis of Factors Associated with Malnutrition

Table 8 presents the adjusted logistic regression model showing factors independently associated with malnutrition after controlling for potential confounding variables. Although numerous variables were significant at the bivariate level, only a few remained statistically significant after adjustment.

Hospitalization emerged as an independent predictor of malnutrition (AOR=0.45, 95% CI: 0.21–0.94, p=0.034). In addition, severe shoulder muscle wasting was independently associated with malnutrition (AOR=2.90, 95% CI: 0.10–8.49, p=0.047), indicating that children with severe muscle wasting were more likely to experience poor nutritional outcomes. Presence of ascites also remained significantly associated with malnutrition (AOR=0.43, 95% CI: 0.19–0.99, p=0.047).

Other factors that were significant during bivariate analysis, including age, meal frequency, current weight, blood transfusion, weight loss, appetite, dietary intake, frequency of crises, and gastrointestinal symptoms, lost statistical significance after adjustment, suggesting that their effects were influenced by other variables included in the model.

The multivariate findings therefore indicate that hospitalization history, severe shoulder muscle wasting, and ascites were the key independent factors associated with malnutrition among children with sickle cell disease in the study population.

Table 8: Multivariate analysis.

VARIABLE	**AOR (95%CI)**	P Value
AGE		
5-10	Ref	
Above 10	1.06(0.38-2.94)	0.918
Breast feeding		
No	Ref	
Yes	1.43(0.67-3.08)	0.353
Not sure	2.16(0.82-5.70)	0.120
No of meal2s		
2	Ref	
3	7.14(0.95-53.49)	0.056

4	3.85(0.51-29.11)	0.191
5	2.26(0.23-21.97)	0.483
Been sick in 2 weeks		
No	ref	
Yes	0.90(0.48-1.71)	0.749
Height		
>99.9	Ref	
100-124	1.10(0.29-4.21)	0.888
125-149	2.06(0.43-9.90)	0.369
150 and above	2.13(0.36-12.69)	0.407
Food shortage		
No	ref	
Yes	0.67(0.37-1.22)	0.186
Current weight		
Very low (<15 kgs)	ref	
Low >15.1-25kgs	1.11(0.27-4.51)	0.889
Moderate 25.1-40kgs	0.32(0.05-1.99)	0.222
High (>40)	0.57(0.7-4.68)	0.601
MUAC		
<14.9cm	Ref	
15-17 cm	0.76(0.32-1.79)	0.523
>18 cm	1.07(0.31-3.75)	0.914
Frequency of crisis		
Weekly	Ref	
Monthly	1.44(1.03-2.02)	0.34
Hospitalization		
No	Ref	
Yes	0.45(0.21-0.94)	0.034
Folic acid		
No	Ref	
Yes	0.49(0.10-2.37)	0.372
Blood transfusion		

No	Ref	
Yes	0.51(0.25-1.03)	0.062
Weight loss		
No	Ref	
Yes	1.13(0.45-2.84)	0.801
Intake		
Normal	Ref	
Reduced	0.60(0.24-1.53)	0.284
Appetite		
No	Ref	
Yes	0.76(0.33-1.76)	0.518
G.I symptoms		
None	Ref	
Diarrhea	1.35(0.43-4.19)	0.606
Nausea and vomiting	1.1(0.47-2.59)	0.828
Constipation	1.13(0.28-4.58)	0.867
Activity		
Normal	Ref	
Reduced	0.52(0.20-1.33)	0.172
Triceps		
Normal	Ref	
Mild	0.86(0.11-6.91)	0.886
Severe	0.32(0.04-3.52)	0.378
Shoulders		
Normal	Ref	
Mild	1.00(0.14-7.27)	0.997
Severe	2.90(0.10-8.49)	0.047
Ascites		
None	Ref	
Present	0.43(0.19-0.99)	0.047

5.0 CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter five discusses the findings of the study on the prevalence and factors influencing malnutrition among children aged 5–17 years with sickle cell disease (SCD) attending Mbale Regional Referral Hospital in Eastern Uganda. The discussion is organized around the study objectives and is supported by comparison with published literature from similar settings in sub-Saharan Africa and globally. Data were collected using a structured questionnaire administered via KoboToolbox and supplemented with anthropometric measurements and Subjective Global Nutritional Assessment (SGNA) findings.

5.2 Prevalence of Malnutrition

The study found that 46.83% of children with sickle cell disease were malnourished based on BMI-for-age classification. This finding confirms that malnutrition is a highly prevalent and significant health burden among older children living with SCD in Eastern Uganda. This prevalence is consistent with reports from Nigeria, where a 2024 study reported a 65.6% prevalence of malnutrition among children with sickle cell anemia, with many cases being severe and more common in adolescents (Yusufu et al., 2023). Similarly, a pooled analysis reported that 55.4% of children with SCD were stunted and 38.9% were underweight across various settings (Islam et al., 2021). However, the prevalence found in this study is higher than the 31.3% reported by Namubamba et al. (2024) at Mulago National Referral Hospital among under-five children with SCD, possibly reflecting the compounded nutritional challenges in the older age group (5–17 years) who are subject to increased metabolic demands during growth and puberty.

In terms of MUAC, 28.10% of children had measurements below 14.9 cm, indicating a substantial proportion at risk of acute undernutrition. This aligns with findings by Asiimwe et al. (2019), who reported wasting at 11.4% and stunting at 13.7% among children aged 5–12 years with SCD in Uganda. The higher proportion of MUAC-based risk in this study may reflect the broader age range included and the heightened disease severity documented among participants, such as frequent crises and repeated hospitalizations. Overall, these findings underscore the urgent need for routine nutritional screening among children with SCD in Eastern Uganda.

5.3 Socio-demographic Factors and Malnutrition

The bivariate analysis in this study demonstrated that age was significantly associated with malnutrition (p=0.04), with children aged 5–10 years showing a higher prevalence of malnutrition (52.41%) compared to older children aged 11–17 years (41.83%). This may reflect the critical nutritional vulnerability of younger school-aged children who are still in early growth phases and may not yet be consuming sufficiently diversified diets. This finding is supported by literature showing that younger children with SCD bear a disproportionate malnutrition burden because their energy demands relative to body size are greater and their dietary autonomy is limited (Obeagu & Obeagu, 2024b). However, after multivariate adjustment, age did not remain a significant independent predictor (AOR=1.06, p=0.918), suggesting that age interacts with other variables such as disease severity and dietary intake in determining nutritional status.

Sex was not significantly associated with malnutrition (p=0.96) in either bivariate or multivariate analyses. This finding is consistent with studies such as that by Ukoha et al. (2020) in Southeast Nigeria, which found no significant sex differences in nutritional status among children with SCD. The household income distribution revealed that the majority (69.49%) earned less than UGX 100,000 per month, reflecting the low socioeconomic status of most families in the study area. While household income was not statistically significant in the bivariate analysis (p=0.72), low income remains a contextual factor that constrains dietary diversity and food access. Similar socioeconomic patterns have been documented in Eastern Uganda, where poverty is a well-recognized driver of malnutrition (UNICEF, 2025). Caregiver education level also did not significantly predict malnutrition in this study, though evidence from comparable settings in sub-Saharan Africa suggests that higher maternal education is associated with better child nutritional outcomes (Namubamba et al., 2024; Ohemeng et al., 2023).

5.3 Child Health, Nutritional History, and Environmental Factors

5.3.1 Breastfeeding and Meal Frequency

Breastfeeding history was significantly associated with malnutrition at the bivariate level (p=0.04). Children whose breastfeeding status was uncertain were more likely to be malnourished (COR=2.37, p=0.011) compared to those confirmed to have been breastfed. Although not retained as an independent predictor in the multivariate model, this finding aligns with established evidence that adequate early breastfeeding is a protective factor against malnutrition through improved immune

function, gut development, and optimal early nutrition (Namubamba et al., 2024; Obeagu & Obeagu, 2024b).

Meal frequency was strongly and significantly associated with malnutrition ($p<0.001$). Children consuming only two meals per day had markedly higher odds of malnutrition compared to those eating three or more meals (COR=13.65 for three meals, $p=0.001$). This finding is particularly important given that children with SCD have elevated energy requirements due to chronic hemolysis, metabolic stress, and recurrent pain crises (Obeagu & Obeagu, 2024b; Ramesh et al., 2025). Insufficient meal frequency directly translates into inadequate energy and nutrient intake, predisposing children to undernutrition. The study finding that 6.34% of children consumed only two meals per day highlights a concerning gap in dietary adequacy in this population. Dietary diversity data further showed that carbohydrates dominated food consumption (98.19%), while only 37.76% consumed vitamin-rich foods and 25.38% had diversified diets. Such narrow dietary patterns are consistent with food insecurity and poverty, and they are known to worsen micronutrient deficiencies that compound malnutrition in SCD (Umeakunne & Hibbert, 2019).

5.3.2 Recent Illness

A significant proportion (44.41%) of children had experienced illness in the two weeks preceding the study. Bivariate analysis showed a significant association between recent illness and malnutrition ($p=0.01$), with children who had been sick showing higher odds of malnutrition (COR=0.55, 95% CI: 0.35–0.85, $p=0.007$). Malaria was the predominant illness (27.79%), followed by respiratory tract infections (16.31%) and fever (13.29%). These findings are consistent with the broader literature documenting the bidirectional relationship between infection and malnutrition, wherein infections increase metabolic demands and reduce appetite while malnutrition compromises immune function, predisposing children to repeated infections (Obeagu & Obeagu, 2024b; Otiti & Allen, 2021).

5.3.3 Food Security, Water, Sanitation, and Hygiene

Food shortage was reported in 58.61% of households. Bivariate logistic regression found that food shortage was significantly associated with malnutrition (COR=0.57, 95% CI: 0.36–0.89, $p=0.013$). This finding is in keeping with evidence from Nigeria where Ramirez-Cuebas et al. (2025) demonstrated that food insecurity significantly impaired malnutrition treatment response in children with SCD and severe acute malnutrition. With most households earning below UGX 100,000 monthly and 65.56% residing in rural areas, food insecurity represents a systemic challenge for this population.

The reliance of 62.24% of families on market-purchased food, combined with low household incomes, further constrains dietary diversity and adequacy.

Regarding water and sanitation, 18.43% of households relied on unsafe water sources including wells and swamps, and 67.07% used pit latrines as their primary sanitation facility. These environmental factors are known contributors to diarrheal disease and other infections that worsen nutritional status in children (Victor et al., 2024, 2025). Handwashing practices and waste disposal methods were also assessed, with burning being the most common method of waste disposal (38.97%), reflecting limited environmental sanitation practices that may indirectly predispose children to repeated enteric and respiratory infections.

5.4 Disease-related Factors and Malnutrition

5.4.1 Hospitalization

Hospitalization was a key independent predictor of malnutrition in the multivariate analysis (AOR=0.45, 95% CI: 0.21–0.94, p=0.034). Of the participants, 75.83% had been hospitalized in the past six months, reflecting the high burden of acute illness complications in this population. The association between hospitalization and malnutrition is well established: repeated hospitalizations disrupt feeding routines, increase catabolism, reduce appetite, and increase energy expenditure through fever, infection, and pain management (Byfield et al., 2024; Ramesh et al., 2025). In this study, children who had been hospitalized were significantly more likely to be malnourished, underscoring the importance of nutritional assessment and support during hospitalization and in follow-up care.

5.4.2 Frequency of Sickle Cell Crisis

Monthly sickle cell crises were reported by 41.69% of participants, and the frequency of crises was significantly associated with malnutrition in the bivariate analysis ($p<0.001$). Specifically, children experiencing monthly crises had higher odds of malnutrition compared to those with weekly crises (COR=2.41, p=0.000). Pain crises are associated with increased basal metabolic rate, reduced oral intake due to pain and hospitalization, and prolonged periods of inadequate nutrition (Osunkwo et al., 2020). These mechanisms collectively compromise nutritional status over time, particularly in children who experience recurrent crises. This finding is consistent with evidence from Obeagu & Obeagu (2024b) highlighting pain crises as a key determinant of poor nutritional outcomes in SCD.

5.4.3 Blood Transfusion

A history of blood transfusion was significantly associated with malnutrition in both bivariate and multivariate analyses. Children who had received blood transfusions, especially multiple transfusions, demonstrated markedly higher odds of malnutrition (COR=0.20, p=0.000). Of those transfused, 45.64% had received transfusions twice, and 20.13% had received three or more transfusions. The need for repeated transfusion likely reflects severe SCD complications including aplastic crises, splenic sequestration, and severe anemia, all of which are associated with nutritional depletion (Byfield et al., 2024; Klein et al., 2023). This finding highlights that transfusion history may serve as a useful clinical proxy for disease severity and nutritional risk stratification.

5.4.4 Medications: Folic Acid, Hydroxyurea, and Antimalarial Prophylaxis

The vast majority of children were receiving folic acid (95.77%), hydroxyurea (87.01%), and antimalarial prophylaxis (90.03%). These medications did not demonstrate statistically significant independent associations with malnutrition in the multivariate model. However, folic acid and hydroxyurea are critical components of SCD management and are known to reduce crisis frequency and chronic hemolysis-related complications (Osunkwo et al., 2020). The near-universal uptake of these medications at MRRH suggests relatively good adherence to standard SCD treatment protocols, which may have mitigated the severity of malnutrition that would otherwise have been observed.

5.5 Nutritional and Clinical Indicators of Malnutrition

5.5.1 Weight Loss and Dietary Intake

More than half of the children (55.29%) reported weight loss in the past six months, with 64.48% experiencing mild loss and 35.52% severe weight loss. Weight loss was significantly associated with malnutrition (COR=0.25, p=0.000). Reduced dietary intake was reported by 46.83% and poor appetite by 58.31%, both significantly associated with malnutrition ($p<0.001$). These findings reflect the appetite-suppressing effects of chronic illness, recurrent pain crises, gastrointestinal symptoms, and medications used in SCD management (Obeagu & Obeagu, 2024b). The SGA-based findings corroborate the anthropometric data and demonstrate the clinical significance of subjective nutritional deterioration in this population.

5.5.2 Gastrointestinal Symptoms

Gastrointestinal (GI) symptoms were prevalent, with 32.93% of children experiencing nausea and vomiting, 11.48% diarrhea, and 4.83% constipation. GI symptoms were significantly associated with

malnutrition (p<0.001). Children with nausea and vomiting (COR=0.27, p=0.000) and diarrhea (COR=0.31, p=0.002) had significantly higher odds of malnutrition. This is consistent with evidence that gastrointestinal complications in SCD, including sickling in mesenteric vessels causing abdominal vaso-occlusive crises, nausea from hydroxyurea, and gut dysfunction from chronic anemia, substantially reduce nutrient absorption and appetite (Umeakunne & Hibbert, 2019).

5.5.3 Muscle Wasting and Ascites

Physical examination findings from the SGNA revealed that 55.76% of children had varying degrees of triceps muscle wasting and 55.32% had shoulder muscle wasting. Severe shoulder muscle wasting was independently associated with malnutrition in the multivariate analysis (AOR=2.90, 95% CI: 0.10–8.49, p=0.047). Muscle wasting is a hallmark of chronic protein-energy malnutrition and is increasingly recognized in children with chronic hemolytic diseases including SCD (Ramesh et al., 2025; Ghafuri et al., 2020).

Ascites was present in 17.27% of children and was independently associated with malnutrition (AOR=0.43, 95% CI: 0.19–0.99, p=0.047). The presence of ascites in children with SCD may reflect hepatic complications from repeated sickling events, iron overload from multiple transfusions, or severe hypoalbuminemia secondary to protein malnutrition. This finding is alarming and highlights the advanced stage of nutritional and clinical deterioration in a significant subset of children attending MRRH.

5.6 Summary of Discussion

This study found a high prevalence of malnutrition (46.83%) among children with SCD in Eastern Uganda, consistent with regional and global literature. Key independent predictors of malnutrition were hospitalization history, severe shoulder muscle wasting, and ascites. Dietary factors including low meal frequency, food insecurity, and poor dietary diversity also significantly contributed to malnutrition at the bivariate level. Disease-related factors such as crisis frequency, blood transfusions, and recurrent illness exacerbated nutritional vulnerability. These findings call for integrated nutritional and clinical care strategies tailored to children with SCD in resource-limited settings.

6.0 CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study is set to determine the prevalence and factors influencing malnutrition among children aged 5–17 years with sickle cell disease attending Mbale Regional Referral Hospital in Eastern Uganda. A descriptive cross-sectional design was employed, with data collected from 331 children using a structured questionnaire administered via KoboToolbox, supplemented with anthropometric measurements and SGNA assessments.

The study found a high prevalence of malnutrition, with 46.83% of children classified as malnourished based on BMI-for-age and 28.10% at risk based on MUAC. These figures are alarming and establish malnutrition as a significant public health problem among school-aged children with SCD in Eastern Uganda. The magnitude of the problem underscores the critical gap left by nutrition programs that primarily target children under five years of age and the general population.

The multivariate analysis identified three independent predictors of malnutrition: hospitalization history, severe shoulder muscle wasting, and the presence of ascites. At the bivariate level, additional factors including age, meal frequency, recent illness, food shortage, breastfeeding history, frequency of sickle cell crises, blood transfusion history, weight loss, poor appetite, reduced dietary intake, gastrointestinal symptoms, reduced physical activity, and triceps muscle wasting were all significantly associated with malnutrition. These findings confirm that malnutrition in children with SCD is multifactorial, arising from the interplay of disease-related factors, dietary inadequacies, socioeconomic constraints, and environmental determinants.

The study has successfully addressed its primary objectives: it has quantified the prevalence of malnutrition among children 5–17 years with SCD at MRRH and identified the key factors influencing it. The findings provide a critical local evidence base that was previously lacking for this population in Eastern Uganda, and they support the urgent need for targeted nutritional screening, prevention, and management within the SCD care pathway.

6.2 RECOMMENDATIONS

6.2.1Recommendations to the Ministry of Health and Policy Makers

The Ministry of Health Uganda should revise national nutrition guidelines to explicitly include children aged 5–17 years with chronic conditions such as SCD as a priority group for nutritional screening and intervention, moving beyond the current focus on children under five years of age.

Nutrition-sensitive social protection programs, including conditional cash transfers and school feeding initiatives, should be extended to rural households caring for children with SCD, given that 69.49% of families in this study earned less than UGX 100,000 per month and 65.56% resided in rural areas.

Policy makers should integrate MUAC screening, BMI-for-age assessment, and SGNA into routine SCD clinic visits at all regional referral hospitals to ensure early identification and treatment of malnutrition.

Investment in water, sanitation, and hygiene (WASH) infrastructure in rural Eastern Uganda is recommended, given that a substantial proportion of study participants relied on unsafe water sources and had limited sanitation facilities, both of which increase infection risk and worsen nutritional outcomes.

6.3 Recommendations to Mbale Regional Referral Hospital

MRRH should establish a dedicated nutritional support pathway within the SCD clinic, including routine anthropometric monitoring (weight, height, MUAC, BMI-for-age), dietary history assessment, and SGNA at every clinic visit.

Given the fact that many children (75.83%) were reported to have been hospitalized in the past six months and hospitalization was independently associated with malnutrition, the hospital should implement nutritional support protocols during hospital admissions for SCD patients, including early nutritional assessment on admission, therapeutic feeding support where indicated, and nutritional counseling prior to discharge.

Programs for Nutritional supplementation, including therapeutic food supplements and micronutrient supplementation beyond folic acid, Zinc should be considered for children identified as malnourished or at nutritional risk.

The hospital (MRRH) should strengthen interdisciplinary collaboration between hematologists, dietitians, nurses, and pediatricians in the management of children with SCD to ensure that nutritional care is integrated into the overall treatment plan.

6.3 Recommendations to Healthcare Workers

Nurses and other healthcare workers at MRRH and affiliated health facilities should be trained in nutritional assessment tools appropriate for school-aged children with SCD, including MUAC measurement, BMI-for-age calculation, and SGNA, to enable early detection of malnutrition.

Healthcare workers should provide targeted nutritional education to caregivers of children with SCD during every clinic visit, emphasizing the importance of dietary diversity, adequate meal frequency (at least three meals per day), and age-appropriate micronutrient intake.

Given the high prevalence of gastrointestinal symptoms (49.24%) and poor appetite (58.31%), healthcare workers should proactively screen for and manage GI complications in SCD patients as part of nutritional care, as these directly reduce food intake and nutrient absorption.

Caregivers should be counseled on food security strategies, including home food production, preservation, and utilization of locally available nutrient-dense foods to mitigate the impact of poverty on dietary diversity.

6.5 Recommendations to Future Researchers

Future studies should employ longitudinal designs to track changes in nutritional status over time among children with SCD, enabling a better understanding of the trajectory of malnutrition and the effectiveness of nutritional interventions in this population.

Qualitative studies exploring caregivers' knowledge, attitudes, and practices regarding nutrition in SCD are recommended to complement quantitative findings and inform culturally appropriate intervention design.

Research into the micronutrient status (zinc, vitamin D, iron, and B vitamins) of older children with SCD in Eastern Uganda is needed, as micronutrient deficiencies are poorly documented in this population despite their known impact on SCD complications and growth.

Future investigators should consider including comparison groups of children without SCD to better estimate the excess nutritional burden attributable to the disease itself, and to strengthen causal inference regarding identified risk factors.

Multi-site studies across Eastern Uganda involving both urban and rural health facilities should be conducted to improve the generalizability of findings and to capture the full spectrum of socioeconomic and environmental factors influencing malnutrition in children with SCD

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APPENDIX ONE: CONSENT FORM

APPENDIX ONE

Consent form

PREVALENCE AND INFLUENCING FACTORS TO MALNUTRITION AMONG CHILDREN 5-17 YEARS WITH SICKLE CELL DISEASE IN EASTERN UGANDA

Principal investigator: MUKHOKOSI JANET, BNS IV, BUSITEMA UNIVERSITY FACULTY OF HEALTH SCIENCES, MBALE, EASTERN UGANDA

Purpose of the Study

You are invited to take part in a study that aims to assess the prevalence and influencing factors of malnutrition among children 5-17 years with sickle cell disease in Mbale, eastern Uganda.

2. Investigator

This study is being conducted by Mukhokosi Janet, a final-year nursing student from Busitema University, Faculty of Health Sciences.

3. Study Participants

Participants will be identified using purposive sampling. The final number of participants will depend on when no new information is obtained (data saturation).

4. Duration of the Study

The study will be carried out over one month. Each discussion session will take approximately 30 to 60 minutes of your time.

5. Study Procedures

A trained research assistant will describe the study to you and clarify anything you may want to know. Once everything is clear, you will be asked to give consent by signing or thumb-printing this form. You will then respond to questions asked during the interview. The entire process will last between 30 to 60 minutes.

6. Possible Risks

Your involvement in this study is expected to involve very minimal risks. The main potential risk is the possibility of someone accessing your private information, but this will be prevented by secure storage and restricted access.

7. Possible Benefits

Your contributions will help generate information that can improve learning outcomes at Busitema University, Faculty of Health Sciences.

8. Costs and Compensation

You will not receive financial pay for taking part in the study. However, a small refreshment will be given to each participant.

9. Your Rights as a Participant

a) Voluntary Participation:

Taking part in this study is completely your choice. You may decline without any negative consequences.

b) Right to Withdraw:

You may stop participating at any point without being penalized in any way.

c)Privacy:

Interviews will be conducted in a private area to make you comfortable.

d)Confidentiality:

Your identity will not be used. Only initials will appear on the forms. All information will be stored securely and only authorized study staff will access it.

10. Contact Information

If you have questions or concerns about this study, you may contact the principal investigator using the phone number 0761200877 or email mukhokosijanet@gmail.com. provided by the research team.

For concerns regarding your rights as a participant, you may contact the Research Ethics Committee at the Faculty of Health Sciences, the chairperson BUFHS REC, Dr. Katuramu Richard on 0772457221 or the office on 0414671162. You will also receive a copy of this consent form.

CONSENT AGREEMENT

What does sign or thumb-printing this form mean?

By signing or thumb-printing below, I confirm that:

1. I have read or have had this form read to me and have been given enough time to decide whether to take part.
2. The study and all related procedures have been clearly explained to me.
3. Any questions I had have been answered to my satisfaction.
4. I understand that taking part is voluntary and I may stop at any time.
5. I am agreeing to participate before the study begins.
6. I willingly give my consent to join this study.
7. I will receive a copy of this form after signing.

Participant's Name: KKELLO N.J HOVISA

Signature/Thumbprint: .....

Date (DD/MM/YY): 27/4/2026

Researcher's Name: MUKHOKOSI JANET

Signature: .....

Date (DD/MM/YY): 24/4/2026.

APPENDIX TWO: QUESTIONAIRE

APPENDIX TWO

QUESTIONNAIRE

Section A: socio-demographic information

Child ID No. ----------

1. How old is the child? --------- years.

2. What is the child's sex?

Male ☐ Female ☐

3. How old are you (caregiver)? ----------

4. What is your relationship with the child?

Mother ☐ Father ☐ Guardian ☐ Other.....

5. What is the highest level of education(caregiver)?

None☐ Primary ☐ Secondary ☐ Tertiary☐

6. What is your main occupation(caregiver)?

Farmer ☐ Trader ☐ Formal job ☐ Housewife ☐ Other.....

7. How many people live in your household? --------people.

8. What is the approximate monthly household income?

≤100,000 UGX ☐ 100,000–300,000 ☐ >300,000 ☐

9.Where do you live?

Urban ☐ rural ☐

Section b: child health and nutritional history

10. What was the child's birth weight (if known)? ____ kg

11. Has the child received all the recommended immunizations?

32

Yes ☐ No ☐ Don't know ☐

12. Was the child exclusively breastfed for 6 months?

Yes ☐ No ☐

13. How many meals does the child eat per day?.....

14. How many foods does the child eat? (legumes, fruits, meat, dairy, etc.)

15. Has the child been ill in the past 2 weeks?

Yes ☐ No ☐

If yes, what illness?

Diarrhea ☐ Fever ☐ Cough others specify.....

16. Where did you seek care for the illness?

Health facility ☐ traditional healers ☐ home care☐ clinic ☐ Other ☐

17. What is your main source of drinking water?

Tap ☐ Borehole ☐ River/stream ☐ Protected well ☐ Unprotected source☐

19. What type of toilet does your household use?

Flush ☐ Pit latrine ☐ Open defecation ☐

20. How do you dispose of household waste? household

Burn throw in a Pit ☐ Open dumping ☐ others☐

21. Do house members wash their hands before eating/feeding the child?

Always ☐ Sometimes ☐ Never☐

22. Has your household experienced a food shortage in the past month?

Yes ☐ No ☐

23. What is your main source of food?

Own production ☐ Market ☐ Relief ☐ Others ☐

Section C: Anthropometric measurements to assess malnutrition.

24. Weight Measured in kgs using calibrated scales……..kg

25. Height/length measured in cm using a stadiometer/board

26. Mid -upper Arm circumference (MUAC) in …… (cm)

27. Mid -upper Arm circumference in …… (cm)

28. Presence of bilateral edema?

Yes ☐ No ☐

29. Weight for height z-score computed using WHO references……z-score

Section D: Disease (Sickle Cell Disease)

31. Has the child been diagnosed with Sickle Cell Disease?

Yes ☐ No ☐

32. How often does the child experience a sickle cell crisis?

Monthly ☐ Quarterly ☐ Rarely ☐

33. Has the child been hospitalized for the last 6 months?

Yes ☐ No ☐

34. Is the child taking prescribed medications (folic acid, hydroxyurea)?

Always ☐ Sometimes ☐ Never ☐

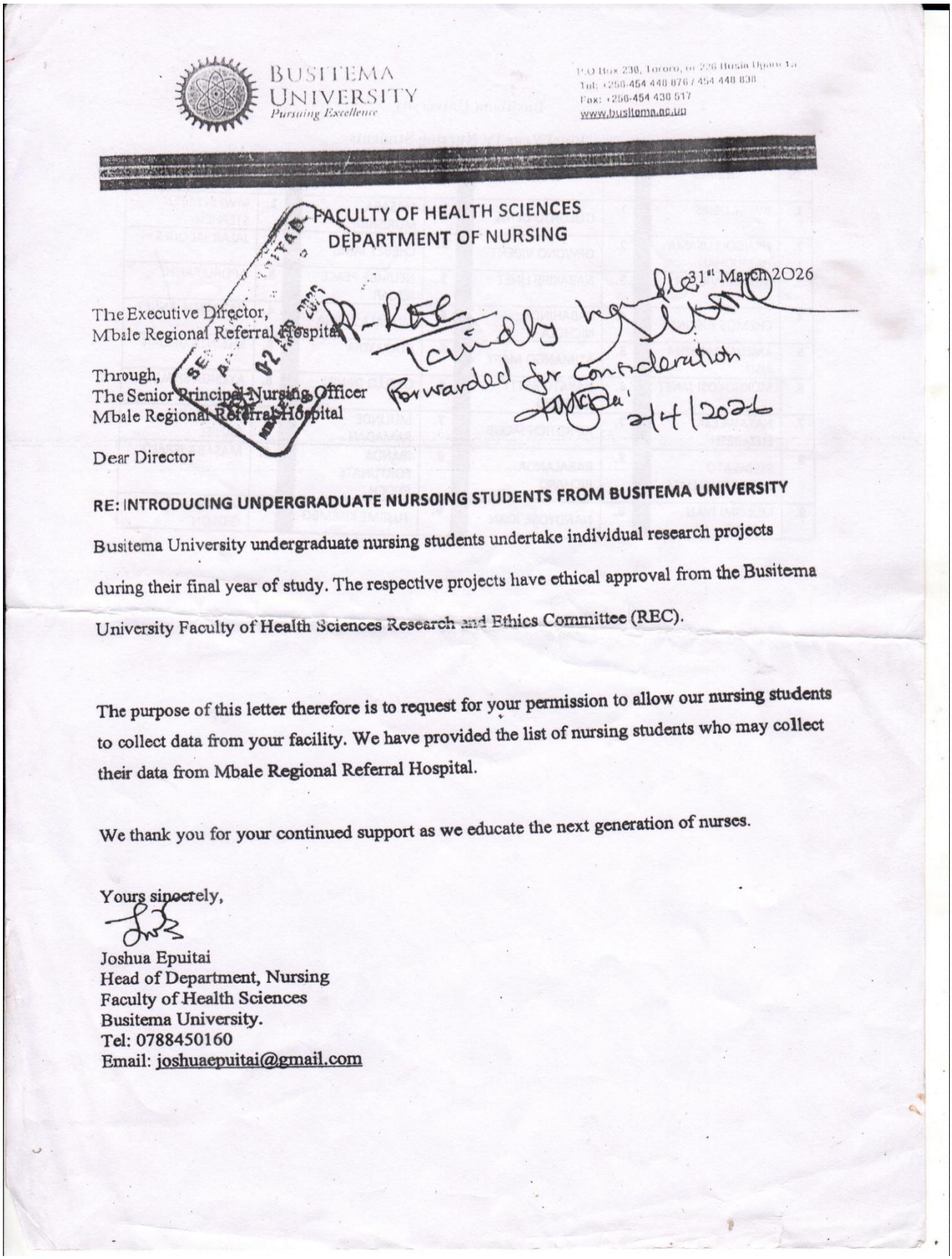
APPENDIX THREE: STUDY WORK PLAN

S/NO	ACTIVITY	2025			2026					
		October	November	December	January	Febr uary	March	April	May	June
1	Topic selection									
2	Topic approval									
3	Proposal writing									
6	Data collection									
7	Data analysis									
8	Report writing									
9	Report Submission									

APPENDIX FOUR: PROPOSED BUDGET

S/NO	ITEM	UNIT	UNIT COST	TOTAL
1	Pens	1 box	20,000	20,000
2	Ruled paper	2 Ream	30,000	60,000
3	Air time	6	100,000	600,000
4	Transport	2	400,000	800,000
5	Flash disk	2	50,000	100,000
6	Internet service	9	50,000	450,000
7	Box file	3	20,000	30,000
8	Research Assistant	2	500,000	1,000,000
9	Printing and binding		100,000	100,000
10	Statesian	1	500,000	500,000
11	Study participant reimbursement	331	5,000	1,830,000
12	Data entry		200,000	200,000
13	Data analysis		500,000	500,000
14	Supervision meetings		1,000,000	1,000,000
15	REC fees		50,000	50,000
16	Administration clearance	1	50,000	50,000
TOTAL				7,290,000/=

APPENDIX FIVE: ADMINISTRATIVE CLEARANCE



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FACULTY OF HEALTH SCIENCES
DEPARTMENT OF NURSING

31st March 2026

The Executive Director,
Mbale Regional Referral Hospital

Through,
The Senior Principal Nursing Officer
Mbale Regional Referral Hospital

Kindly handle
Forwarded for consideration
2/4/2026

Dear Director

RE: INTRODUCING UNDERGRADUATE NURSOING STUDENTS FROM BUSITEMA UNIVERSITY

Busitema University undergraduate nursing students undertake individual research projects during their final year of study. The respective projects have ethical approval from the Busitema University Faculty of Health Sciences Research and Ethics Committee (REC).

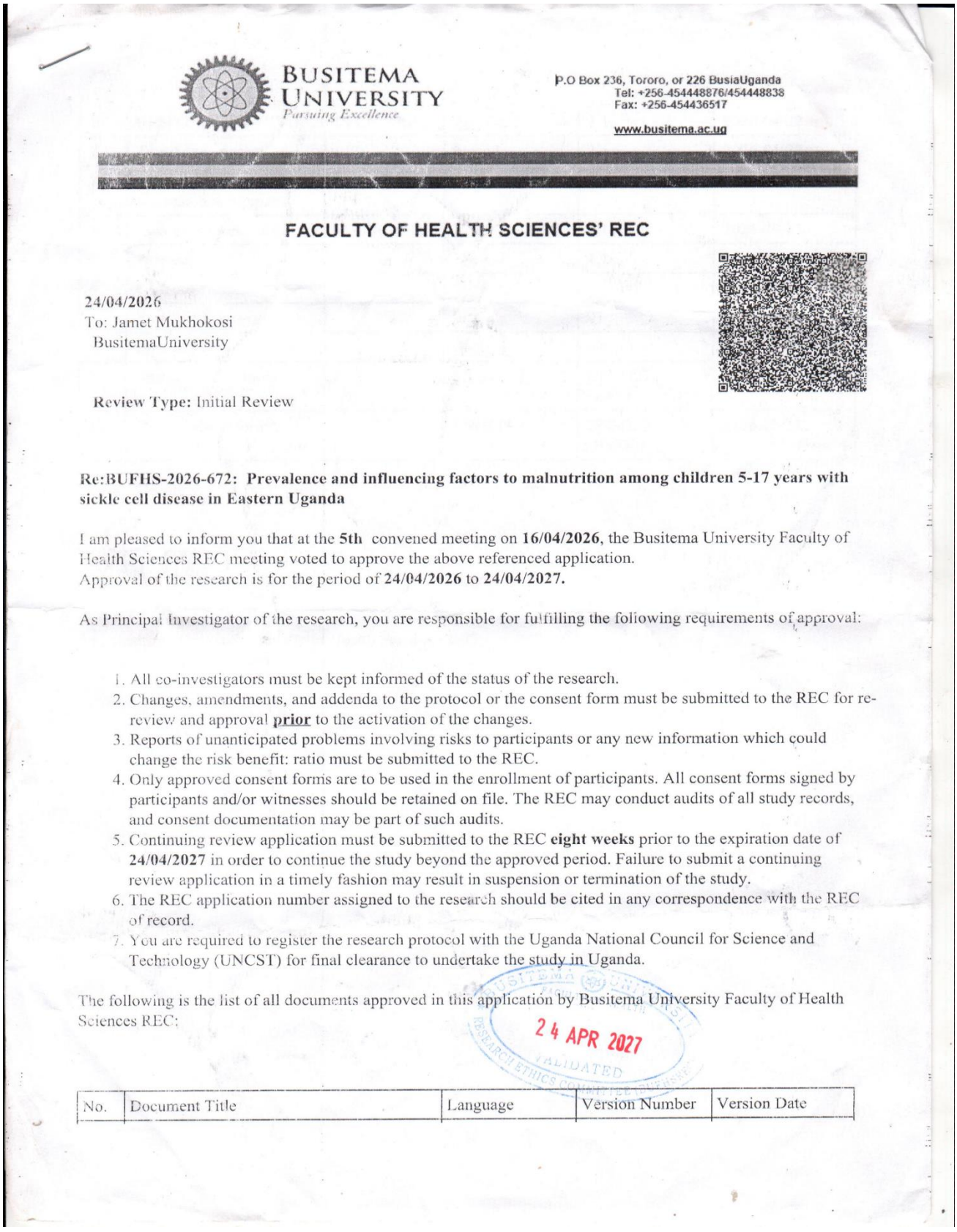
The purpose of this letter therefore is to request for your permission to allow our nursing students to collect data from your facility. We have provided the list of nursing students who may collect their data from Mbale Regional Referral Hospital.

We thank you for your continued support as we educate the next generation of nurses.

Yours sincerely,

Joshua Epuitai
Head of Department, Nursing
Faculty of Health Sciences
Busitema University.
Tel: 0788450160
Email: joshuaepuitai@gmail.com

APPENDIX SIX: APPROVAL LETTER



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FACULTY OF HEALTH SCIENCES' REC

24/04/2026
To: Jamet Mukhokosi
BusitemaUniversity

Review Type: Initial Review

Re:BUFHS-2026-672: Prevalence and influencing factors to malnutrition among children 5-17 years with sickle cell disease in Eastern Uganda

I am pleased to inform you that at the **5th** convened meeting on **16/04/2026**, the Busitema University Faculty of Health Sciences REC meeting voted to approve the above referenced application.
Approval of the research is for the period of **24/04/2026** to **24/04/2027.**

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **24/04/2027** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Busitema University Faculty of Health Sciences REC:

24 APR 2027
VALIDATED

No.	Document Title	Language	Version Number	Version Date

1	RESPONSE TO REVIEWERS LETTER	English	1.1	2026-04-22
2	Translated consent	luganda	1.1	2026-04-22
3	Informed consent form for the recruitment of research participants	English	1.1	2026-04-22
4	Data collection tools	English	1.1	2026-04-22
5	Protocol	English	1.1	2026-04-22
6	Protocol	English	1.1	2026-04-22
7	Translated consent	luganda	01	2026-03-02
8	Protocol	English	01	2026-03-02
9	Data collection tools	ENGLISH	UNITED STATES	2026-02-23
10	Main Consent forms	ENGLISH	UNITED STATES	2026-02-23

Yours sincerely,

Richard Katuramu
For: Busitema University Faculty of Health Sciences REC