PREVALENCE OF ACUTE MALNUTRITION AMONG 6-59 MONTHS OLD CHILDREN RESIDING IN TEA GARDEN DOMINATED AREAS OF BISWANATH DISTRICT, ASSAM

APRIL 2025

ADITYA RANJAN GOSWAMI

BSc. (Hons) Food Nutrition and Dietetics

PREVALENCE OF ACUTE MALNUTRITION AMONG 6-59 MONTHS OLD CHILDREN RESIDING IN TEA GARDEN DOMINATED AREAS OF BISWANATH DISTRICT, ASSAM

BY

ADITYA RANJAN GOSWAMI

A dissertation submitted in partial fulfillment of the requirement for the degree of

MASTERS OF SCIENCE

(PUBLIC HEALTH NUTRITION)

DEPARTMENT OF FOODS AND NUTRITION

FACULTY OF FAMILY AND COMMUNITY SCIENCES

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA,

VADODARA-390002, GUJARAT

CERTIFICATE

This is to certify that the research work presented in this thesis has been carried out independently by Mr. ADITYA RANJAN GOSWAMI under the guidance of Dr. Swati Dhruv in pursuit of Maters of Science (Faculty of Family and Community Sciences) with major in Foods and Nutrition (Public Health Nutrition) and this is his original work.

Dr. Swati Dhruv
(Research Guide)

I/C Head, Department of Foods and Nutrition
Faculty of family and Community Sciences
The Maharaja Sayajirao University of Baroda,
Vadodara-390002, Gujarat

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to all those who have contributed to the successful completion of my work.

First and foremost, I am deeply thankful to my guide, Dr. Swati Dhruv, for her invaluable guidance, support, and encouragement throughout the course of this research project. I would also like to express my sincere appreciation to Prof. Mini Sheth, I/C Head of the Department of Foods and Nutrition, and Prof. Anjali Pahad, Dean, Faculty of Family & Community Science, for their constant inspiration and support.

I am also thankful for the help and cooperation extended by the DSW office, Biswanath, the ICDS team, and the Anganwadi workers, without whose support this work would not have been possible.

I warmly thank the young children who participated and supported this study in their own unique way.

A special thanks to Dr. Shruti Kantawala for her valuable insights and encouragement.

My sincere thanks extend to the entire teaching and non-teaching staff of the Department of Foods and Nutrition for their cooperation and assistance.

I would like to express my deepest gratitude to my father, Robin Chandra Goswami, my mother, Momi Sarmah Goswami, and my sister, Barasha Goswami, for their unwavering support, love, and motivation.

Lastly, I thank all my friends for their constant encouragement and companionship.

Aditya Ranjan Goswami

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AWC-ANGANWADI CENTER

AWW-ANGANWADI WORKER

BMI-BODY MASS INDEX

CM-CENTIMETRES

DOQ - DIETARY QUALITY QUESTIONNAIRE

WHZ- WEIGHT-FOR-HEIGHT Z-SCORE

HAZ-HEIGHT-FOR-AGE Z-SCORE

WAZ - WEIGHT-FOR-AGE Z-SCORE

UNICEF - UNITED NATIONS CHILDREN'S FUND

WASH - WATER, SANITATION AND HYGIENE

WHO - WORLD HEALTH ORGANIZATION

HCM-HOT COOKED MEALS

ICDS - INTERGRATED CHILD DEVELOPMENT SERVICES

IYCF- INFANT AND YOUNG CHILD FEEDING

KG-KILOGRAMS

MAM - MODERATE ACUTE MALNUTRITION

SAM - SEVERE ACUTE MALNUTRITION

NFHS - NATIONAL FAMILY HEALTH SURVEY

OBC-OTHER BACKWARD CASTE

THR- TAKE HOME RATION

SC -SCHEDULED CASTE

SDGS - SUSTAINABLE DEVELOPMENT GOALS

SPSS- SOCIAL PACKAGES FOR STATISTICAL ANALYSIS

ST - SCHEDULED TRIBE

ABSTRACT

ABSTRACT

Malnutrition continues to be a leading cause of morbidity and mortality among children under five years old globally, contributing to nearly 45% of all child deaths (UNICEF et al., 2023). In India, despite progress in recent decades, acute malnutrition remains alarmingly high. The state of Assam, especially its rural, tribal, and tea garden communities, faces challenges related to food insecurity, inadequate healthcare access, and socio-economic vulnerabilities. Children in tea garden areas are particularly vulnerable due to historically marginalized living conditions and poor maternal literacy.

This study was carried out to investigate the burden of acute malnutrition among children aged 6–59 months in tea garden-dominated areas of Biswanath district, Assam, with a particular focus on its prevalence, and associated risk factors such as socio-economic status, immunization status, WASH practices, minimum dietary diversity and IYCF practices of the children. The study was conducted in tea garden-dominated areas of Biswanath District. 30 out of 475 AWCs in 3 blocks viz. Sakomatha, Baghmora and Behali were randomly selected and all registered children aged between 6-59 months were included in the study. There was a total of 1719 children registered in these AWCs. The screening was done for 913 children aged between 6-59 months. The prevalence of various forms of malnutrition, i.e., wasting, underweight and stunting were found in these AWCs using WHZ, WAZ and HAZ, and the associated risk factors of acute malnutrition were assessed using a pre-tested questionnaire.

Findings from the study revealed that the mean weight for boys was 12.27 kg and that of girls was 12.03 kg while the mean height of boys was 90.63 cm while that of girls was 90.86 cm. The prevalence of Acute Malnutrition was found to be 24.6%, where Severe Acute Malnutrition (SAM) was 2.4% and Moderate Acute Malnutrition (MAM) was 22.2%. The prevalence of severe underweight and moderate underweight was found to be 2.7% and 29.6%, respectively. The prevalence of severe stunting and moderate stunting was found to be 7% and 32.6 %, respectively. SAM is most prevalent among children aged 13-35 months at 3%, while MAM is highest in the 6-12 months age group at 31.4%. SAM prevalence is similar between boys (2.0%) and girls (2.8%), whereas MAM is slightly more common in girls (23.5%) than in boys (20.9%). Severe underweight is most prevalent among children aged 13-35 months (3.3%), while moderate underweight peaks in the 6-12 months group (42.9%). Girls are more affected than boys, with 2.8% severely and 30.2% moderately underweight. Severe stunting is most prevalent among children aged 13-35 months (11.3%), with moderate stunting

also peaking in this group (42.4%). Slightly more boys (7.3%) suffer from severe stunting compared to girls (6.7%), while moderate stunting rates are nearly the same for both genders.

Risk factors associated with Acute Malnutrition children revealed that the majority of the children were from nuclear families belonging to the Hindu OBC community, with mothers having a mean age of 23 years. A significant proportion of mothers (57.8%) and household heads (44.4%) were illiterate, and the average monthly household income was ₹10,789. According to the Kuppuswamy Socio-Economic Scale, 72.2% of the families were classified under the upper-lower class category. Access to safe drinking water and adherence to hygienic food handling practices remained inadequate.

Despite 92.9% of the children aged 6-36 months receiving supplementary nutrition in the form of Take-Home Rations (THR) from AWCs, issues such as intra-household sharing and limited dietary diversity reduced its efficacy. Immunization coverage was found to be nearly universal, and 63.6% of children aged 6–23 months achieved the Minimum Acceptable Diet (MAD). However, critical gaps persisted in practices related to exclusive breastfeeding, early initiation of complementary feeding, and consumption of protein-rich foods.

This study revealed a high burden of acute malnutrition among children aged 6–59 months in the tea garden-dominated areas of Biswanath District, Assam. Wasting, underweight, and stunting remained critical public health concerns, especially among younger children. Key contributing factors included low maternal education, poor household income, and limited dietary diversity. Although supplementary nutrition programs existed, their impact was constrained by irregular distribution, sharing of rations, and poor dietary practices. Inadequate access to clean water and sanitation further heightened children's nutritional risks.

INTRODUCTION

BACKGROUND

Malnutrition is a critical public health issue that affects millions of children worldwide, contributing to significant morbidity and mortality (Ronghangpi et al., 2023). The World Health Organization (WHO) defines malnutrition as deficiencies, excesses, or imbalances in energy, protein, and other nutrients. It encompasses both under nutrition and over nutrition, with under nutrition being particularly concerning in the context of child health (UNICEF et al., 2021). According to UNICEF (2020), malnutrition contributes to more than 3 million child deaths annually, making it one of the leading causes of preventable mortality among children under five years old (UNICEF, 2021). The consequences of malnutrition extend beyond immediate health impacts; they affect growth, cognitive development, and overall well-being, perpetuating cycles of poverty as well as inequality.

TYPES OF MALNUTRITION

Malnutrition manifests in various forms, including wasting (low weight-for-height), stunting (low height-for-age), and underweight (low weight-for-age). Each condition reflects different underlying processes and carries distinct implications for health. Wasting is often associated with acute malnutrition resulting from recent food deprivation or illness and poses an immediate risk to children's survival (Black et al., 2008). Children who are wasted have a significantly higher risk of mortality due to their compromised immune systems. Stunting, on the other hand, reflects chronic under nutrition due to prolonged food insecurity and inadequate maternal health. It leads to irreversible impairments in physical growth and cognitive development, affecting children's educational outcomes and future productivity (lowast, 2024). Underweight serves as a composite measure that encompasses both acute and chronic malnutrition, indicating the combined effects of these conditions. The UNICEF Conceptual Framework for Malnutrition and the Social Determinants of Health model illustrates the complex interplay of immediate, underlying, and basic causes of malnutrition, emphasizing the need for comprehensive strategies to address this multifaceted problem (Ronghangpi et al., 2023).

Malnutrition manifests in various forms, including wasting (low weight-for-height), stunting (low height-for-age), and underweight (low weight-for-age). Each condition

reflects different underlying processes and carries distinct implications for health. Wasting is often associated with acute malnutrition resulting from recent food deprivation or illness and poses an immediate risk to children's survival (Konwar et al., 2019). Children who are wasted have a significantly higher risk of mortality due to their compromised immune systems. Stunting, on the other hand, reflects chronic under nutrition due to prolonged food insecurity and inadequate maternal health. It leads to irreversible impairments in physical growth and cognitive development, affecting children's educational outcomes and future productivity (lowast, 2024).

PREVALENCE OF MALNUTRITION

Malnutrition remains a critical global challenge, affecting millions worldwide. In 2023, 733 million people faced chronic hunger, equivalent to one in eleven individuals globally and one in five in Africa, reflecting a 15-year setback in progress toward Sustainable Development Goal (SDG) 2 (Zero Hunger) (*Hunger Numbers Stubbornly High for Three Consecutive Years as Global Crises Deepen: UN Report*, n.d.). Child malnutrition persists alarmingly: 148.1 million children under five were stunted (chronically undernourished), 45 million wasted (acutely malnourished), and 37 million overweight in 2022 (UNICEF et al., 2023). Sub-Saharan Africa and South Asia bear the highest burden, accounting for two-thirds of stunted children, with Africa seeing a rise in cases due to population growth and crises (Eastwood, 1988) (WHO, 2019). While stunting rates have declined globally since 2000 (from 40% to 22%), progress has stalled since 2015, with only a third of countries on track to halve stunting by 2030 (UNICEF et al., 2023) (Eastwood, 1988). Concurrently, adult and child obesity are rising sharply, with 1.2 billion adults projected to be obese by 2030 (*Hunger Numbers Stubbornly High for Three Consecutive Years as Global Crises Deepen: UN Report*, n.d.) (WHO, 2019)**.** This double burden of malnutrition—coexisting under nutrition and obesity—is exacerbated by food insecurity, climate shocks, and economic inequality, disproportionately impacting low-income regions. For instance, 71.5% of low-income populations cannot afford healthy diets, compared to 6.3% in high-income countries (*Hunger Numbers Stubbornly High for Three Consecutive Years as Global Crises Deepen: UN Report*). Without urgent action, 582 million people will remain undernourished by 2030, half in Africa, mirroring 2015 levels and highlighting systemic stagnation (WHO, 2019).

INTRODUCTION

India faces a significant challenge regarding child malnutrition, with approximately one-third of the world's malnourished children residing in the country. The National Family Health Survey (NFHS-5) reported that 21.7% of children under five years old are wasted, while 9.9% suffer from Severe Acute Malnutrition (SAM) (Goswami, 2020). Assam, in particular, exhibits some of the highest rates of child malnutrition in India. In Biswanath district specifically, recent studies have indicated alarming statistics: 27.1% wasting and 13.7% SAM among children aged 6-59 months (Mohfw, 2021). These figures highlight the urgent need for targeted interventions to address malnutrition in this vulnerable population.

The high prevalence of malnutrition in Assam can be attributed to several factors that intersect at individual, household, community, and systemic levels. The state's socio-economic conditions play a critical role; many families live below the poverty line and lack access to adequate nutrition and healthcare services (Medhi et al., 2006). Additionally, cultural practices surrounding food consumption and child-rearing may contribute to poor nutritional outcomes. For instance, dietary preferences may prioritize staple foods over diverse nutrient-rich options like fruits and vegetables (Black et al., 2008).

CAUSES OF MALNUTRITION

The causes of malnutrition are complex and interrelated, stemming from immediate, underlying, and basic factors as outlined by UNICEF's Conceptual Framework for malnutrition (Figure 1.1) (UNICEF, 2021). Immediate causes include inadequate dietary intake and disease; underlying causes encompass food insecurity, poverty, poor maternal healthcare, inadequate sanitation, and insufficient knowledge about nutrition. Basic causes relate to systemic issues such as political instability and economic disparities.

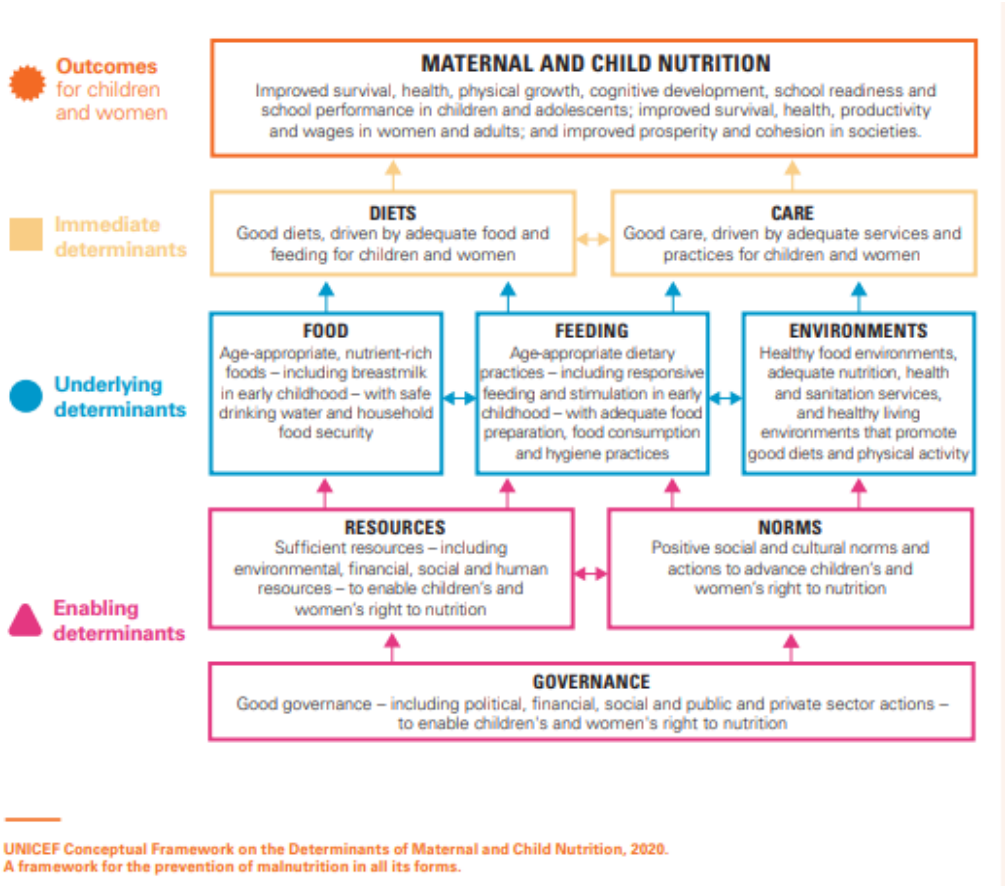
Underlying Causes: Food insecurity is a significant underlying cause of malnutrition in Assam's tea garden communities. Many workers earn low wages that do not provide sufficient income for purchasing nutritious foods (Medhi et al., 2006). The lack of access to affordable healthcare services further compounds the problem; families may be unable to seek timely medical attention for illnesses that could impact their children's

nutritional status (*How Centre's "Poshan Maah" Drive Is Helping In Fight Against Malnutrition In Assam*).

Basic Causes: At a broader level, basic causes include structural inequalities rooted in historical contexts such as colonialism and labor exploitation within tea gardens. These communities often face marginalization due to socio-economic factors that limit their access to resources necessary for improving nutrition—such as education about healthy eating practices or access to quality healthcare services (lowast, 2024).

The Nutrition Transition Theory suggests that rural populations like tea garden workers are increasingly shifting from traditional diets rich in nutrients to processed foods that are often calorie-dense but nutrient-poor (Black et al., 2008). This Transition contributes to worsening malnutrition rates as families struggle to balance nutritional needs with economic constraints.

Figure 1.1: Conceptual framework analyzing the causes of Malnutrition



UNICEF Conceptual Framework on the Determinants of Maternal and Child Nutrition, 2020.
A framework for the prevention of malnutrition in all its forms.

CONSEQUENCES OF MALNUTRITION

Malnutrition has profound short-term and long-term consequences for individuals and societies alike. Short-term effects include increased susceptibility to infections such as diarrhea and pneumonia; developmental delays; impaired cognitive function; and higher rates of morbidity among affected children (Goswami, 2020). Malnourished children are more likely to experience frequent illnesses due to their compromised immune systems (Black et al., 2008). These health challenges can lead to school absenteeism or lower academic performance compared with their well-nourished peers.

Long-term consequences manifest as reduced educational attainment; lower economic productivity; increased healthcare costs; and a higher risk of non-communicable diseases (NCDs) later in life (lowast, 2024). Research indicates that stunted children are at a higher risk for poor educational outcomes—often leading to diminished earning potential later on—thus perpetuating cycles of poverty across generations (Victora et al., 2010).

Moreover, the double burden of malnutrition—characterized by the coexistence of under nutrition alongside rising rates of overweight/obesity—poses additional challenges for public health systems (Medhi et al., 2006). Many regions in India are witnessing rising rates of overweight among certain populations due to dietary shifts towards processed foods while still facing persistent under nutrition issues within marginalized communities like tea garden workers.

DOUBLE BURDEN OF MALNUTRITION: EMERGING CHALLENGES

Assam is currently grappling with this double burden of malnutrition characterized by high rates of both under nutrition and emerging overweight/obesity trends. While under nutrition remains prevalent in rural areas like tea gardens—where rates of wasting can exceed 27%—there is also a rising incidence of overweight among certain populations due to dietary shifts towards processed foods (Mohfw, 2021). This dual burden complicates public health strategies aimed at addressing nutrition-related issues since interventions must simultaneously tackle both forms while considering local contexts.

Addressing this double burden requires integrated public health strategies that tackle both forms of malnutrition simultaneously through coordinated efforts across sectors such as agriculture; education; health care; social protection; food security policies; marketing regulations on unhealthy foods etc.

RESEARCH QUESTIONS

This study aims to investigate critical questions regarding acute malnutrition among children aged 6-59 months in tea garden-dominated areas:

1. What is the prevalence of acute malnutrition among children aged 6-59 months in these communities?
2. What socio-economic and dietary factors contribute significantly to acute malnutrition?
3. How do infant and young child feeding practices correlate with nutritional status?

These questions will guide the research design methodology employed throughout this study while providing insights into understanding how various determinants interact within these specific contexts.

PURPOSE OF THE STUDY

The primary objective is to assess the prevalence of acute malnutrition among children in Biswanath district's tea gardens while identifying key determinants influencing nutritional outcomes within this vulnerable population group. Findings will help in planning targeted interventions aimed at improving child nutrition within these marginalized communities through evidence-based recommendations tailored specifically toward addressing identified risk factors associated with poor nutritional status.

OBJECTIVES OF THE STUDY

Broad Objective:

To assess the prevalence of acute malnutrition among children aged 6-59 months residing in tea garden-dominated areas of Biswanath District.

Specific Objectives:

1. To evaluate the nutritional status of acutely malnourished children.
2. To analyze socio-economic status; dietary diversity; infant feeding practices.
3. To assess morbidity profiles; immunization coverage among these children.

SIGNIFICANCE OF THE STUDY

This research holds significant implications for policy formulation aimed at reducing child malnutrition rates specifically within Assam's Biswanath district's tea gardens:

- Policy Implications: The findings will provide evidence for strengthening existing nutritional programs such as ICDS (Integrated Child Development Services) along with POSHAN Abhiyaan initiatives aimed at improving maternal-child nutrition outcomes.
- Localized Intervention Strategies: Insights gained can lead directly into community-specific interventions tailored specifically toward local needs based upon identified risk factors contributing toward poor nutritional status.
- Bridging Knowledge Gaps: This study will contribute valuable data on child nutrition specific not only toward tea garden communities but also across similar marginalized populations throughout India.
- Interdisciplinary Relevance: Results will benefit various stakeholders including public health professionals; social policymakers; economists involved within health program planning efforts aimed at improving overall community well-being through enhanced nutrition security measures.

In conclusion, addressing acute malnutrition among children residing within Assam's tea gardens necessitates a nuanced, holistic approach that acknowledges the interplay of socio-economic, cultural, and systemic factors perpetuating this crisis. The multifactorial nature of malnutrition in these communities is deeply rooted in structural inequalities, where generations of tea garden workers—largely descendants of indentured laborers—face systemic neglect, economic marginalization, and limited access to essential services. For instance, as highlighted in the National Family Health Survey (NFHS-5), 32.8% of children under five in Assam are underweight, and 65.9%

of women in tea gardens suffer from anemia, reflecting chronic food insecurity and intergenerational deprivation (Mohfw, 2021).

Socio-economic determinants such as poor maternal health, inadequate antenatal care, and low literacy rates further exacerbate malnutrition. Many mothers, themselves undernourished, struggle with breastfeeding and lack awareness of complementary feeding practices, perpetuating cycles of under nutrition. Additionally, the absence of functional sanitation infrastructure and clean drinking water in tea estates increases susceptibility to diarrheal diseases and infections, which deplete already compromised nutritional reserves. Studies from Dibrugarh district reveal that nearly 85% of children admitted to Nutritional Rehabilitation Centres (NRCs) belong to tea gardens, with conditions like marasmus and "baggy pant appearance" (severe muscle wasting) being tragically common (Baruah, 2018; *Malnutrition Rampant among State TE Infants*).

Effective interventions must integrate socio-economic empowerment with targeted health strategies. Programs like POSHAN Abhiyaan and Poshan on Wheels have shown promise by deploying mobile nutrition units to screen children, deliver therapeutic foods, and educate families on dietary diversity. However, their reach remains limited in remote tea estates. Scaling up community-based initiatives—such as kitchen garden projects to enhance access to fresh vegetables or micronutrient supplementation drives—can address immediate gaps. For example, the Nutritional Rehabilitation Centre (NRC) in Jorhat reported that 85.3% of SAM (Severe Acute Malnutrition) cases admitted were from tea gardens, underscoring the need for decentralized, garden-specific NRCs to reduce travel burdens for families (Baruah, 2018).

Long-term solutions require dismantling systemic barriers. Advocacy for fair wages and labor rights in tea plantations is critical, as economic stability enables families to prioritize nutrition. Simultaneously, strengthening Integrated Child Development Services (ICDS) and Anganwadi networks can improve antenatal care, immunization coverage, and maternal education. Data from Sivasagar district reveal that 50.6% of adolescent girls in tea gardens are stunted, indicating that interventions must also target this demographic to break intergenerational cycles of malnutrition (Konwar et al., 2019).

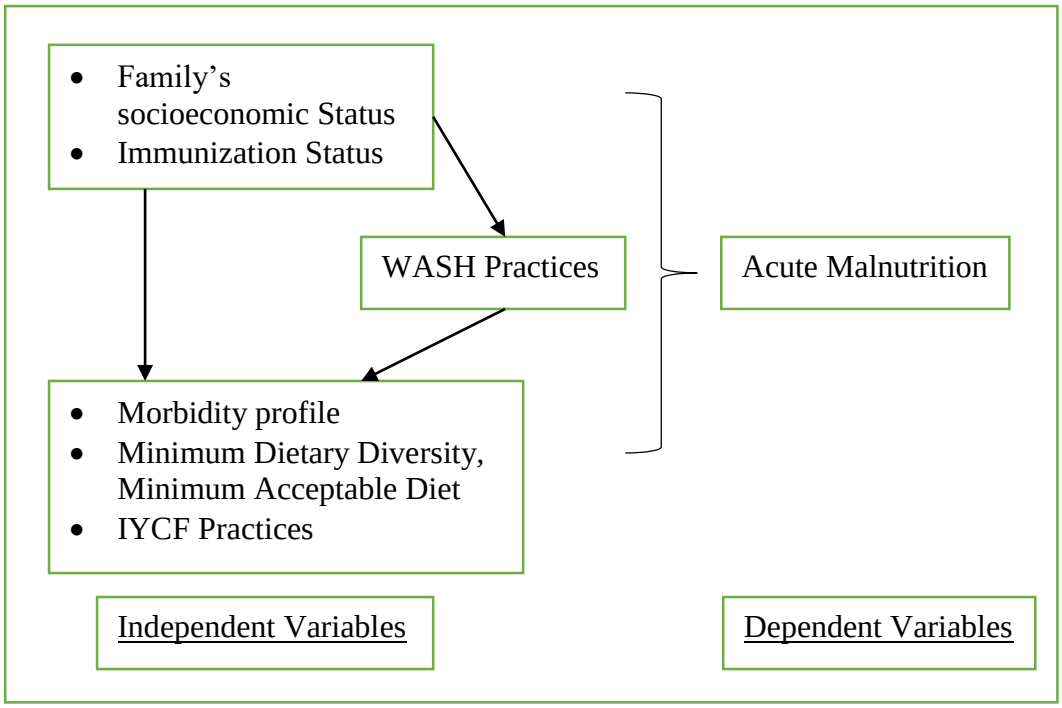
The, collaboration between government agencies, NGOs, and the tea industry is vital. The tea industry, a key stakeholder, must invest in worker welfare through crèches, subsidized ration systems, and healthcare camps. Community participation—such as training local health volunteers from tea tribes—can foster trust and ensure culturally sensitive outreach. As Assam's Poshan Maah initiative demonstrates, combining nutritional support with hygiene education and COVID-19 vaccination drives creates synergies that address overlapping vulnerabilities (*How Centre's "Poshan Maah" Drive Is Helping In Fight Against Malnutrition In Assam*, n.d.).

In essence, eradicating acute malnutrition in Assam's tea gardens demands a paradigm shift from short-term relief to sustainable, equity-driven policies. Only by addressing the root causes—poverty, gender inequality, and systemic exclusion—can we ensure that children in these marginalized communities achieve their full growth potential and break free from the shackles of malnutrition.

CONCEPTUAL FRAMEWORK OF THE STUDY

A conceptual framework visually demonstrates the expected relationship between the independent and dependent variables. For this study, the conceptual framework was developed based on review of literature from the related studies (Fig 1.2).

Figure 1.2: Conceptual framework of the study



REVIEW OF LITERATURE

Malnutrition, especially among children aged 6–59 months, remains a critical global health challenge, impeding physical and cognitive development and perpetuating cycles of poverty and ill-health (UNICEF, WHO, & World Bank, 2022). Globally, the statistics are alarming: In 2022, an estimated 45 million children suffered from wasting (low weight-for-height), indicating acute under nutrition due to recent food shortages or illness; 148 million were stunted (low height-for-age), a sign of chronic under nutrition reflecting long-term deprivation; and 45 million were overweight, pointing to an emerging epidemic of over nutrition even in resource-limited settings (UNICEF, WHO, & World Bank, 2022). These conditions not only affect immediate physical health but also have long-lasting impacts on cognitive function, educational attainment, and future economic productivity (Grantham-McGregor et al., 2007).

The implications of malnutrition extend far beyond individual health outcomes, affecting societal development and economic growth. Malnutrition-related stunting in early childhood can lead to irreversible cognitive deficits, resulting in poor school performance, reduced earning potential, and decreased overall productivity in adulthood (Martorell & Behrman, 2002). Addressing malnutrition, therefore, is not just a matter of public health but also an investment in human capital and sustainable development (Horton & Steckel, 2013).

In India, despite the implementation of numerous intervention programs aimed at improving child nutrition, under nutrition rates remain unacceptably high (IIPS, 2021). The National Family Health Survey-5 (NFHS-5) (2020-21) provides a comprehensive snapshot of the nutritional status of children under five years, revealing that 19.3% were wasted, 35.5% were stunted, and 32.1% were underweight (IIPS, 2021). These figures underscore the persistent challenges in achieving optimal nutrition for young children across the country.

Assam, a state in northeastern India with a significant tea garden workforce, faces particularly acute malnutrition challenges (NFHS-5, 2021). The state's malnutrition rates exceed the national average, with 21.7% of children under five years wasted, 35.3% stunted, and 32.8% underweight (NFHS-5, 2021). These elevated rates are attributed to a complex interplay of socio-economic factors, limited access to healthcare, poor sanitation, and inadequate dietary practices prevalent in tea garden communities (O'Hanlon et al., 2017).

The Biswanath district in Assam is particularly vulnerable to malnutrition due to its high concentration of tea gardens and associated socio-economic challenges. Tea garden workers often face low wages, poor living conditions, and limited access to essential services such as healthcare and education, contributing to higher rates of under nutrition among children (Mahanta et al., 2015). In Biswanath district specifically, recent studies have indicated alarming statistics: 27.1% wasting and 13.7% SAM among children aged 6-59 months (Mohfw, 2021). These figures highlight the urgent need for targeted studies to inform evidence-based interventions tailored to the specific needs of the community (Nair et al., 2020).

Double Burden of Malnutrition: A Global Concern

The double burden of malnutrition (DBM) refers to the coexistence of under nutrition (including stunting, wasting, and micronutrient deficiencies) and overweight/obesity within the same individuals, households, or populations (WHO, 2022). This phenomenon is increasingly prevalent in low- and middle-income countries undergoing rapid economic and nutritional transitions, where traditional diets are being replaced by processed foods high in fats, sugars, and salt (Popkin et al., 2012).

The World Health Organization (WHO) emphasizes that DBM poses a significant challenge to public health systems worldwide, requiring integrated approaches that address both ends of the nutritional spectrum (WHO, 2022). While under nutrition continues to affect children, particularly in rural and marginalized communities, overweight and obesity are on the rise, driven by sedentary lifestyles and increased consumption of energy-dense foods (Hawkes et al., 2017).

In India, the DBM is evident in the coexistence of high rates of child under nutrition and a growing prevalence of overweight and obesity among adults, particularly in urban areas (Ranjani et al., 2014). This trend is attributed to factors such as urbanization, changing dietary patterns, and reduced physical activity levels (Shrivastava et al., 2013). Addressing the DBM requires a multi-pronged approach that includes promoting healthy diets, encouraging physical activity, and implementing policies that support healthy food environments (Bhutta et al., 2013).

Tackling malnutrition, in all its forms, is crucial for achieving sustainable development goals related to health, education, and economic growth (Black et al., 2013). Malnutrition significantly impacts economic growth by reducing human capital, increasing healthcare costs, and lowering productivity (Horton & Steckel, 2013). Additionally, malnutrition-related stunting in early childhood has long-lasting repercussions, including lower economic productivity, increased susceptibility to chronic diseases, and higher healthcare costs throughout life (Popkin et al., 2020).

The global burden of malnutrition underscores the urgent need for immediate intervention, particularly in high-risk regions like Assam, where both under nutrition and emerging obesity trends are observed (NFHS-5, 2021). Targeted interventions that address the underlying determinants of malnutrition, such as poverty, food insecurity, and inadequate healthcare access, are essential for improving the nutritional status of vulnerable populations (Bhutta et al., 2013).

Comparative Analysis with WHO Cut-off Values

The World Health Organization (WHO) has established cut-off values for assessing the severity of malnutrition based on its public health significance (WHO, 2010). These cut-off values provide a standardized framework for monitoring and evaluating malnutrition trends at the global, regional, and national levels, allowing for comparisons across different populations and time periods.

For wasting, a prevalence of ≥10% is considered serious, indicating a significant public health problem requiring immediate attention (WHO, 2010). A prevalence of ≥15% is classified as critical, signifying a severe humanitarian crisis with high rates of morbidity and mortality (WHO, 2010). India's national prevalence of wasting (19.3%) and Assam's (21.7%) both exceed the critical threshold, highlighting the urgent need for targeted interventions to address acute malnutrition in these regions (IIPS, 2021).

Similarly, stunting prevalence above 30% is considered high, indicating a chronic malnutrition problem with long-term consequences for child development and economic productivity (WHO, 2010). Both India (35.5%) and Assam (35.3%) surpass this benchmark, underscoring the persistent challenges in achieving optimal linear growth among children in these areas (IIPS, 2021). Addressing stunting requires a

comprehensive approach that includes improving maternal nutrition, promoting exclusive breastfeeding, ensuring adequate complementary feeding, and addressing underlying factors such as poverty and food insecurity (Bhutta et al., 2013).

Underweight prevalence exceeding 30% is categorized as a very high public health concern, reflecting a combination of both acute and chronic malnutrition (WHO, 2010). This indicator underscores the severity of malnutrition at the national and state levels, highlighting the need for intensified efforts to improve the nutritional status of children (IIPS, 2021). These alarming statistics emphasize the urgent need for targeted interventions in high-burden regions like Assam, especially in tea garden-dominated districts, where socio-economic disparities and limited access to healthcare exacerbate malnutrition risks (O'Hanlon et al., 2017).

Malnutrition results from a wide range of factors, which are discussed in this chapter.

Birth Weight

Low birth weight (LBW), defined as a birth weight of less than 2.5 kg, is a significant predictor of malnutrition, as it predisposes children to stunting, wasting, and increased risk of morbidity and mortality (Victora et al., 2008). LBW infants are often born with depleted nutrient stores and impaired immune function, making them more vulnerable to infections and developmental delays (fall et al., 2003). Addressing LBW is therefore crucial for improving child survival and nutritional status.

In India, NFHS-5 reported that 17.7% of newborns had low birth weight, a major public health concern (IIPS, 2021). The prevalence of LBW is particularly high in tea garden areas of Assam, where maternal malnutrition, inadequate antenatal care, and poor access to healthcare services contribute to adverse birth outcomes (O'Hanlon et al., 2017). Additionally, infants with low birth weight face increased risks of infections, developmental delays, and chronic diseases later in life, necessitating improved maternal nutrition programs and early childhood interventions (Barker, 2004).

Strategies to reduce LBW include improving maternal nutrition before and during pregnancy, providing comprehensive antenatal care services, promoting optimal breastfeeding practices, and addressing underlying socio-economic factors such as

poverty and food insecurity (Bhutta et al., 2013). Interventions that focus on improving maternal health and nutrition are essential for breaking the intergenerational cycle of malnutrition and ensuring optimal growth and development for all children (Black et al., 2013).

Parental Education Level

Parental education, particularly maternal education, is strongly correlated with child nutritional status. Studies consistently show that children of educated mothers are more likely to be well-nourished and have better health outcomes compared to children of uneducated mothers (UNICEF, 2021). Educated mothers are more likely to adopt optimal infant and young child feeding practices, seek timely healthcare, and create a supportive home environment that promotes child development (Smith et al., 2003).

In Assam, NFHS-5 data showed that 29.7% of mothers had no formal education, which negatively impacts child nutrition (IIPS, 2021). Children of uneducated mothers are more likely to be underweight, stunted, and suffer from micronutrient deficiencies due to inadequate dietary intake and poor hygiene practices (Victora et al., 2008). Educated mothers are more likely to adopt proper infant feeding practices, ensuring adequate nutrient intake during crucial growth periods, and are also better equipped to make informed decisions about healthcare and hygiene (Smith et al., 2003).

The role of paternal education is also significant, as higher parental literacy levels contribute to better household food security and healthcare-seeking behaviors (Doepke & Zilibotti, 2005). Educated fathers are more likely to support their wives in adopting optimal child-rearing practices, provide financial resources for nutritious food and healthcare, and participate actively in childcare (Cabrera et al., 2000). Investing in education for both parents is therefore crucial for improving child nutrition and overall family well-being.

Pre-lacteal Feeding

Pre-lacteal feeding practices, which involve giving newborns liquids or foods other than breast milk before initiating breastfeeding, are detrimental to infant health and nutrition. These practices delay breastfeeding initiation, increase the risk of infections, and

interfere with the establishment of exclusive breastfeeding (WHO, 2021). Globally, WHO recommends early initiation of breastfeeding within one hour of birth and exclusive breastfeeding for the first six months of life to ensure optimal infant growth, development, and survival (WHO, 2021).

In India, 15% of newborns receive pre-lacteal feeds, with Assam recording a higher prevalence with 16% (NFHS-5, 2021). Common pre-lacteal feeds include honey, sugar water, and animal milk, which may be contaminated with harmful pathogens and lack the essential nutrients present in breast milk (Bhandari et al., 2003). This practice interferes with exclusive breastfeeding and contributes to malnutrition by exposing infants to harmful pathogens, thereby increasing infant morbidity and mortality rates (WHO, 2021).

Promoting early initiation of breastfeeding and discouraging pre-lacteal feeding requires a multi-faceted approach that includes educating mothers and families about the benefits of breastfeeding, training healthcare providers to support breastfeeding mothers, and implementing policies that protect and promote breastfeeding in healthcare facilities and communities (Rollins et al., 2016). Community-based interventions that involve peer counselors and support groups can also be effective in promoting optimal breastfeeding practices and reducing the prevalence of pre-lacteal feeding (Bhutta et al., 2013).

Water, Hygiene, and Sanitation

Poor sanitation and contaminated water sources are major contributors to recurrent diarrheal diseases, which exacerbate malnutrition by impairing nutrient absorption and increasing nutrient losses (WHO, 2021). Access to clean drinking water and proper waste disposal are essential for preventing waterborne diseases and promoting child health and nutrition (Prüss-Üstün et al., 2019).

According to NFHS-5, 61.6% of households in Assam use unimproved sanitation facilities, increasing the risk of infections (IIPS, 2021). Unimproved sanitation facilities, such as open defecation and pit latrines without proper waste disposal,

contaminate water sources and create breeding grounds for disease-carrying vectors, leading to increased rates of diarrheal diseases and other waterborne infections (Bartram & Cairncross, 2010). Access to clean drinking water and proper waste disposal significantly impacts child health by reducing exposure to waterborne diseases (Prüss-Üstün et al., 2019).

Improving sanitation infrastructure is vital to preventing malnutrition and associated health complications. Strategies to improve water, hygiene, and sanitation include promoting the construction and use of improved latrines, providing access to safe drinking water through piped water systems or point-of-use water treatment methods, and implementing community-based hygiene promotion programs that encourage handwashing with soap (Fewtrell et al., 2005). Investing in water, hygiene, and sanitation is therefore a critical step towards improving child health and nutrition and reducing the burden of malnutrition (Bhutta et al., 2013).

Hand washing Practices

Inadequate hand hygiene is a significant risk factor for childhood infections, particularly diarrheal diseases and respiratory infections. Hand washing with soap is one of the most effective and cost-effective interventions for preventing the spread of infectious diseases and promoting child health (WHO, 2020). WHO (2020) emphasizes that hand washing with soap can reduce diarrheal diseases by up to 50% and respiratory infections by up to 25%.

NFHS-5 reports only 63.8% of households in Assam practice regular hand washing, impacting child nutrition (IIPS, 2021). Poor hand hygiene is directly linked to high rates of gastrointestinal infections, leading to nutrient loss and impaired growth. Children who frequently suffer from diarrheal diseases are at increased risk of malnutrition due to reduced nutrient absorption and increased nutrient losses (Guerrant et al., 2003).

Implementing hand washing awareness programs in tea garden areas is crucial for improving child health outcomes. Strategies to promote hand washing include educating families about the importance of hand washing with soap at critical times, such as before preparing food, after using the toilet, and after cleaning a child, providing access to hand washing facilities with soap and water, and implementing community-

based hygiene promotion campaigns (Curtis et al., 2009). Engaging community health workers and local leaders in promoting hand washing can also be effective in changing hygiene behaviors and reducing the burden of childhood infections (Bhutta et al., 2013).

Dietary Practices and Gender Disparities

Frequent, nutrient-rich meals are crucial for child growth and development, particularly during the first two years of life when growth rates are rapid and nutrient requirements are high. Inadequate dietary intake during this critical period can lead to stunting, wasting, and micronutrient deficiencies, with long-lasting consequences for physical and cognitive development (Black et al., 2013).

NFHS-5 data reveal that only 11.3% of children aged 6–23 months in Assam meet the Minimum Acceptable Diet (IIPS, 2021). The Minimum Acceptable Diet is a composite indicator that reflects the proportion of children who receive a minimum number of food groups and a minimum meal frequency, ensuring adequate nutrient intake for optimal growth and development (WHO, 2010). Inadequate meal frequency and poor dietary diversity limit essential nutrient intake, exacerbating malnutrition risks.

Gender-based disparities in child nutrition persist in India, with girls more likely to be malnourished due to intra-household food discrimination (Bose, 2019). In many Indian households, boys are often given preferential treatment in terms of food allocation and healthcare access, leading to poorer nutritional outcomes for girls (Arnold & Kishor, 1991). NFHS-5 (2021) data show that girls in Assam have higher stunting rates (37.1%) than boys (33.8%), highlighting the persistent gender gap in child nutrition.

Addressing gender disparities in child nutrition requires challenging traditional cultural norms and promoting gender equality in food allocation and healthcare access. Strategies to improve dietary practices and reduce gender disparities include educating families about the importance of providing nutritious and diverse diets to both boys and girls, promoting women's empowerment and decision-making power within the household, and implementing policies that ensure equal access to healthcare and nutrition services for all children (Bhutta et al., 2013).

Recent Illnesses and Geographic Location

Frequent illnesses, such as diarrhea and respiratory infections, are major contributors to malnutrition in children. Infections increase nutrient requirements, reduce appetite, and impair nutrient absorption, leading to weight loss, stunting, and micronutrient deficiencies (Guerrant et al., 2003). WHO (2021) states that 45% of child deaths due to infections are linked to undernutrition, highlighting the synergistic relationship between infection and malnutrition.

Assam's tea garden communities have a high prevalence of undernutrition, with tea garden workers experiencing poorer health outcomes due to low wages, poor living conditions, and limited access to healthcare services (Das et al., 2020). Poor road connectivity and inadequate health infrastructure further exacerbate this issue, making it difficult for tea garden workers to access essential healthcare and nutrition services (O'Hanlon et al., 2017).

Geographic location also plays a significant role in determining child nutritional status, with children living in rural and remote areas often facing greater challenges in accessing nutritious food and healthcare services compared to children living in urban areas (Ruel et al., 2003). Addressing the geographic disparities in child nutrition requires strengthening healthcare infrastructure in rural areas, improving road connectivity, and implementing targeted nutrition interventions that address the specific needs of vulnerable communities (Bhutta et al., 2013).

Climate Change and Malnutrition

Climate change has emerged as a significant factor exacerbating malnutrition by impacting agricultural productivity, reducing food availability and accessibility, and increasing the frequency and intensity of extreme weather events (FAO, 2018). Increasing temperatures, erratic rainfall, and droughts can reduce crop yields, leading to food shortages and increased food prices, particularly in regions that rely heavily on agriculture for food security (Schlenker & Lobell, 2010).

In Assam, tea garden communities face climate-related challenges that affect their livelihood and nutritional security. Tea cultivation is highly vulnerable to climate

change, with increasing temperatures and changes in rainfall patterns affecting tea yields and quality (IPCC, 2014). Droughts and floods disrupt food supply chains, leading to increased food prices and reduced dietary diversity, further worsening malnutrition rates.

Addressing the impact of climate change on malnutrition requires a multi-faceted approach that includes promoting climate-smart agriculture practices, diversifying food systems, strengthening social safety nets, and building resilience to climate-related shocks (HLPE, 2012). Strategies to promote climate-smart agriculture include adopting drought-resistant crops, improving water management practices, and promoting sustainable land use management (Lipper et al., 2011). Strengthening social safety nets, such as food assistance programs and cash transfer programs, can help protect vulnerable populations from the impacts of climate change on food security and nutrition (FAO, 2018).

The high prevalence of malnutrition in Assam, particularly in tea garden-dominated areas, necessitates urgent public health interventions. Addressing determinants like maternal education, sanitation, dietary diversity, and climate resilience is crucial to improving child health outcomes. Comparative analysis with global, national, and district data emphasizes the need for targeted strategies in Biswanath district. Strengthening nutrition-sensitive policies and improving healthcare access in vulnerable communities can significantly reduce the malnutrition burden in Assam. A holistic, multi-sectoral approach is required, involving government agencies, NGOs, community organizations, and the private sector, to address the complex interplay of factors contributing to malnutrition and ensure that all children have the opportunity to reach their full potential.

Infant and Young Child Feeding (IYCF) Practices

Infant and young child feeding (IYCF) practices are recognized as pivotal determinants of child health and nutritional status, particularly during the first two years of life, a period characterized by rapid growth and development (Black et al., 2013). These practices encompass a range of feeding behaviors, including early initiation of breastfeeding, exclusive breastfeeding for the first six months, continued breastfeeding up to two years of age, and appropriate complementary feeding practices (WHO, 2009).

Adherence to optimal IYCF practices is crucial for preventing malnutrition, reducing morbidity and mortality, and promoting long-term health outcomes among children (UNICEF, 2021).

Early Initiation of Breastfeeding

Early initiation of breastfeeding, defined as initiating breastfeeding within one hour of birth, is a cornerstone of newborn care (WHO, 2021). This practice ensures that infants receive colostrum, a nutrient-rich fluid produced during the first few days after birth, which is packed with antibodies and immune factors essential for protecting newborns against infections (Rollins et al., 2016). Early initiation also promotes mother-infant bonding and stimulates milk production (Victora et al., 2016). Despite the well-documented benefits, adherence to early initiation remains suboptimal in many regions, including India. According to NFHS-5 data, only 41.8% of newborns in India are breastfed within one hour of birth, with Assam reporting a slightly higher rate of 47.3% (IIPS, 2021). However, cultural beliefs, inadequate support from healthcare providers, and the preference for pre-lacteal feeds often delay breastfeeding initiation (Bhandari et al., 2003).

Exclusive Breastfeeding for the First Six Months

Exclusive breastfeeding, defined as providing only breast milk without any additional food or liquids (including water) for the first six months of life, is universally recommended as the optimal feeding practice for infants (WHO, 2021). Breast milk provides all the necessary nutrients and antibodies to support infant growth and development while protecting against infections such as diarrhea and pneumonia (Kramer & Kakuma, 2012). NFHS-5 data indicate that 58% of infants under six months in India are exclusively breastfed (IIPS, 2021). Assam demonstrates a higher prevalence of 63.6%, reflecting some progress in promoting this practice (IIPS, 2021). Nevertheless, factors such as maternal employment without adequate maternity leave policies, aggressive marketing of formula milk, and societal norms that discourage breastfeeding continue to hinder exclusive breastfeeding practices (Smith et al., 2003).

Continued Breastfeeding at 12–23 Months

Continued breastfeeding, defined as breastfeeding alongside complementary foods until the child is two years of age or beyond, provides essential nutrients and immune

protection during a period of rapid growth and development (WHO, 2021). As infants transition to solid foods, breast milk continues to serve as an important source of calories, vitamins, and minerals (Dewey & Adu-Afarwuah, 2008). In Assam, NFHS-5 reports that 78% of children aged 12–23 months are still being breastfed, indicating relatively good adherence to this practice (IIPS, 2021). However, early cessation of breastfeeding due to maternal fatigue or misconceptions about its necessity remains a concern in certain communities (Smith et al., 2003).

Complementary Feeding Practices

Complementary feeding, defined as the process of introducing solid or semi-solid foods alongside breast milk when infants reach six months of age, is critical for meeting their increasing energy and nutrient needs (WHO, 2021). Timely, adequate, and safe complementary feeding practices are essential for preventing malnutrition and promoting optimal growth and development (Dewey & Brown, 2003). Key indicators of appropriate complementary feeding include timely introduction of solid foods, minimum dietary diversity, and minimum meal frequency (WHO, 2010). NFHS-5 data show that only 42% of children aged 6–8 months in Assam receive timely complementary foods (IIPS, 2021).

Minimum dietary diversity (MDD) measures the proportion of children aged 6–23 months who consume foods from at least five out of eight food groups, including grains, legumes, dairy products, meat, eggs, vitamin-A-rich fruits/vegetables, other fruits/vegetables, and breast milk (WHO, 2010). This indicator reflects the breadth and variety of foods consumed, which is essential for ensuring adequate nutrient intake. Alarmingly, only 11.3% of children aged 6–23 months in Assam meet MDD criteria, highlighting widespread dietary inadequacies (IIPS, 2021). Limited access to diverse foods due to poverty and food insecurity remains a significant challenge in tea garden communities (O'Hanlon et al., 2017).

Minimum meal frequency (MMF) assesses whether children aged 6–23 months receive meals at least twice daily (for ages 6–8 months) or three times daily (for ages 9–23 months). For non-breastfed children, MMF includes four meals per day with at least one milk feeding (WHO, 2010). Adequate meal frequency ensures that children receive sufficient energy and nutrients throughout the day. Nationally, about half of children meet MMF requirements, with Assam showing similar trends (IIPS, 2021). Factors

such as maternal time constraints and lack of awareness about feeding frequency contribute to poor adherence (Smith et al., 2003).

The minimum acceptable diet (MAD) is a composite indicator that combines MDD and MMF criteria to provide a holistic measure of dietary adequacy among children aged 6–23 months (WHO, 2010). NFHS-5 data reveal that only 8% of children in Assam meet MAD requirements, underscoring significant gaps in feeding practices and dietary quality (IIPS, 2021).

Immunization and Acute Malnutrition in Children Aged 6-59 Months

Immunization, the process of conferring immunity to infectious diseases through the administration of vaccines, is a critical public health intervention aimed at reducing childhood morbidity and mortality (WHO, 2021). While the direct impact of immunization on nutritional status may not be immediately apparent, a growing body of evidence underscores the synergistic relationship between immunization and nutrition, particularly in children aged 6-59 months, who are highly vulnerable to both infectious diseases and acute malnutrition (UNICEF, 2019). Acute malnutrition, characterized by rapid weight loss or failure to gain weight, often compromises the immune system, making children more susceptible to vaccine-preventable diseases (VPDs) and reducing their response to vaccines (Bhutta et al., 2013). Conversely, VPDs can exacerbate malnutrition by increasing metabolic demands, reducing appetite, and impairing nutrient absorption, thereby creating a vicious cycle of infection and malnutrition (Guerrant et al., 2003).

The Impact of Malnutrition on Immunization Outcomes

Malnutrition impairs both humoral and cell-mediated immunity, thereby reducing the effectiveness of vaccines. Studies have shown that malnourished children exhibit lower antibody titers and reduced seroconversion rates following vaccination compared to well-nourished children (Reddy et al., 1976). This diminished immune response increases the risk of vaccine failure and breakthrough infections, undermining the protective effects of immunization (Cutts et al., 1998). Specifically, severe acute malnutrition (SAM) has been associated with reduced antibody responses to measles, polio, and other routine childhood vaccines (Black, 2003). In such cases, additional vaccine doses or modified immunization schedules may be necessary to achieve adequate protection (WHO, 2014).

Furthermore, malnutrition can affect the immunogenicity of vaccines through alterations in gut microbiota and nutrient deficiencies. Malnourished children often have altered gut microbial composition, which can impair the development of immune cells and reduce the production of antibodies (Guarner & Malagelada, 2003). Deficiencies in micronutrients such as vitamin A, zinc, and iron, which are common among malnourished children, can further compromise immune function and reduce vaccine responsiveness (Shankar & Prasad, 1998). Vitamin A deficiency, for example, has been shown to impair the development of mucosal immunity, increasing the risk of mucosal infections and reducing the effectiveness of oral vaccines (Semba, 1994).

Immunization as a Strategy to Prevent Malnutrition

Immunization plays a crucial role in preventing malnutrition by reducing the incidence of infectious diseases that can exacerbate nutritional deficiencies and impair growth. VPDs such as measles, diarrhea, and respiratory infections can significantly increase metabolic demands and reduce appetite, leading to weight loss and malnutrition, particularly in children already at risk (Guerrant et al., 2003). By preventing these diseases, immunization helps to maintain nutritional status and promote healthy growth (Black et al., 2013).

Measles, for example, is a highly contagious viral disease that can cause severe complications such as pneumonia, encephalitis, and diarrhea, which can lead to significant weight loss and malnutrition (Perry et al., 2004). Measles vaccination has been shown to reduce the incidence of measles-related complications and improve nutritional outcomes in children (Hulland et al., 2014). Similarly, rotavirus vaccination has been effective in reducing the burden of diarrheal diseases, which are a major cause of malnutrition in young children (Patel et al., 2013).

In addition to preventing specific diseases, immunization can also have indirect effects on nutritional status through improvements in overall child health and well-being. Healthy children are more likely to have good appetites, absorb nutrients efficiently, and grow and develop optimally, thereby reducing the risk of malnutrition (Victora et al., 2008). Moreover, immunization can reduce the burden on healthcare systems, freeing up resources for other essential services such as nutrition supplementation and counseling (Bhutta et al., 2013).

Immunization Coverage and Access in High-Risk Settings

Despite the clear benefits of immunization, coverage rates remain suboptimal in many high-risk settings, particularly in resource-limited communities with high rates of malnutrition. Factors such as poverty, geographical isolation, lack of awareness, and inadequate healthcare infrastructure can hinder access to immunization services (Rainey et al., 2011). In Assam's tea garden communities, for example, poor road connectivity, limited access to healthcare facilities, and socio-economic disparities can impede immunization efforts (O'Hanlon et al., 2017).

To improve immunization coverage in these settings, targeted interventions are needed to address the specific barriers faced by vulnerable populations. These interventions may include community-based outreach programs, mobile immunization clinics, and integration of immunization services with other health and nutrition programs (Bhutta et al., 2013). It is also essential to address misconceptions and build trust in vaccines through culturally sensitive health education and community engagement activities (Larson et al., 2014).

Integrating Immunization and Nutrition Interventions

Given the synergistic relationship between immunization and nutrition, integrating these interventions can be a highly effective strategy for improving child health and reducing malnutrition. Integrated programs can leverage existing healthcare platforms to deliver multiple interventions, such as immunization, nutrition supplementation, and health education, thereby maximizing efficiency and impact (Ruel & Levin, 2007). For example, vitamin A supplementation is often delivered alongside measles vaccination to boost immune function and reduce morbidity and mortality (Ramakrishnan et al., 2004).

Integrating immunization and nutrition interventions can also help to address the underlying determinants of malnutrition, such as poverty, food insecurity, and inadequate sanitation. By combining immunization with interventions to improve household food security, promote breastfeeding, and improve water and sanitation practices, comprehensive programs can create a supportive environment for child health and nutrition (Bhutta et al., 2013). Furthermore, linking immunization services with early childhood development programs can promote cognitive and social-emotional

development, which are essential for long-term well-being (Grantham-McGregor et al., 2007).

Immunization is a critical intervention for preventing infectious diseases and improving child health, with important implications for nutritional status, particularly in settings with high rates of acute malnutrition. Malnutrition can impair vaccine responses, underscoring the need to prioritize immunization in vulnerable populations. Integrating immunization with nutrition interventions and addressing the underlying determinants of malnutrition can maximize the impact of these interventions and promote healthy growth and development. Continued efforts to improve immunization coverage, strengthen healthcare systems, and promote integrated approaches are essential for reducing the burden of infectious diseases and malnutrition in children aged 6-59 months.

METHODS AND MATERIALS

METHODS AND MATERIALS

Acute malnutrition remains a significant public health issue and its leading causes are food insecurity, inadequate diet, poor health and hygiene practices, and inadequate maternal and child care practices. Therefore, the study was designed to determine the prevalence of severe acute malnutrition in children 6-59 months residing in Biswanath district, Assam, and the association between socio-economic status, morbidity profile, immunization status, WASH practices, minimum dietary diversity and IYCF practices of the acutely malnourished children. For the study, the scientific and systematic methodology was planned.

RESEARCH DESIGN

The research design was a one time, community-based qualitative approach cross-sectional study which involves children 6-59 months old who are registered in AWCs and residing in tea garden dominated areas of Biswanath District, Assam.

LOCATION OF THE STUDY

The study was conducted in Biswanath district of Assam. Biswanath was declared a district on 15 august, 2016. It covers an area of 1,415 square kilometers. As per the 2011 census, Biswanath had a population of 612,491. There are 832 villages and two towns: Biswanath and Gohpur. There was also the presence of Asia's largest tea garden i.e. Monabari Tea Estate owned by the McLeod Russel India Limited, a part of Williamson Magor Group in Biswanath district.

ENROLEMENT OF THE SUBJECTS

Biswanath district had seven development blocks: Sootea, Biswanath, Sakomatha, Behali, Baghmara, Chaiduar, and Pub-Chaiduar, from these, 3 development blocks were selected for the study based on the predominance of tea gardens. The selected blocks were Sakomatha, Behali, and Baghmara, where the majority of the population were engaged in tea garden labor. Out of 475 Anganwadi centres (AWCs) of these 3 developments blocks, 10 AWCs from each blocks with a total of 30 AWCs were randomly selected.

STUDY POPULATION

The study population consist of children, both boys and girls aged between 6-59 months old registered in AWCs of Biswanath District.

SAMPLING AND SAMPLE SIZE

On the basis of the prevalence of wasting in Biswanath District (NFHS-5) the sample size of the present study was calculated by adopting the formula: $n= z^2 \times p \times (1-p)/E^2$

where,

- n= Sample size
- P= Prevalence of wasting = 27.1% = 0.271
- Z= 1.96Z =1.96 (for 95% level of confidence)
- E= Precision is 5%= 0.05

$$n = \frac{z^2 \times p \times (1-p)}{E^2}$$

$$n = \frac{1.96^2 \times 0.271 \times (1-0.271)}{0.05^2}$$

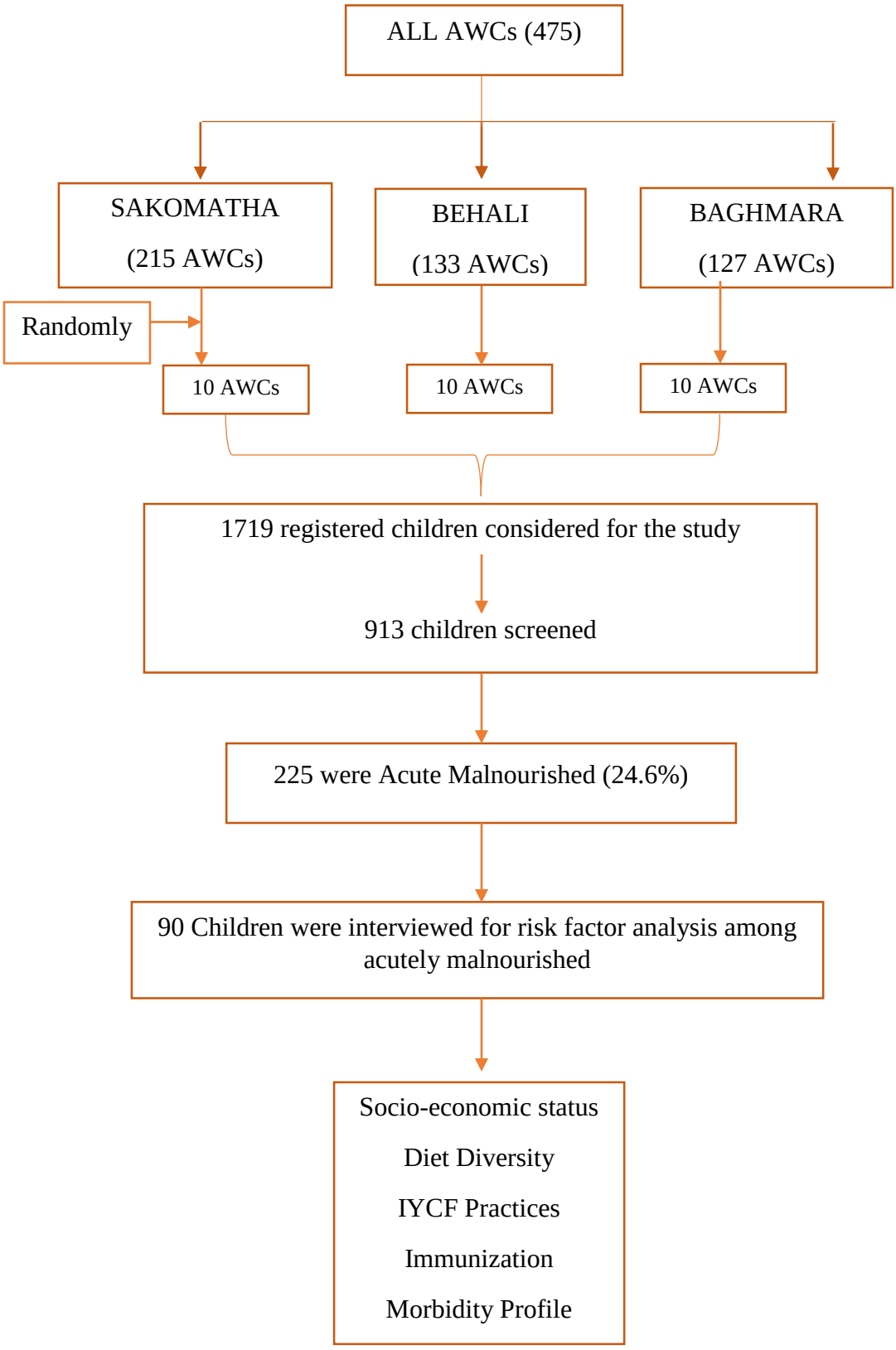
$$n = 303.2$$

To account for potential non-response or attrition, we added 10% of the calculated sample size:

10% non-response rate = 303.2 + 10% = 333.5 ≈ **334**

Thus, the total sample size for the study will be **334**. This number ensures the study was adequately powered to detect the prevalence of acute malnutrition within the population, with a 5% allowable error.

Figure 3.1: Experimental Plan



Random sampling technique was employed for the study as, despite all the children in the selected AWCs being screened, only those who were found to be acutely malnourished were taken into consideration as the sample population for the further associated factors.

INCLUSION CRITERIA

- All children 6-59 months old registered in selected AWCs were included and those who were found to be Acute Malnourished would be followed up for the rest part of the study.

EXCLUSION CRITERIA

- Children experiencing chronic illnesses for the past 15 days of the study period were excluded.
- Those whose parents who did not give consent to participate.

TOOLS AND METHODS

Several methods of data collection were used in this study including: anthropometric assessment, research questionnaire and dietary quality questionnaire. Data collection was done using an interview-based approach in the local language Assamese, to ensure that the respondents understood the questions as intended by the researcher, and also to improve accuracy terms of completely filling up the questionnaires. The responses were collected using the Epicollect 5 and MS Excel.

Table 3.1: Tools and Techniques

Parameter	**Tools/Methods**
Anthropometric measurement: 1. Weight 2. Height	 Infant weighing scale/Bathroom scale Infantometer/Stadiometer
Socio-economic status	Semi-structured questionnaire
Diet diversity	DQQ FOR IYCF India
IYCF practices	Semi-structured questionnaire
Immunization	Semi-structured questionnaire
Morbidity profile	Semi-structured questionnaire

ANTHROPOMETRIC ASSESSMENT

Anthropometry is the measurement of the human body and usually comprises a series of non- invasive, inexpensive and easy to perform methods of estimating body composition using parameters such as weight, height/length and in children 6-59 months.

Weight: A digital 3-in-1 weighing scale (baby, child and adult weighing scale) was used to measure the body weight of the children. The weight was taken without shoes, socks, heavy clothing including sweaters and jackets, belts and watches. For the infants, their weight was taken while they lay down or sat on the weighing scale's tray while for the young children who could stand, their weight was taken after they comfortably stood erect on the scale with their arms hanging loosely and them facing forward. Only after the display was fixed the weight displayed recorded to the nearest 0.1kg. For every subject, the machine had to be adjusted to zero (0.00) before weighing the next subject.

Height: Height was taken for the children who were above 2 years of age by the use of a portable stadiometer. The child was asked to stand on the base with no shoes on, upright against the middle of the stadiometer. The child's head, shoulders, buttocks, knees and heels were held against the stadiometer by the mother/AWW. The slider was then taken down up to the top of the child's head, compressing the hair and the reading taken by the investigator as indicated by the arrow on the slider, to the nearest 0.1 cm.

Length: Length was taken for children below 2 years. The infantometer was placed on the floor and the child was lay along the middle of the infantometer. The AWW/mother was at the fixed side of the board and held the child's head in position, firmly as it touched the headboard with the hair compressed. Then, placed one hand on the child's legs, gently stretching the child and then kept one hand on the thighs to prevent flexion. While positioning the child's legs, the sliding foot-plate was pushed firmly against the bottom of the child's feet and their length was read at the mark where the foot-plate was perpendicular to the board, to the nearest 0.1 cm.

WHZ: The weight-for-height z-score was recorded by taking the child's height and then, using the WHO growth charts, the corresponding weight of the child along the height row was estimated and classified as SAM (≤-3), MAM (≥-3 - ≤-2) or normal (>-2) using the z-scores.

WAZ: The weight-for-age z-score was recorded by taking the child's age and then, using the WHO growth charts, the corresponding weight of the child along the age row was estimated and classified as severely underweight (≤-3), underweight (≥-3 - ≤-2) or normal (>-2) using the z-scores.

HAZ: The height-for-age z-score was recorded by taking the child's age and then, using the WHO growth charts, the corresponding height of the child along the age row was estimated and classified as severely stunted (≤-3), stunted (≥-3 - ≤-2) or normal (>-2) using the z-scores.

DIETARY ASSESSMENT

For dietary assessment, the Diet Quality Questionnaire was used. The DQQ is a standardized tool to collect indicators of dietary adequacy, including the minimum dietary diversity for women (MDD-W) indicator (Martin-Prevel et.al, 2017) and All-5, as well as indicators of protection of health against non-communicable diseases (NCDs), including NCD-Protect, NCD-Risk, and the global dietary recommendations score (GDR) (Herforth et.al, 2020). The DQQ was developed to enable population-level diet quality monitoring. It can be used to assess dietary patterns and trends in the general population; separate companion questionnaires are designed for infants and young children under age 2 years, which were used for this study.

RESEARCH QUESTION

In a community-based study, it was necessary and possible to obtain information by asking questions. Socio-economic and demographic data, WASH practices, knowledge on supplementary nutrition, immunization status and morbidity profile were collected by using a semi-structured researcher administered questionnaire. Socio-economic status was based on the educational levels, occupation and income of the interviewed person as well as the household head, as characterized in the KUPPUSWAMY scale.

VALIDITY

In this study, validation of the instrument (questionnaire) was done to ensure that the content and the format of the questionnaire were consistent with the study variables. In this case face validation, content and construction of the questionnaire were assessed by a technical committee from the Food and Nutrition Department, MSU Baroda and approved by the institutional ethics committee for Human Research (IECHR).

RELIABILITY

For this study, reliability of the instruments and tools was done by calibration and standardization of the measuring instruments (stadiometer, infantometer, infant weighing scale, and the bathroom scale) was done. The test-retest reliability approach was employed.

ETHICAL CONSIDERATIONS

The researcher obtained an introductory letter from the department before carrying out the study. This facilitated the acquisition of a permission letter from the district social welfare office authorizing the carrying out of the research among the children of Biswanath District. The researcher also sought permission from the CDPO offices to be allowed to carry out the study in the AWCs. Individuals' informed consent was obtained before interviewing them and this was after explaining to them the purpose of the study and how the results from the study will be used. Both the information letter and consent form were in Assamese. They were also assured of strict confidentiality of all the information collected in the study.

DATA ANALYSIS

Following the collection of data using the Epicollect 5, the spreadsheets were downloaded from Epicollect 5. Thereafter, both descriptive and inferential analyses of the data was undertaken using the Statistical Package for Social Sciences version 22 computer software. Percentage, frequency distribution, mean and standard deviation was used under descriptive analysis while independent t- test, chi- square test and ANOVA was used to indicate the relationship between the various variables.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

Acute malnutrition, particularly in its severe form, remains a major public health concern, especially among children under five years of age in low- and middle-income countries. It significantly contributes to child morbidity and mortality, often resulting from inadequate dietary intake and recurrent infections. This study focuses on assessing the prevalence of severe acute malnutrition and identifying its associated factors to better understand the underlying causes and determinants. The findings are presented and discussed in this chapter.

SCREENING FOR ACUTE MALNUTRITION

The present study was undertaken in the tea garden-dominated regions of Biswanath district, Assam. From a total of 475 Anganwadi Centers (AWCs) across the three administrative blocks of the district, 30 AWCs were randomly selected to serve as the study area. Details of these AWC's are given in Table 4.1.

All children within the age group of 6 to 59 months registered in these centers were considered eligible for the study. Among 1,719 registered children aged 6 to 72 months, anthropometric screening was successfully conducted for 985 individuals. Of these, 913 children who met the age criteria of 6 to 59 months formed the final study population for further analysis.

Gender Wise Anthropometry

The comparison of anthropometric measures between boy and girl children as categories in Table 4.2 reveals no statistically significant differences across weight, height, weight-for-height Z-score (WHZ), weight-for-age Z-score (WAZ), and height-for-age Z-score (HAZ). Boy children exhibited a marginally higher mean weight (12.27 ± 2.39 kg) than girls (12.03 ± 2.38 kg), though the difference was not statistically significant ($p = 0.138$). Similarly, height measurements were nearly identical between genders, with boys averaging 90.63 ± 10.55 cm and girls 90.86 ± 10.15 cm ($p = 0.739$). The WHZ scores were comparable between boys (-0.85 ± 1.12) and girls (-0.87 ± 1.13), indicating no significant difference in acute malnutrition prevalence ($p = 0.788$). Likewise, WAZ and HAZ scores, also did not differ significantly between genders ($p = 0.475$ and $p = 0.646$, respectively).

Age wise anthropometry

The distribution of anthropometric indicators across different age groups as categorized in Table 4.3 demonstrates statistically significant variations, particularly in weight ($p < 0.001$), height ($p < 0.001$), WHZ ($p < 0.001$), and HAZ ($p < 0.001$), suggesting substantial growth differences with age. As expected, mean weight increased with age, from 7.65 ± 1.11 kg in the 6–12-month group to 13.44 ± 1.73 kg in the 36–59-month group. Height followed a similar pattern, with mean values of 69.17 ± 3.49 cm, 81.48 ± 6.00 cm, and 96.92 ± 6.21 cm for the respective age groups. The WHZ score, indicative of wasting, exhibited a significant decline in the older age groups, with the 6–12-month category showing a mean WHZ of -0.781 ± 1.45 compared to -0.979 ± 1.10 in the 36–59-month group. This trend suggests an increasing burden of acute malnutrition with age. The HAZ score also varied significantly across age groups ($p < 0.001$), with the lowest value recorded in the 13–35-month category (-1.82 ± 1.09), indicating that stunting is most pronounced in 13-35 month age group. However, the WAZ score did not demonstrate significant variation across age groups ($p = 0.490$).

Table 4.1: AWCs in Biswanath District considered for the study

	BLOCK	NAME OF AWC	CHILDREN REGISTERED IN THE AWCs (6-72 Months)				
			TOTAL (1719)	6-35 Months (685)		36-72 Months (1034)	
			N	N	N%	N	N%
1	SAKOMATHA	Bolodunga	123	51	41.46	72	58.5
2		Sadharu Paka Line	67	29	43.28	38	56.7
3		Bakambari Line	60	20	33.3	40	66.6
4		Gup Sadharu	61	23	37.7	38	62.2
5		Dhulie 23 No. Line	45	16	35.5	29	64.4
6		Munda Chuburi	33	15	45.45	18	54.5
7		Diring Line No. 3	104	39	37.5	65	62.5
8		Diring Madhupur Bongaon	57	23	40.3	34	59.6
9		Ghahibasti Gajal Bari	28	16	57.1	12	42.8
10		2 No Dhulie Deilichang	28	8	28.5	20	71.4
11	BAGHMORA	Monabari Purona Line	64	34	53.1	30	46.8
12		Monabari Basti	22	9	40.9	13	59.09
13		Nimbari	66	30	45.4	36	54.5
14		Monabari Nonkebasti	55	18	32.7	37	67.2
15		Gamariguri	64	23	35.9	41	64.06
16		Gorkha Staff Line	34	10	29.4	24	70.5
17		Gamariguri Line	29	12	41.3	17	58.6
18		10 no Line	23	8	34.7	15	65.2
19		Kalapani	73	24	32.8	49	67.1
20		2 No Jorabari	31	14	45.1	17	54.8
21	BEHALI	Pachim Telengonia	30	17	56.6	13	43.3

22		Dakhin Telengonia	65	24	36.9	41	63.07
23		Borgang T.E.	112	41	36.6	71	63.3
24		Ketla 13 No Line	46	19	41.3	27	58.6
25		Ketla T.E.	81	32	39.5	49	60.4
26		Ketla 3 No Line	80	42	52.5	38	47.5
27		Ketla 9 no. Line	48	22	45.8	26	54.1
28		Bedeti T.E.	96	36	37.5	60	62.5
29		Bedeti TE 12 No. Line	21	5	23.8	16	76.1
30		Borajule T.E.	73	25	34.2	48	65.7

Table 4.2: Anthropometric Means Gender Wise

	GENDER						
	BOY (N=450)		GIRL (N=463)		TOTAL (N=913)		t-value (p value)
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
WEIGHT	12.27	2.39	12.03	2.38	12.15	2.39	1.483 (0.138)
HEIGHT	90.63	10.55	90.86	10.15	90.75	10.34	-.333 (0.739)
WHZ	-.85	1.12	-.87	1.13	-.8609	1.13	0.269 (0.788)
WAZ	-1.43	.888	-1.47	.891	-1.45	0.88	0.715 (0.475)
HAZ	-1.56	1.09	-1.53	1.08	-1.54	1.08	-.460 (0.646)

Table 4.3: Anthropometric Means Age Wise

	AGE								
	6-12 Months (N=35)		13-35 Months (N=302)		36-59 Months (N=576)		TOTAL (N=913)		f-value (p value)
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	
WEIGHT	7.65	1.11	10.22	1.47	13.44	1.73	12.15	2.39	520.907 (0.000)***
HEIGHT	69.17	3.49	81.48	6.00	96.92	6.21	90.75	10.34	872.698 (0.000)***
WHZ	-.781	1.45	-.643	1.11	-.979	1.10	-.860	1.13	8.990 (0.000)***
WAZ	-1.37	1.09	-1.40	.945	-1.47	.844	-1.45	.889	.714 (0.490)
HAZ	-1.44	1.18	-1.82	1.09	-1.41	1.05	-1.54	1.08	14.847 (0.000)***

*** Significant at p<0.001

PREVALENCE OF MALNUTRITION

Acute malnutrition was assessed using the Weight-for-Height Z-score (WHZ), Weight-for-Age Z-score (WAZ), and Height-for-Age Z-score (HAZ) in accordance with the World Health Organization (WHO) cutoff criteria. These anthropometric indicators provide critical insights into the burden of wasting, underweight, and stunting within the study population. The findings from this study offer a granular understanding of the nutritional status of children residing in resource-limited settings, particularly in tea garden communities, where socio-economic constraints and limited access to healthcare services exacerbate the risk of malnutrition. A comparative analysis of age and gender distributions, along with block-wise disparities, highlights the heterogeneity of nutritional deficiencies and underscores the urgent need for targeted interventions.

Prevalence of Wasting

Age-Wise Analysis

The prevalence of wasting varies significantly across age categories ($p < 0.001$). Severe Acute Malnutrition (SAM) is most prevalent in the youngest age group (6-12 months) at 2.9%, while Moderate Acute Malnutrition (MAM) is highest among children aged 6-12 months (31.4%) (Table 4.4). The proportion of children categorized as "at risk" of wasting remains consistent across age groups, with a slight increase in the 36-59 months group (15.3%) (Table 4.4). Notably, the percentage of children with normal nutritional status is highest in the 13-35 months age group (63.9%), declining in both younger and older children (Table 4.4). The presence of overweight children is minimal across all age groups (≤0.5%).

The chi-square test was conducted to examine the association between age groups and the prevalence of wasting. The chi-square test result was found to be 63.83 ($p < 0.001$) (Table 4.4), from the result it was evident that there was a statistically significant difference in wasting prevalence across different age categories. This specified that the distribution of wasting among children varies significantly with age.

Gender-Wise Analysis

The distribution of wasting across gender does not exhibit significant statistical differences ($p = 0.205$). SAM prevalence remains similar between boys (2.0%) and girls (2.8%), while MAM is slightly higher among girls (23.5%) compared to boys (20.9%) (Table 4.5). The percentage of children at risk of wasting is higher among boys (17.8%)

than girls (12.5%), whereas the proportion of children categorized as normal is slightly higher in girls (58.3%) than in boys (55.1%), and Overweight prevalence is below 1% in both genders (Table 4.5).

The results of chi-square test was found to be 7.220 (p = 0.205) (Table 4.5), which was not statistically significant. This indicates that wasting prevalence does not differ significantly between boys and girls.

Table 4.4: Age-Wise Distribution of Wasting Prevalence among Children (6-59 Months)

	AGE CATEGORIES								
	6-12 Months (N=35)		13-35 Months (N=302)		36-59 Months (N=576)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SAM	1	2.9	9	3	12	2.1	22	2.4	63.830 (0.000)***
MAM	11	31.4	43	14.2	149	25.9	203	22.2	
AT RISK	4	11.4	46	15.2	88	15.3	138	15.1	
NORMAL	14	40	193	63.9	311	54	518	56.7	
POSSIBLE RISK OF OVERWEIGHT	2	5.7	10	3.3	15	2.6	27	3	
OVERWEIGHT	3	8.6	1	0.3	1	0.2	5	0.5	

*** Significant at p<0.001

Fig 4.1: Age-Specific Mean WHZ (Z-Score)

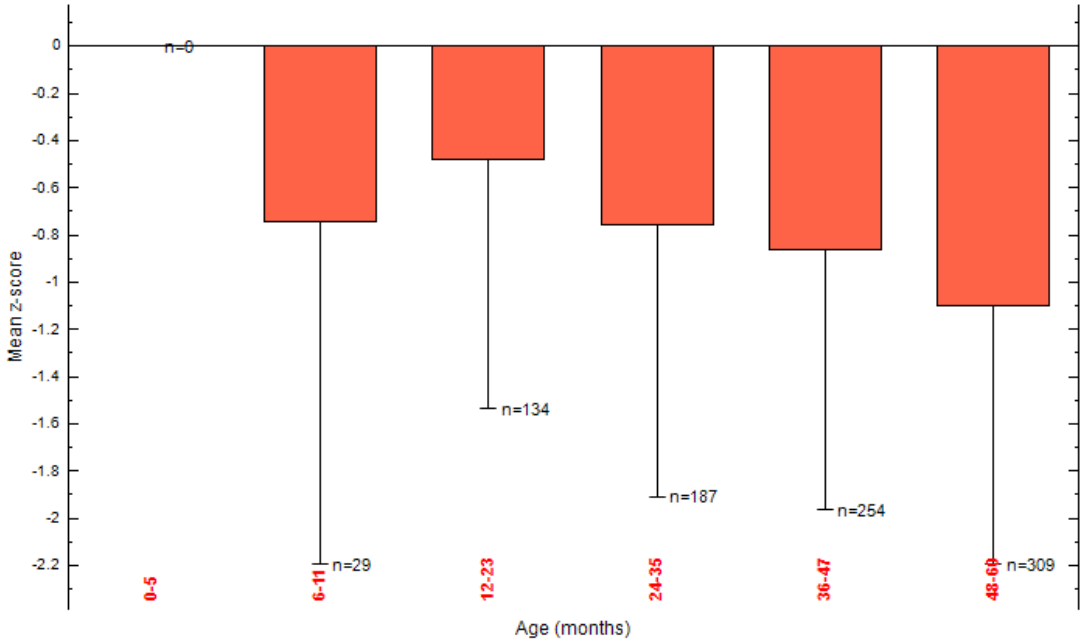
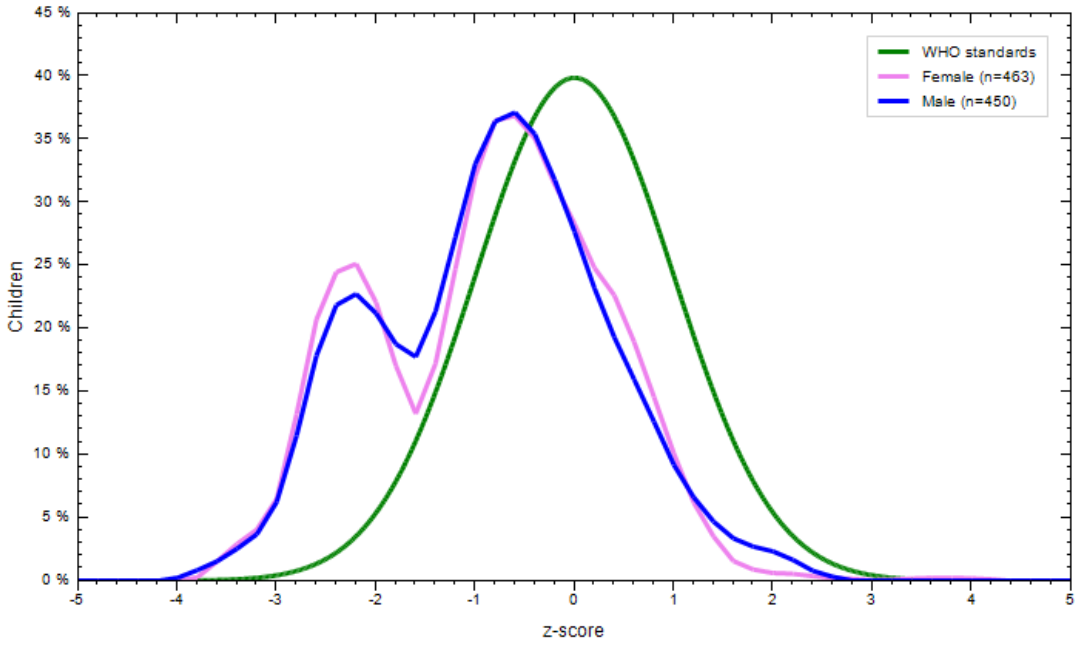


Table 4.5: Gender-Wise Distribution of Wasting Prevalence among Children (6-59 Months)

	GENDER						
	BOY (N=450)		GIRL (N=463)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SAM	9	2	13	2.8	22	2.4	7.220 (0.205)
MAM	94	20.9	109	23.5	203	22.2	
AT RISK	80	17.8	58	12.5	138	15.1	
NORMAL	248	55.1	270	58.3	518	56.7	
POSSIBLE RISK OF OVERWEIGHT	16	3.6	11	2.4	27	3	
OVERWEIGHT	3	0.7	2	0.4	5	0.5	

Fig 4.2: Gender-Specific Mean WHZ (Z-Score)



Prevalence of Underweight

Age-Wise Analysis

No significant differences in underweight prevalence across age groups are observed ($p = 0.600$). Severe underweight is more pronounced in children aged 13-35 months (3.3%) and 36-59 months (2.6%) (Table 4.6). The prevalence of moderate underweight is highest in the 36-59 months group (29.3%), while children aged 6-12 months exhibit a high proportion (42.9%) (Table 4.6). The "at risk" category comprises a substantial percentage across all age groups, peaking at 36.8% in 36-59 months, and the percentage of children with normal weight status decreases with age, from 34.1% in 13-35 months to 30.9% in 36-59 months (Table 4.6). The chi-square test was conducted to examine the association between age groups and the prevalence of underweight. The chi-square test result was found to be 6.423 ($p=0.600$) (Table 4.6) which was not statistically significant. This indicates that underweight prevalence does not differ significantly between the age categories.

Gender-Wise Analysis

Underweight prevalence does not significantly vary by gender ($p = 0.680$) (Table 4.7). The proportion of severely underweight children is comparable between boys (2.7%) and girls (2.8%), Moderate underweight is slightly higher among girls (30.2%) than boys (28.9%) (Table 4.7). The proportion of children at risk of underweight is identical in both genders (35.6%), while normal nutritional status is slightly more prevalent in boys (32.4%) than girls (31.3%) (Table 4.7). The results of chi-square test was found to be 2.306 ($p = 0.680$) (Table 4.7), which was not statistically significant. This indicates that underweight prevalence does not differ significantly between boys and girls.

Table 4.6: Age-Wise Distribution of Underweight Prevalence among Children (6-59 Months)

	AGE CATEGORIES								
	6-12 Months (N=35)		13-35 Months (N=302)		36-59 Months (N=576)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SEVERELY UNDERWEIGHT	0	0	10	3.3	15	2.6	25	2.7	6.423 (0.600)
MODERATLY UNDERWEIGHT	15	42.9	86	28.5	169	29.3	270	29.6	
AT RISK	10	28.5	103	34.1	212	36.8	325	35.6	
NORMAL	10	28.6	103	34.1	178	30.9	291	31.9	
POSSIBLE RISK OF OVERWEIGHT	0	0	0	0	2	0.3	2	0.2	

Fig 4.3: Age-Specific Mean WAZ (Z-Score)

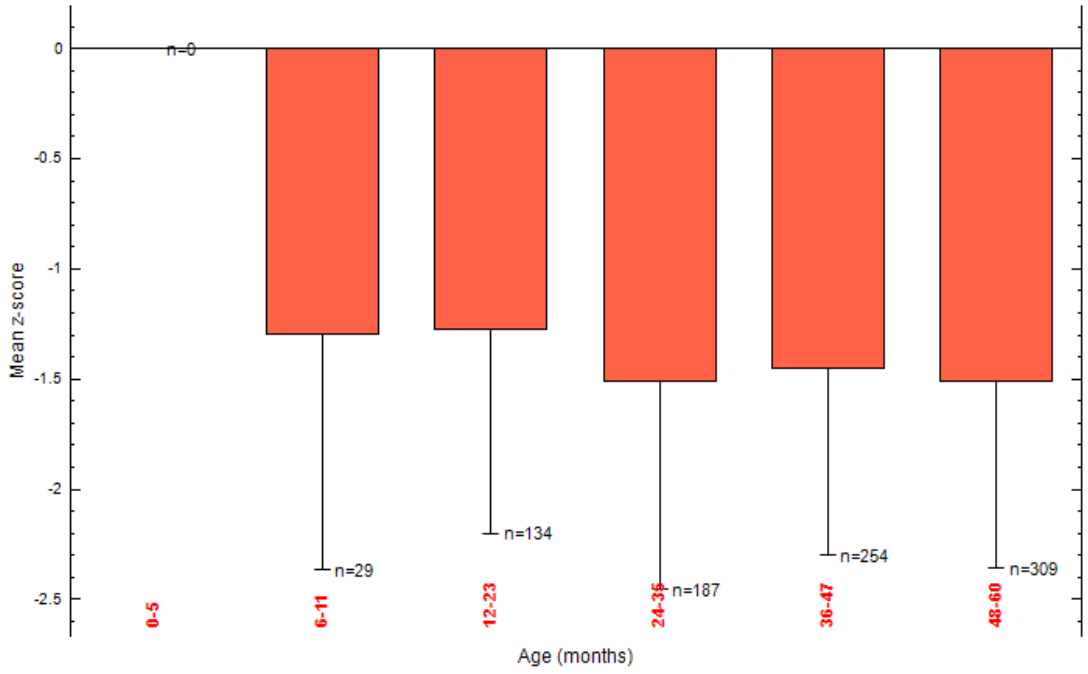
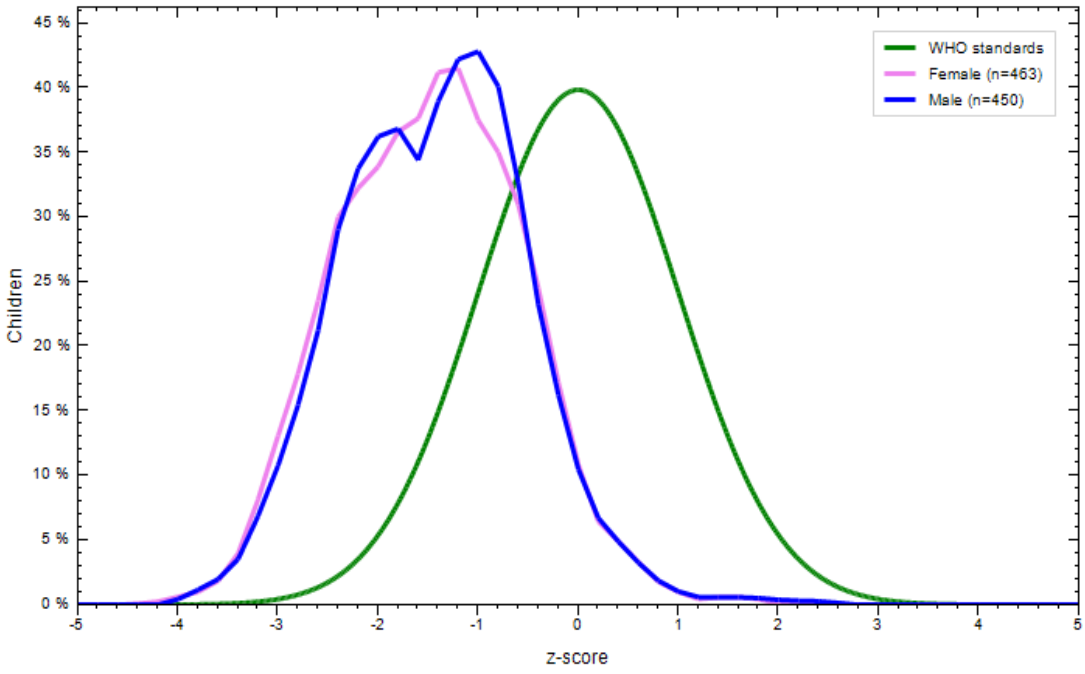


Table 4.7: Gender-Wise Distribution of Underweight Prevalence among Children (6-59 Months)

	GENDER CATEGORIES						
	BOY (N=450)		GIRL (N=463)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SEVERELY UNDERWEIGHT	12	2.7	13	2.8	25	2.7	2.306 (0.680)
MODERATLY UNDERWEIGHT	130	28.9	140	30.2	270	29.6	
AT RISK	160	35.6	165	35.6	325	35.6	
NORMAL	146	32.4	145	31.3	291	31.9	
POSSIBLE RISK OF OVERWEIGHT	2	0.4	0	0	2	0.2	

Fig 4.4: Gender-Specific Mean WAZ (Z-Score)



Prevalence of Stunting

Age-Wise Analysis

Stunting prevalence differs significantly across age groups ($p < 0.001$) (Table 4.8). The prevalence of severe stunting is highest among children aged 13-35 months (11.3%), while moderate stunting peaks in the same age group (42.4%), and the "at risk" category is most prevalent among children aged 36-59 months (35.9%) (Table 4.8). The percentage of children with normal height-for-age status is highest in the youngest age group (40%) (Table 4.8), decreasing as age increases. The chi-square test was conducted to examine the association between age groups and the prevalence of Stunting.

The chi-square test result was found to be 44.218 ($p < 0.001$) (Table 4.8), from the result it was evident that there was a statistically significant difference in stunting prevalence across different age categories. This specified that the distribution of stunting among children varies significantly with age.

Gender-Wise Analysis

No significant gender-based differences in stunting prevalence are found ($p = 0.861$) (Table 4.9). The prevalence of severe stunting is slightly higher among boys (7.3%) compared to girls (6.7%), Moderate stunting is nearly identical in both groups (33.1% in boys, 32.2% in girls), the proportion of children categorized as "at risk" is similar between genders, and the percentage of children with normal height-for-age status is slightly higher among girls (29.4%) compared to boys (26.9%) (Table 4.9).

The results of chi-square test was found to be 0.753 ($p = 0.861$) (Table 4.9), which was not statistically significant. This indicates that stunting prevalence does not differ significantly between boys and girls.

Table 4.8: Age-Wise Distribution of Stunting Prevalence among Children (6-59 Months)

	AGE CATEGORIES								
	6-12 Months (N=35)		13-35 Months (N=302)		36-59 Months (N=576)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
SEVERELY STUNTED	2	5.7	34	11.3	28	4.9	64	7	44.219 (0.000)***
MODERATLY STUNTED	12	34.3	128	42.4	158	27.4	298	32.6	
AT RISK	7	20	80	26.5	207	35.9	294	32.2	
NORMAL	14	40	60	19.9	183	31.8	257	28.1	

*** Significant at p<0.001

Fig 4.5: Age-Specific Mean HAZ (Z-Score)

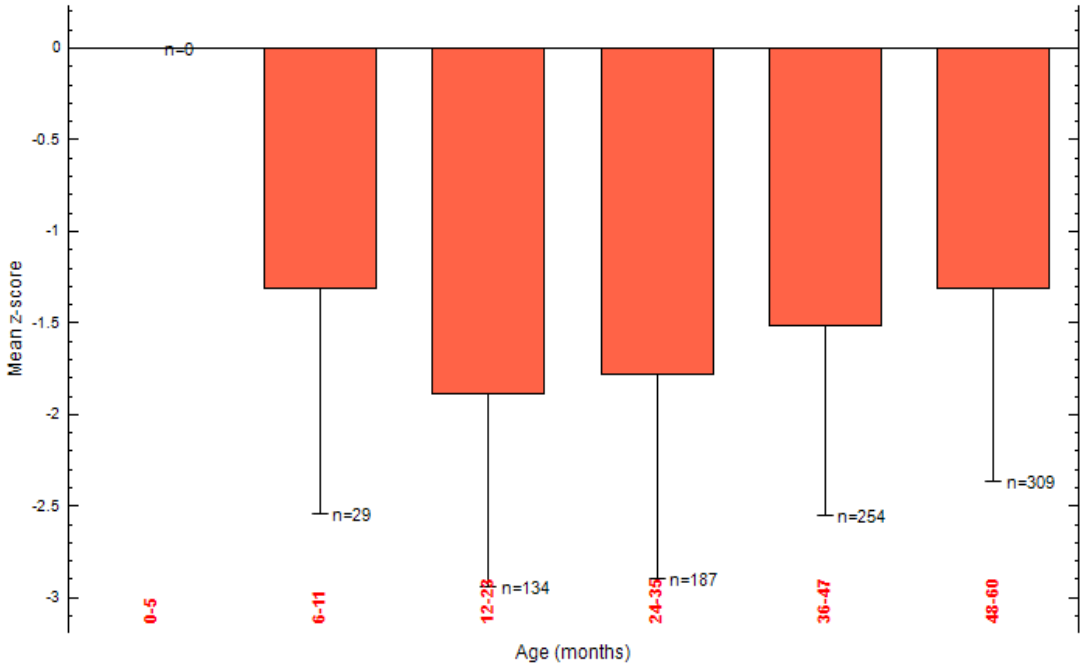
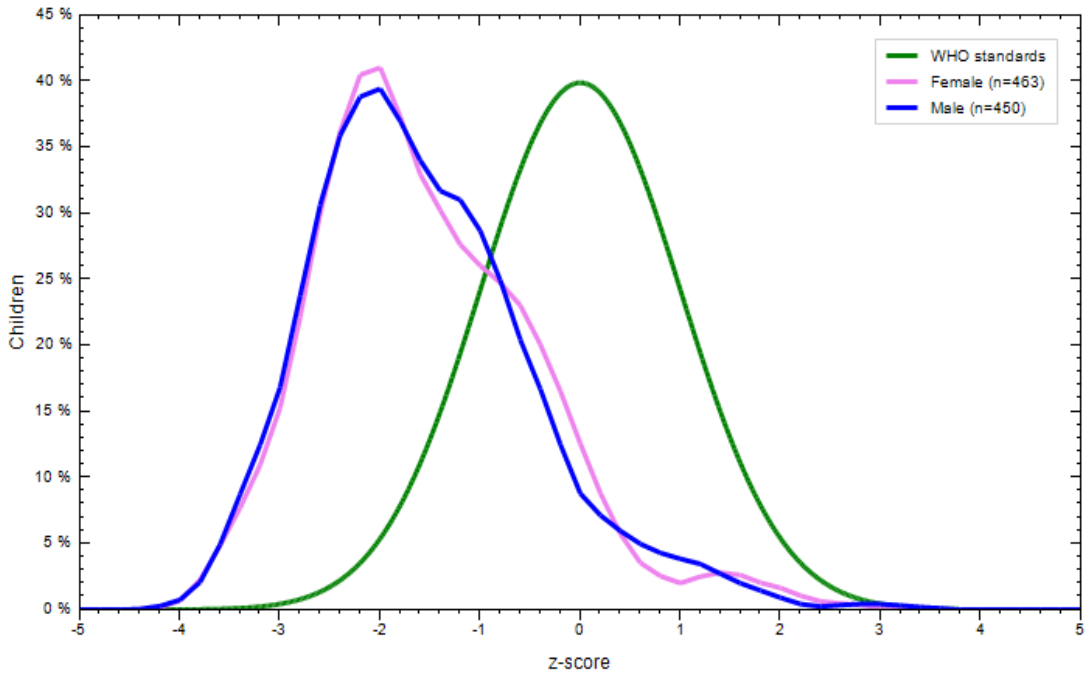


Table 4.9: Gender-Wise Distribution of Stunting Prevalence among Children (6-59 Months)

	GENDER CATEGORIES						
	BOY (N=450)		GIRL (N=463)		TOTAL (N=913)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SEVERELY STUNTED	33	7.3	31	6.7	64	7	0.753 (0.861)
MODERATLY STUNTED	149	33.1	149	32.2	298	32.6	
AT RISK	147	32.7	147	31.7	294	32.2	
NORMAL	121	26.9	136	29.4	257	28.1	

Fig 4.6: Gender-Specific Mean WAZ (Z-Score)



PREVALENCE OF MALNUTRITION IN 3 BLOKS

The spatial distribution of malnutrition indicators exhibits significant variability across different geographical regions. In Sakomatha block, the prevalence of wasting was recorded at 20.5% (Fig 4.7), while the prevalence of underweight and stunting stood at 32.1% and 28.7%, respectively (Fig 4.8) (Fig 4.9). In Baghmora block the prevalence of acute malnutrition is slightly higher, with wasting at 23.2%, underweight at 34.5%, and stunting at 30.2% (Fig 4.8). Similarly, Behali block reported a wasting prevalence of 21.8%, an underweight prevalence of 31.7%, and a stunting prevalence of 29.5% (Fig 4.9).

Fig 4.7: Block-wise Prevalence of Wasting in Tea Garden Dominated Areas
(Percentage representing across study regions)

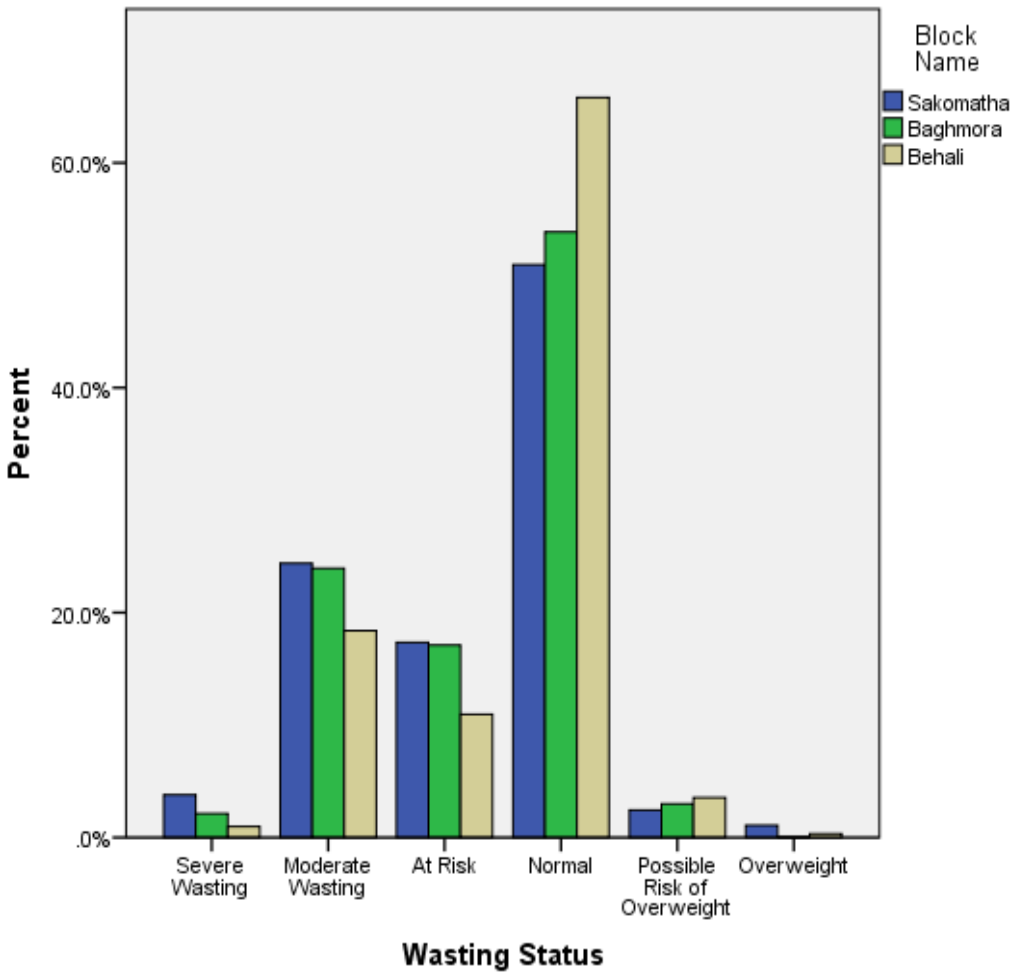


Fig 4.8: Block-wise Prevalence of Underweight in Tea Garden Dominated Areas
(Percentage representing across study regions)

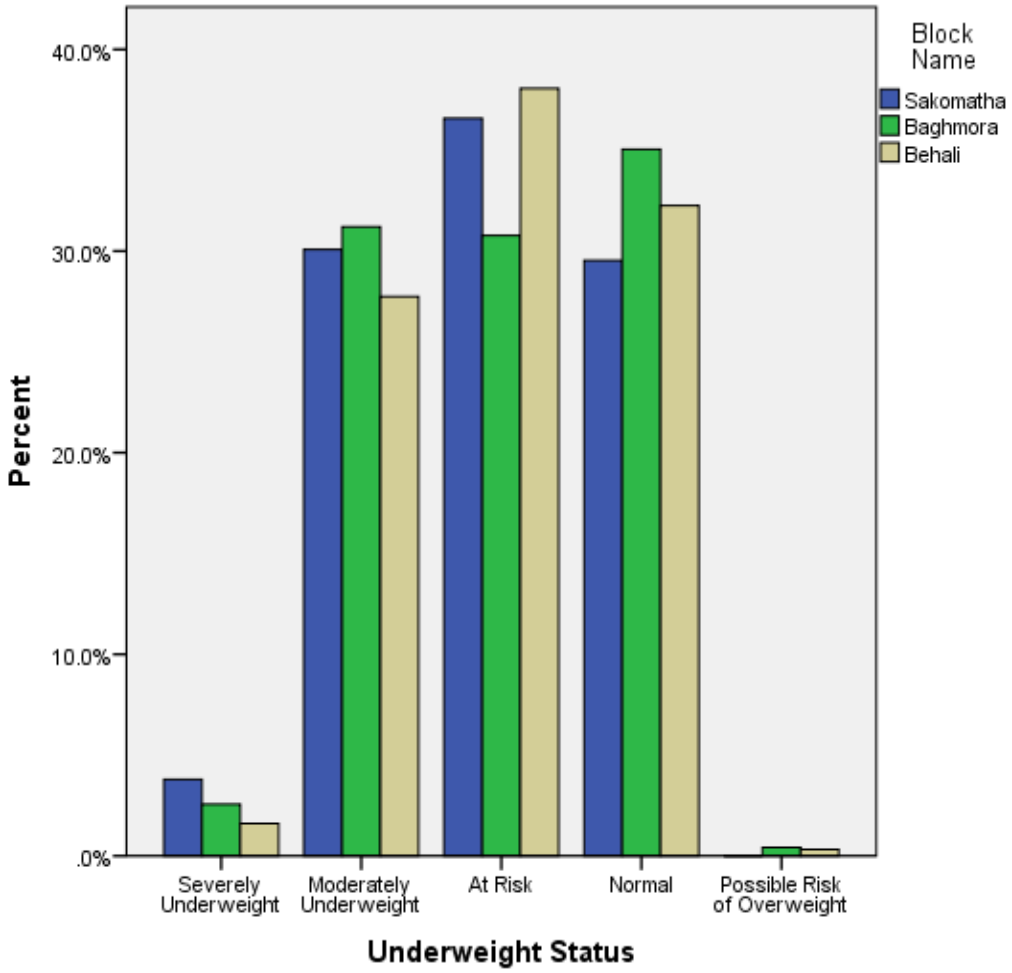
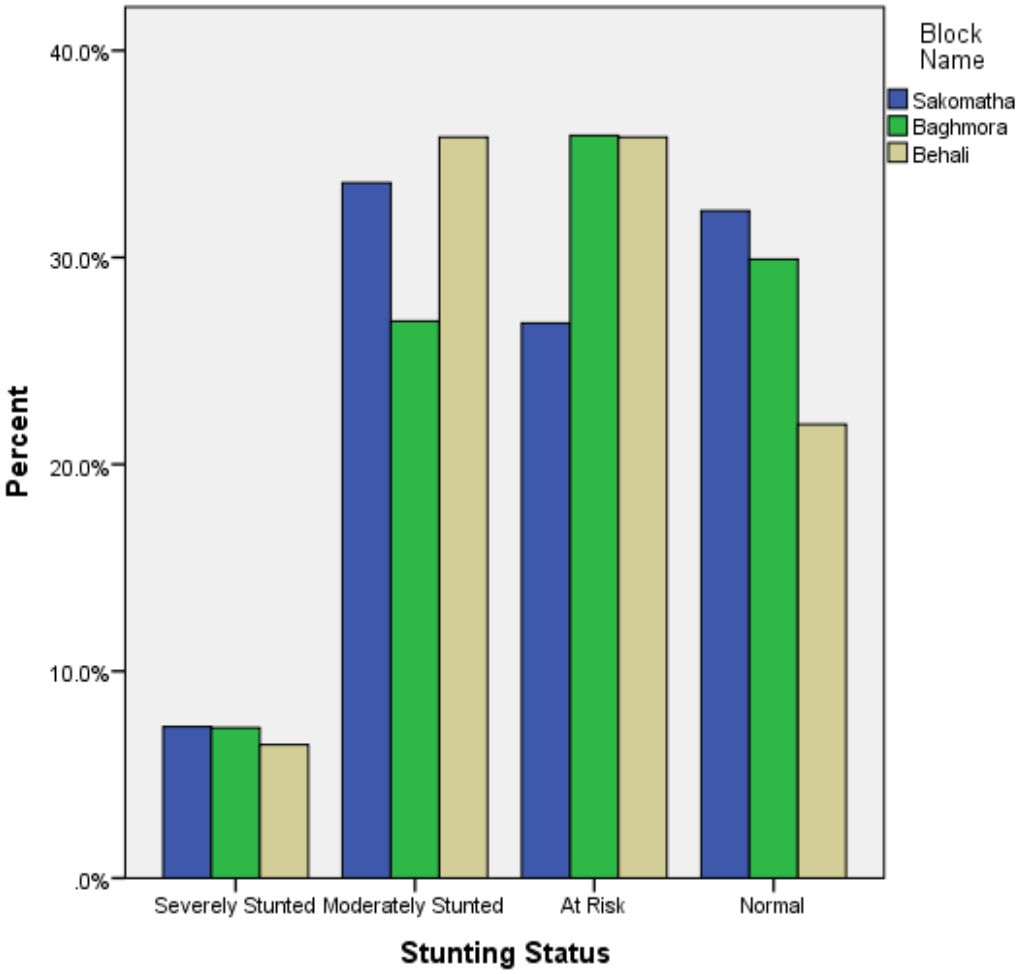


Fig 4.9: Block-wise Prevalence of Stunting in Tea Garden Dominated Areas
(Percentage representing across study regions)



ASSOCIATING FACTOR

Following the prevalence analysis, the study determined that the prevalence of acute malnutrition, specifically wasting, among children aged 6-59 months was 24.8%. 913 children were systematically assessed for acute malnutrition and further 90 acutely malnourished children were examined to identify the associated factors contributing to its prevalence and were randomly selected from three blocks—Sakomatha, Baghmora, and Behali. Furthermore, additional contributing factors were examined, including socio-economic status (SES), water, sanitation, and hygiene (WASH) practices, access to supplementary nutrition, immunization coverage, and infant and young child feeding (IYCF) practices to establish a comprehensive understanding of malnutrition determinants in the study region.

SOCIOECONOMIC STATUS

The results indicate that children who were identified as acutely malnourished are born to mother with mean age of 23 years, oldest mother's age is 28 years and youngest mother's age is 19 years.

Socioeconomic Status by Gender

The results indicate that the average age of mothers was slightly higher for girl children (23.44 years) than for boy children (22.58 years), with a p-value of 0.061, suggesting no statistically significant difference. The mean number of children per household was significantly higher among families with girl children (2.74) than those with boy children (2.41) (p=0.047), indicating a possible gender-based fertility preference. The total monthly income of families with girl children was higher (INR 11,074.07) than that of boy children (INR 10,361.11), although the difference was not statistically significant (p=0.195). Birth order and age of children also showed no significant differences between genders (Table 4.10).

Socioeconomic Status by Age Category

The results highlight that the average age of mothers was highest for the 36-59 month group (23.349 years) and lowest for the 13-35 month group (22.45 years). A statistically significant difference (p=0.033) was observed in the number of children, indicating a trend of increasing family size with the child's age group. The average total monthly income of families did not differ significantly across age groups (p=0.161). A highly

significant difference (p=0.000) was found in child age distribution across groups, which is expected given the defined age categories. Birth order did not show statistically significant variation across groups (p=0.870) (Table 4.11).

Socio Economic Status Indices on the Basis of Gender

Religious distribution did not show significant variation across genders, with Hinduism being the dominant religion (76.7%), followed by Christianity (17.8%) and Islam (5.6%) (p=0.626). The caste distribution was predominantly Other Backward Classes (OBC) (93.3%), with no significant gender differences (p=0.730). Nuclear families were highly dominant (98.9%), showing no significant gender disparity (p=0.412). Household ownership rates were nearly identical between boy and girl child households (p=0.862). The chi-square test was conducted to examine the association between gender and the socioeconomic status.

Maternal education levels showed that most mothers were illiterate (57.8%), with 41.1% completing primary school and only 1.1% reaching middle school (Table 4.12). The educational attainment of household heads followed a similar trend, with 44.4% being illiterate and 45.6% possessing primary school education. No statistically significant differences were found in educational status across genders. Occupationally, the majority of household heads were engaged in skilled agricultural and fishery work (51.1%), followed by elementary occupations (35.6%). Income level classification showed that most families belonged to the upper-lower class (72.2%), with no variation between genders (p=1.000) (Table 4.12).

Socio Economic Status Indices on the Basis of Age

The religious distribution varied across age groups, but the differences were not statistically significant (p=0.285). The OBC category was predominant across all groups (93.3%), with no significant differences (p=0.295). Nuclear families accounted for 98.9% of the sample, regardless of age category. House ownership rates also showed minimal variation. Maternal illiteracy rates were highest in the 6-12 month group (80%), though not statistically significant (p=0.826). The educational status of household heads was similar across age groups, with illiteracy rates remaining high (44.4%). Occupational trends showed that elementary occupations were predominant across all age groups (p=0.554). The majority of families fell into the upper-lower income category (72.2%), and the income distribution was consistent across age groups

(p=0.217). The chi-square test was conducted to examine the association between age groups and the socioeconomic status (Table 4.13).

Occupation of Household Heads with Acute Malnutrition

The graph indicates that households with heads employed in elementary occupations and agricultural work had a higher prevalence of acute malnutrition. This suggests a correlation between lower-skilled job categories and child malnutrition risk, likely due to economic constraints affecting dietary diversity and healthcare access (Fig 4.10).

Education Level of Mothers

A significant proportion of mothers were illiterate or had only primary school education, which may contribute to lower nutritional awareness and inadequate child-feeding practices. The lack of maternal education appears to be a critical determinant of malnutrition prevalence in the study population (Fig 4.11).

Education Level of Household Head

Similar to maternal education, a significant proportion of household heads were either illiterate or had minimal formal education. This suggests limited economic mobility and awareness regarding nutritional best practices, further exacerbating malnutrition risk among children (Fig 4.12).

Socio Economic Status according to Kuppuswamy

The Kuppuswamy scale classification suggests that most households belonged to the lower socio-economic strata. Given the established links between economic deprivation and malnutrition, the low socio-economic standing of these families likely contributes to the high prevalence of acute malnutrition among children in tea garden-dominated areas of Biswanath district (Fig 4.13).

Table 4.10: Mean Socio Economic Status and Child Profile Indices on the Basis of Child's Gender

	GENDER				
	Boy (N=36)		Girl (N=54)		t-value (p value)
	Mean	S.D	Mean	S.D	
Age of mother (years)	22.58	2.0195	23.44	2.16	-1.901 (0.061)
Number of children	2.41	0.6918	2.74	0.7815	-2.016 (0.047)*
Total monthly income of the family (rupees)	10361.11	2257.08	11074.07	2704.65	-1.307 (0.195)
Age of the child (months)	39.5	14.82	43.25	13.93	-1.222 (0.225)
Birth order of the child	1.889	0.7475	2.093	0.8527	-1.165 (0.247)

*significant at $p<0.05$

Table 4.11: Mean Socio Economic Status and Child Profile Indices on the Basis of Child's Age

	AGE						
	6-12 Months (N=5)		13-35 Months (N=22)		35-59 Months (N=63)		f-value (p value)
	Mean	S.D	Mean	S.D	Mean	S.D	
Age of mother (years)	22.8	1.303	22.45	2.109	23.349	2.171	1.49 (0.229)
Number of children	2.2	0.836	2.31	0.838	2.74	0.694	3.55 (0.033)*
Total monthly income of the family (rupees)	9400	1949.35	11545.45	2520.90	10634.92	2554.57	1.86 (0.161)
Age of the child (months)	10.4	1.673	25.95	6.643	49.76	6.85	163.33 (0.000)***
Birth order of the child	2.2	0.836	2	0.755	2	0.842	0.140 (0.870)

*significant at $p<0.05$,

Table 4.12: Socio Economic Status Indices on the Basis of Gender

	GENDER						
	Boy (N=36)		Girl (N=54)		Total (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	
RELIGION							
Hindu	28	77.8	41	75.9	69	76.7	0.937(0.626)
Muslim	1	2.8	4	7.4	5	5.6	
Christian	7	19.4	9	16.7	16	17.8	
CASTE							
General	2	5.6	4	7.4	6	6.7	0.119(0.730)
Other backward class	34	94.4	50	92.6	84	93.3	
TYPE OF FAMILY							
Nuclear	36	100	53	98.1	89	98.9	0.674(0.412)
Joint	0	0.0	1	1.9	1	1.1	
FAMILY OWN HOUSE							
Yes	20	55.6	31	57.4	51	56.7	0.30(0.862)
No	16	44.4	23	42.6	39	43.3	
MOTHER'S EDUCATION LEVEL							
Illiterate	20	55.6	32	59.3	52	57.8	0.880(0.644)
Primary school certificate	16	44.4	21	38.9	37	41.1	
Middle school certificate	0	0.0	1	1.9	1	1.1	
HOUSEHOLD HEAD'S EDUCATION LEVEL							
Illiterate	15	41.7	25	46.3	40	44.4	2.208(0.530)
Primary school certificate	19	52.8	22	40.7	41	45.6	
Middle school certificate	2	5.6	6	11.1	8	8.9	
High school certificate	0	0.0	1	1.9	1	1.1	
OCCUPATION OF THE HOUSEHOLD HEAD							
Unemployed	1	2.8	3	5.6	4	4.4	3.808(0.433)
Elementary occupation	13	36.1	19	35.2	32	35.6	
Plant & machine operators and assemblers	3	8.3	3	5.6	6	6.7	
Skilled agricultural & fishery workers	17	47.2	29	53.7	46	51.1	
Skilled workers and shop & market sale workers	2	5.6	0	0.0	2	2.2	

INCOME LEVEL CATEGORIES							
Lower class (v)	10	27.8	15	27.8	25	27.8	0.000(1.000)
Upper lower class (iv)	26	72.2	39	72.2	65	72.2	

Table 4.13: Socio Economic Status Indices on the Basis of Age

	AGE								
	6-12 Months (N=5)		13-35 Months (N=22)		36-59 Months (N=63)		Total (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
RELIGION									
Hindu	5	100	15	68.2	49	77.8	69	76.7	5.026(0.285)
Muslim	0	0.0	3	13.6	2	3.2	5	5.6	
Christian	0	0.0	4	18.2	12	19	16	17.8	
CASTE									
General	0	0.0	3	13.6	3	4.8	6	6.7	2.442(0.295)
Other backward class	5	100	19	86.4	60	95.2	84	93.3	
TYPE OF FAMILY									
Nuclear	5	100	22	100	62	98.4	89	98.9	0.433(0.805)
Joint	0	0.0	0	0.0	1	1.6	1	1.1	
FAMILY OWN HOUSE									
Yes	3	60	11	50	37	58.7	51	56.7	0.530(0.767)
No	2	40	11	50	26	41.3	39	43.3	
MOTHER'S EDUCATION LEVEL									
Illiterate	4	80	13	59.1	35	55.6	52	57.8	1.505(0.826)
Primary school certificate	1	20	9	40.9	27	42.9	37	41.1	
Middle school certificate	0	0.0	0	0.0	1	1.6	1	1.1	
HOUSEHOLD HEAD'S EDUCATION LEVEL									
Illiterate	2	40	9	40.9	29	46	40	44.4	2.263(0.894)
Primary school certificate	2	40	12	54.5	27	42.9	41	45.6	
Middle school certificate	1	20	1	4.5	6	9.5	8	8.9	
High school certificate	0	0.0	0	0.0	1	1.6	1	1.1	
OCCUPATION OF THE HOUSEHOLD HEAD									
Unemployed	0	0.0	0	0.0	4	6.3	4	4.4	6.840(0.554)
Elementary occupation	3	60	9	40.9	20	31.7	32	35.6	
Plant & machine operatiors and assemblers	0	0.0	3	13.6	3	4.8	6	6.7	

Skilled agricultural & fishery workers	2	40	9	13.6	3	4.8	6	6.7	
Skilled workers and shop & market sale workers	0	0.0	1	4.5	1	1.6	2	2.2	
INCOME LEVEL CATEGORIES									
Lower class (V)	2	40	3	13.6	20	31.7	25	27.8	3.060(0.217)
Upper lower class (IV)	3	60	19	86.4	43	68.3	65	72.2	

Fig 4.10: Occupation of Household Heads with Acute Malnutrition

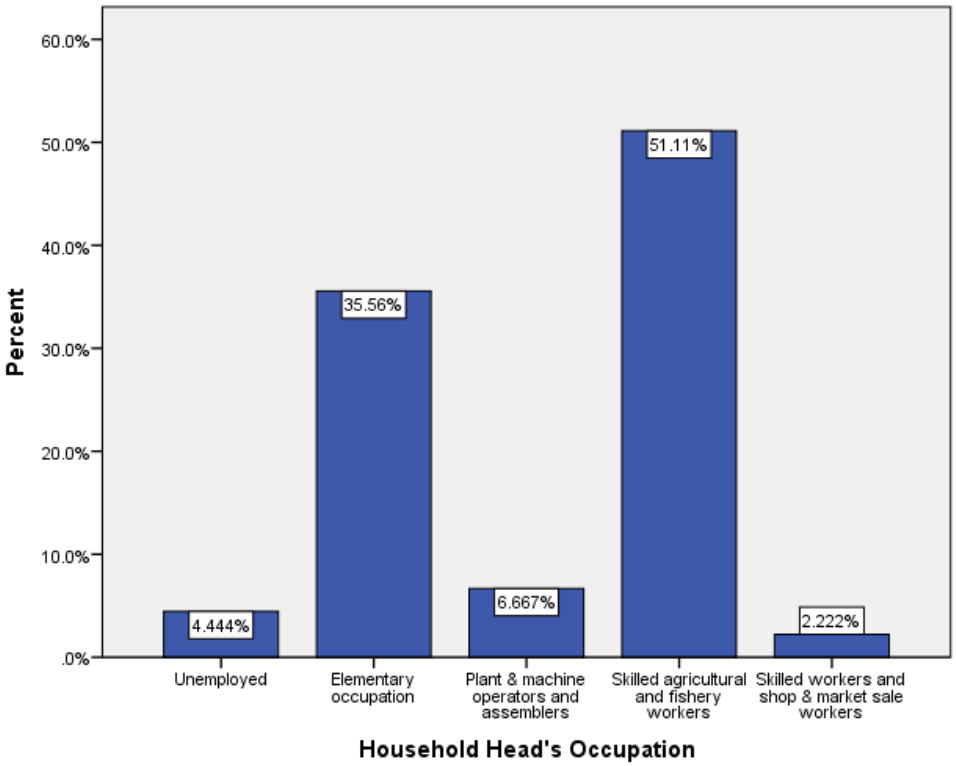


Fig 4.11: Education Level of Mothers

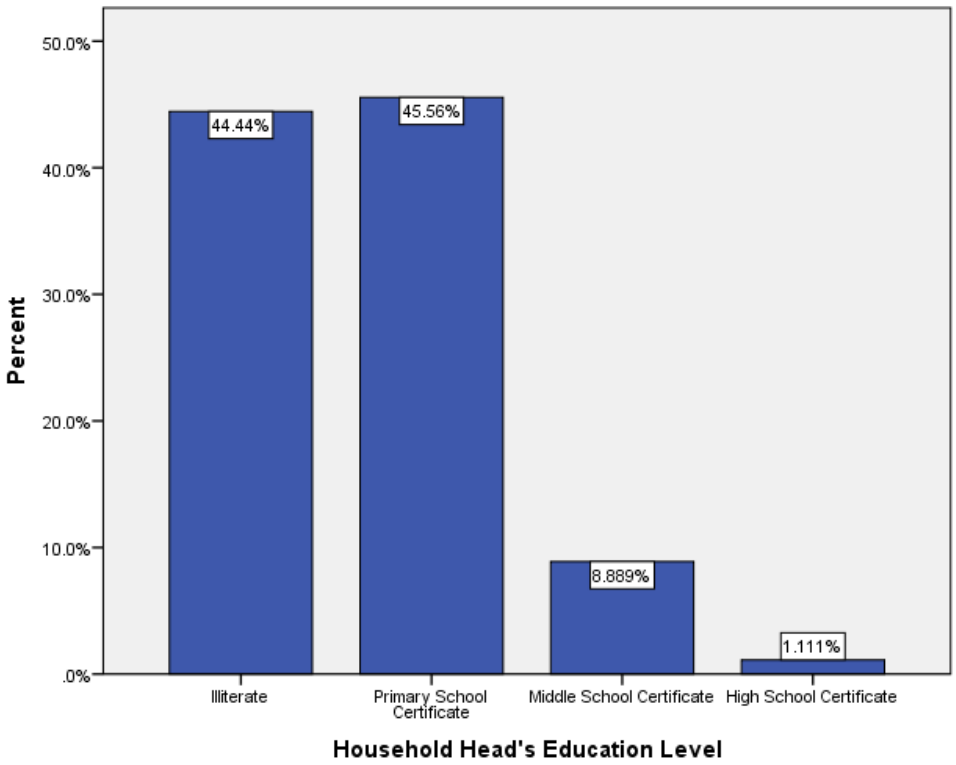


Fig 4.12: Education Level of Household Head

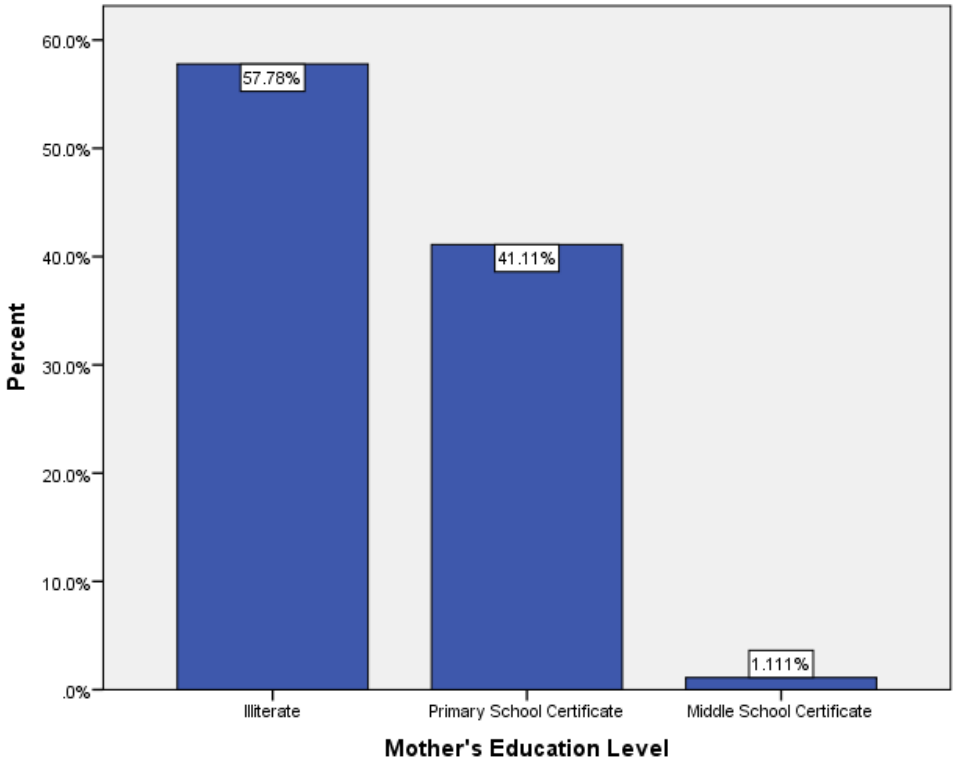
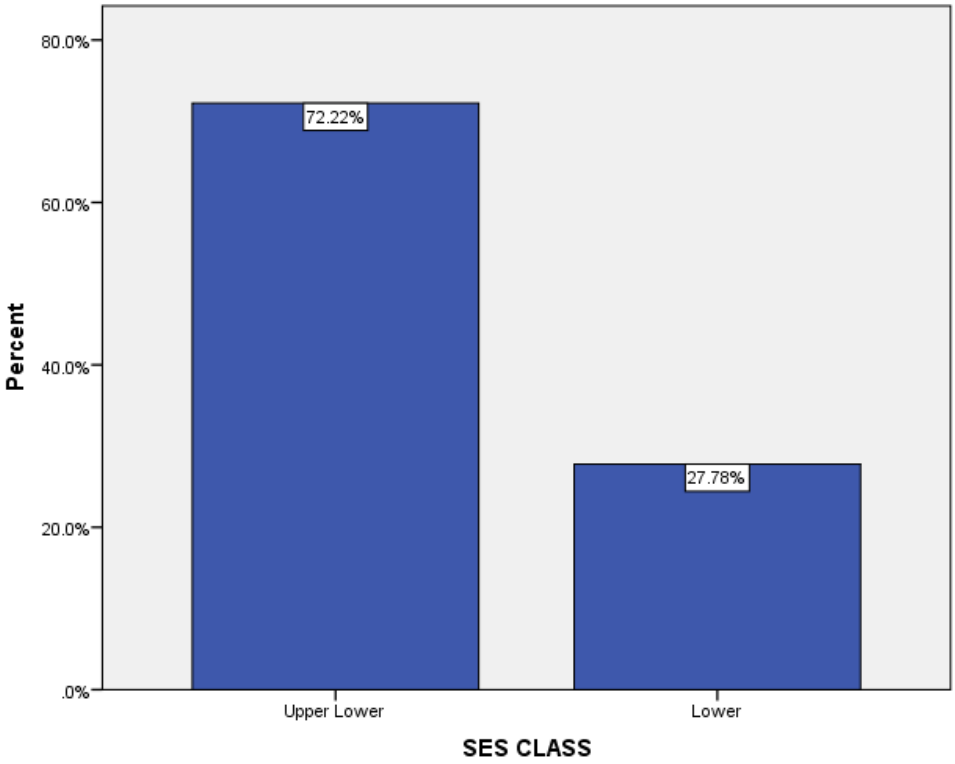


Fig 4.13: Socio Economic Status according to Kuppuswamy



WATER, SANITATION AND HYGIENE (WASH) PRACTICES

The analysis of WASH practices reveals that majority of the family has piped water as the primary source of drinking water, with variations in additional sources such as groundwater and well water. A significant proportion of the population perceives their drinking water as safe, though water filtration methods vary, with a notable dependence on water filters. Access to sanitation facilities is nearly universal, with home toilets being the most used facility. Hand washing with soap is widely practiced, particularly after toilet use, though gaps remain in comprehensive hand hygiene.

Source of Drinking Water

The data indicate that piped water is the primary source of drinking water for both boys (58.3%) and girls (50%). Additionally, 16.7% of the population utilizes both piped water and groundwater, while 30% rely on a combination of piped and well water. The chi-square test ($p = 0.720$) suggests no significant gender-based differences in drinking water sources.

Water Safety and Measures

Water safety awareness appears to be consistent across genders, with 55.6% of both boys and girls perceiving their drinking water as safe. The chi-square test ($p = 1.000$) confirms no statistical difference in this perception.

Regarding water safety measures, 30% of households use water filters, while 16.7% employ a combination of boiling and filtration. A minority (8.9%) rely solely on boiling. The lack of a significant association ($p = 0.328$) suggests uniformity in water purification methods across genders.

Type of Fuel Used for Cooking

The data suggest that most households rely on a combination of wood and LPG/natural gas (36.7%) or wood and coal/lignite (35.6%). Pure LPG/natural gas usage is comparatively low (17.8%). The chi-square test ($p = 0.865$) indicates no significant gender disparity in fuel usage patterns.

Type of Toilet Facility

A substantial majority (97.8%) of households have home toilets, with 100% of girl respondents reporting access compared to 94.4% of boys. The absence of a toilet facility is minimal (2.2%). Though there is a slight gender difference, statistical analysis ($p = 0.080$) shows that this is not significant.

Household Hand washing Practices

Most families report that members wash hands with soap (86.7%). However, a small proportion (13.3%) do not follow this practice. Gender-wise, a slightly higher percentage of boys (88.9%) follow proper hand washing compared to girls (85.2%).

In terms of critical hand washing moments, 61.1% wash hands after toilet use, while 22.2% also wash hands after cleaning a baby's backside. The data reveal that only 1.1% adhere to comprehensive hand washing practices (after toilet use, before eating, and after cleaning a baby's backside). The result of chi-square test ($p = 0.215$) applies to differences in critical hand washing moments, indicating no statistically significant difference.

Storage Duration of Complementary Food

A majority (62.2%) of households do not store complementary food, while 35.6% store it for 2–3 hours. Only 2.2% store food for over four hours. Gender differences are not statistically significant ($p = 0.164$), suggesting similar food storage behaviors across both groups.

Washing Practices for Vegetables

Approximately 74.4% of respondents wash vegetables before cutting, whereas 25.6% cut them before washing. Although more girls (77.8%) follow the recommended practice of washing before cutting than boys (69.4%), the chi-square test ($p = 0.375$) shows no significant association between gender and this practice (Table 4.14).

Table 4.14: Wash Practices Indicators Gender Wise

	GENDER						
	Boy (N=36)		Girl (N=54)		Total (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	
SOURCE OF DRINKING WATER							
Piped water	21	58.3	27	50	48	53.3	.658(.720)
Piped water & ground water	5	13.9	10	18.5	15	16.7	
Piped water & well water	10	27.8	17	31.5	27	30	
WATER SAFETY							
Yes	20	55.6	30	55.6	50	55.6	0.000(1.000)
No	16	44.4	24	44.4	40	44.4	
WATER SAFETY MEASURES							
Boil	2	5.6	6	11.1	8	8.9	3.441(.328)
Boil & use water filter	4	11.1	11	20.4	15	16.7	
Use water filter	14	38.9	13	24.1	27	30	
TYPE OF FUEL USED							
Wood	4	11.1	4	7.4	8	8.9	1.281(.865)
Wood & LPG/natural gas	12	33.3	21	38.9	33	36.7	
Wood, LPG/natural gas & coal/lignite	0	0.0	1	1.9	1	1.1	
Wood & coal/lignite	13	36.1	19	35.2	32	35.6	
LPG/natural gas	7	19.4	9	16.7	16	17.8	
TYPE OF TOILET FACILITY							
Home toilet	34	94.4	54	100	99	97.8	3.068(.080)
No facility	2	5.6	0	0.0	2	2.2	
HOUSEHOLD HAND WASHING PRACTICES							
Family members wash hands with soap	32	88.9	46	85.2	78	86.7	7.071(.215)
Family members not wash hands with soap	4	11.1	8	14.8	12	13.3	
After using toilet	19	52.8	36	66.7	55	61.1	
After using toilet, before eating, after cleaning baby's backside	0	0.0	1	1.9	1	1.1	
After using toilet, after cleaning baby's backside	12	33.3	8	14.8	20	22.2	

After using toilet, after cleaning baby's backside, before feeding baby	0	0.0	1	1.9	1	1.1	
After using toilet, before eating	1	2.8	0	0.0	1	1.1	
HOW LONG IS COMPLEMENTARY FOOD STORED							
Does not store	20	55.6	36	66.7	56	62.2	3.616(.164)
For 2-3 hours	14	38.9	18	33.3	32	35.6	
More than 4 hours	2	5.6	0	0.0	2	2.2	
WHEN VEGETABLES ARE CUT							
Before washing	11	30.6	12	22.2	23	25.6	.788(.375)
After washing	25	69.4	42	77.8	67	74.4	

SUPPLEMENTARY NUTRITION

The findings highlight that gender and wasting status do not significantly impact SNP distribution and consumption patterns. However, gender-based differences in the frequency of receipt and taste preference were observed. A proportion of boy children (80%) received SNP twice a month, whereas 68.8% of girl children received it only once a month ($p = 0.016$). Additionally, 90% of boy children liked the taste of SNP compared to only 43.8% of girl children ($p = 0.018$). In contrast, while wasting status affected the sharing of SNP and preparation methods—77.8% of SAM children shared SNP with siblings compared to 47.1% of MAM children—these differences were not statistically significant.

Supplementary Nutrition Based on Gender of the Child

A majority of both boy (90.9%) and girl (94.1%) children received supplementary nutrition (SNP), with no statistically significant difference ($p = 0.747$). The primary reason for not receiving SNP was being newly registered at the Anganwadi Center (AWC).

Regarding the frequency of distribution, a significant proportion of boy children (80%) reported receiving SNP twice a month, whereas a greater proportion of girls (68.8%) received it only once a month. This difference was statistically significant ($p = 0.016$), suggesting potential gender-based discrepancies in SNP distribution frequency.

Regular receipt of SNP was reported by 100% of boys and 87.5% of girls, though the difference was not statistically significant ($p = 0.245$). Similarly, the regular consumption of SNP was slightly higher among boy children (100%) compared to girl children (81.3%), but this was not statistically significant ($p = 0.145$).

Consumption patterns indicate that a majority of children shared the SNP with their siblings (57.7%), while around 30.8% shared it with family members, and only 11.5% consumed it solely. These proportions did not show significant differences based on gender ($p = 0.975$).

Significant differences were observed regarding taste preference ($p = 0.018$). A higher proportion of boy children (90%) liked the taste of SNP compared to only 43.8% of girl children. The remaining 56.3% of girls did not like the taste, compared to 10% of boys.

In terms of preparation methods, porridge or halwa was the most common form (69.2%), followed by plain porridge (23.1%) and porridge/laddu (7.7%), with no statistically significant differences (p = 0.177). Perceived benefits of SNP were reported by 80.8% of children across both genders, showing no significant differences (p = 0.937) (Table 4.15).

Supplementary Nutrition Based on Wasting Status of the Child

All SAM children (100%) received SNP, while 89.5% of MAM children did, with no statistically significant difference (p = 0.312). The two children who did not receive SNP were newly registered at the AWC.

The frequency of SNP receipt showed some differences, though not statistically significant (p = 0.216). Among SAM children, 66.7% received SNP once a month, whereas 58.8% of MAM children received it twice a month.

Regular receipt of SNP was reported by 88.9% of SAM children and 94.1% of MAM children (p = 0.634). Regular consumption was slightly lower among SAM children (77.8%) than MAM children (94.1%), but this difference was not statistically significant (p = 0.215).

Regarding SNP consumption patterns, a larger proportion of SAM children (77.8%) shared it with siblings, while 47.1% of MAM children shared it with siblings. On the other hand, 41.2% of MAM children shared SNP with family members, compared to only 11.1% of SAM children. These differences were not statistically significant (p = 0.260).

Taste preferences were comparable, with 66.7% of SAM children and 58.8% of MAM children liking the taste (p = 0.696). The method of preparation showed some differences; 82.4% of MAM children's households prepared SNP as porridge or halwa, compared to 44.4% of SAM children's households. However, these differences were not statistically significant (p = 0.125).

The perceived benefits of SNP were reported by 80.8% of children overall, with slightly higher positive responses from MAM children (88.2%) compared to SAM children (66.7%), but the difference was not statistically significant (p = 0.184) (Table 4.16).

Table 4.15: Responses with Regards to Supplementary Nutrition of 6-36 months old children based on Gender of the Child

	GENDER						
	BOY (N=11)		GIRL (N=17)		TOTAL (N=28)		Chi-square (p value)
	N	N%	N	N%	N	N%	
GET SNP							
Yes	10	90.9	16	94.1	26	92.9	.104(.747)
No	1	9.1	1	5.9	2	7.17.1	
REASON FOR NOT RECEIVING SNP							
Newly registered in the AWC	1	100	1	100	2	100	
HOW OFTEN DO YOU GET SNP							
Once a month	2	20	11	68.8	13	50	5.850(.016)*
Twice a month	8	80	5	31.3	13	50	
DO THE CHILD RECEIVE IT REGULARLY							
Yes	10	100	14	87.5	24	92.3	1.354(.245)
No	0	0.0	2	12.5	2	7.7	
DO THE CHILD CONSUME IT REGULARLY							
Yes	10	100	13	81.3	23	88.5	2.120(.145)
No	0	0.0	3	18.8	3	11.5	
HOW PACKETS ARE CONSUMED							
Solely by child	1	10	2	12.5	3	11.5	.051(.975)
Shared by the family members	3	30	5	31.3	8	30.8	
Shared by siblings	6	60	9	56.3	15	57.7	
DO THE CHILD LIKE THE TASTE							
Yes	9	90	7	43.8	16	61.5	5.562(.018)*
No	1	10	9	56.3	10	38.5	
HOW PACKETS ARE PREPARED							
Porridge/Halwa	6	60	12	75	18	69.2	3.467(.177)
Porridge/Laddu	2	20	0	0.0	2	7.7	
Porridge	2	20	4	25	6	23.1	
PERCEIVED BENEFITS OF SNP							
Yes	8	80	13	81.3	21	80.8	.006(.937)
No	2	20	3	18.8	5	19.2	

*significant at $p<0.05$

Table 4.16: Responses with Regards to Supplementary Nutrition Based on Wasting Status of the Child

	WASTING STATUS						
	SAM (N=9)		MAM (N=19)		TOTAL (N=28)		Chi-square (p value)
	N	N%	N	N%	N	N%	
GET SNP							
Yes	9	100	17	89.5	26	92.9	1.020(.312)
No	0	0.0	2	10.5	2	7.1	
REASON FOR NOT RECEIVING SNP							
Newly registered in the AWC	0	0.0	2	100	2	100	
HOW OFTEN DO YOU GET SNP							
Once a month	6	66.7	7	41.2	13	50	1.529(.216)
Twice a month	3	33.3	10	58.8	13	50	
DO THE CHILD RECEIVE IT REGULARLY							
Yes	8	88.9	16	94.1	24	92.3	.227(.634)
No	1	11.1	1	5.9	2	7.7	
DO THE CHILD CONSUME IT REGULARLY							
Yes	7	77.8	16	94.1	23	88.5	1.539(.215)
No	2	22.2	1	5.9	3	11.5	
HOW PACKETS ARE CONSUMED							
Solely by child	1	11.1	2	11.8	3	11.5	2.693(.260)
Shared by the family members	1	11.1	7	41.2	8	30.8	
Shared by siblings	7	77.8	8	47.1	15	57.7	
DO THE CHILD LIKE THE TASTE							
Yes	6	66.7	10	58.8	16	61.5	.153(.696)
No	3	33.3	7	41.2	10	38.5	
HOW PACKETS ARE PREPARED							
Porridge/Halwa	4	44.4	14	82.4	18	69.2	4.154(.125)
Porridge/Laddu	1	11.1	1	5.9	2	7.7	
Porridge	4	44.4	2	11.8	6	23.1	
PERCEIVED BENEFITS OF SNP							
Yes	6	66.7	15	88.2	21	80.8	1.762(.184)
No	3	33.3	2	11.8	5	19.2	

IMMUNIZATION STATUS

As reported by mothers recall, the findings indicate that universal coverage (100%) was achieved for BCG, Hepatitis B, and OPV-0 among the acutely malnourished children. The coverage for O/IPV 1, 2, & 3 (98.9%) suggests high adherence to primary immunization schedules. However, a slight decline in coverage is observed for Penta 1, 2, & 3 (95.6%), Rota 1, 2, & 3 (93.3%), and the first dose of Measles/MMR (95.6%).

The administration of Vitamin A (first dose) was reported at 96.7%, while a decreasing trend is evident in subsequent doses (85.6% for the 2nd to 9th dose). Booster doses also show reduced coverage, with DPT and Measles/MMR second doses at 87.8% and OPV Booster at 88.9% (Table 4.17).

Immunization Status according to Gender

The gender-wise distribution of immunization coverage among acute malnourished children reveals no significant disparities between boy and girl children. Universal immunization coverage (100%) was achieved for BCG, Hepatitis B, and OPV-0 across both genders. While minor variations are observed in other vaccines, Chi-square test indicates that these differences are not statistically significant ($p > 0.05$).

While O/IPV 1, 2, & 3 coverage was higher among girl children (100%) compared to boys (97.2%), this variation was not statistically significant ($p = 0.218$). Similarly, Penta 1, 2, & 3 and Rota 1, 2, & 3 showed slightly higher coverage among boy children, but the differences remained statistically insignificant ($p = 0.531$ and $p = 0.227$, respectively). Booster doses (DPT, Measles/MMR 2nd dose, OPV Booster) followed a similar trend, with slightly lower coverage among boys but no significant association ($p > 0.05$) (Table 4.18).

MORBIDITY STATUS

None of the children had acute illness in past 15 days.

Table 4.17: Immunization Status of Acute Malnourished Children

	RECEIVED		NOT RECIEIVED		NOT APPLICABLE	
	N	N%	N	N%	N	N%
BCG	90	100	0	0.0	0	0.0
HEPATITIS B	90	100	0	0.0	0	0.0
OPV – 0	90	100	0	0.0	0	0.0
O/IPV 1,2 & 3	89	98.9	1	1.1	0	0.0
PENTA 1,2 & 3	86	95.6	4	4.4	0	0.0
ROTA 1,2 & 3	84	93.3	6	6.7	0	0.0
MEASLES/ MMR 1^{ST} DOSE	86	95.6	2	2.2	2	2.2
VITAMIN A (1^{ST} DOSE)	87	96.7	1	1.1	2	2.2
DPT BOOSTER	79	87.8	3	3.3	8	8.9
MEASLES/ MMR 2^{ND} DOSE	79	87.8	3	3.3	8	8.9
OPV BOOSTER	80	88.9	2	2.2	8	8.9
VITAMIN A (2^{ND} to 9^{TH} DOSE)	77	85.6	5	5.6	8	8.9

Table 4.18: Immunization Status of Acute Malnourished Child Gender Wise

	GENDER						
	BOY (N=36)		GIRL (N=54)		TOTAL (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	
BCG	36	100	54	100	90	100	
HEPATITIS B	36	100	54	100	90	100	
OPV – 0	36	100	54	100	90	100	
O/IPV 1,2 & 3	35	97.2	54	100	89	98.9	1.517(.218)
PENTA 1,2 & 3	35	97.2	51	94.4	86	95.6	.392(.531)
ROTA 1,2 & 3	35	97.2	49	90.7	84	93.3	1.458(.227)
MEASLES/ MMR 1^{ST} DOSE	34	94.4	52	96.3	86	95.6	.174(.916)
VITAMIN A (1^{ST} DOSE)	34	94.4	53	98.1	87	96.7	1.614(.446)
DPT BOOSTER	30	83.3	49	90.7	79	87.8	1.357(.507)
MEASLES/ MMR 2^{ND} DOSE	30	83.3	49	90.7	79	87.8	1.357(.507)
OPV BOOSTER	30	83.3	50	92.6	80	88.9	3.542(.170)
VITAMIN A (2^{ND} TO 9^{TH} DOSE)	29	80.6	48	88.9	77	85.6	1.342(.511)

INFANT YOUNG CHILD FEEDING AND DIET DIVERSITY

This section presents age-wise and gender-wise patterns in the consumption of 7 food groups among children aged 6–59 months. Table 4.19-4.20 revealed the dietary trends across three age groups (6–12 months, 13–35 months, and 36–59 months), as well as differences between boys and girls.

Age-wise Consumption of Food Groups

The data indicate that all children across age groups (6–12 months, 13–35 months, and 36–59 months) consumed grains, starchy roots, tubers, and plantains 100%. The consumption of legumes, nuts, and seeds showed a slight decline in the older age group 85.7% compared to younger age groups, though the association was not statistically significant ($p = 0.117$).

Consumption of dairy products showed a significant decline with age, with only 36.4% of children aged 13–35 months and 44.4% of those aged 36–59 months consuming dairy, compared to 100% in the youngest group ($p = 0.034$). Flesh food consumption increased with age, with 66.7% of children aged 36–59 months consuming meat, fish, or poultry, compared to none in the 6–12 months group ($p = 0.006$).

Egg consumption remained relatively consistent across all age groups (40%–45.5%, $p = 0.976$). Similarly, consumption of vitamin A-rich fruits and vegetables, as well as other fruits and vegetables, increased with age, but the differences were not statistically significant ($p = 0.134$ and $p = 0.065$, respectively) (Table 4.19).

Gender-wise Consumption of Food Groups

No significant differences were observed in the consumption patterns of different food groups between boy and girl children. Both groups had 100% consumption of grains, while legumes, nuts, and seeds were consumed by 88.9% of boys and 90.7% of girls ($p = 0.774$). Dairy product consumption were 47.2% in boys and 44.4% in girls where ($p = 0.795$). Flesh food consumption was higher among girl children (61.1%) compared to boys (52.8%), but the difference was not statistically significant ($p = 0.433$). Likewise, egg consumption was 47.2% in boys and 42.6% in girls, $p = 0.665$). Vitamin A-rich fruit and vegetable consumption was 75% in boys and 75.9% in girls and other fruits and vegetables was 94.4% in boys and 81.5% in girls which also did not show significant differences ($p = 0.920$ and $p = 0.076$, respectively) (Table 4.20).

Table 4.19: Age wise 7 food groups consumed by Acutely Malnourished children

Food Groups	6-12 Months (N=5)		13-35 Months (N=22)		36-59 Months (N=63)		Total (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	N	N%	
Grains, white/pale starchy roots, tubers and plantains	5	100	22	100	63	100	90	100	
Beans, peas, lentils, nuts and seeds	5	100	22	100	54	85.7	81	90	4.286(.117)
Fluids/Dairy products	5	100	8	36.4	28	44.4	41	45.6	6.756(.034)*
Flesh foods: meat, fish, poultry, organ meats	0	0.0	10	45.5	42	66.7	52	57.8	10.252(.006)**
Eggs	2	40	10	45.5	28	44.4	40	44.4	.049(.976)
Vitamin A-rich fruits and vegetables	2	40	16	72.7	50	79.4	68	75.6	4.013(.134)
Other fruits and vegetables	4	80	16	72.7	58	92.1	78	86.7	5.480(.065)

*significant at $p<0.05$, ** significant at $p<0.01$

Table 4.20: Gender wise 7 food groups consumed by the children

Food Groups	BOY (N=36)		GIRL (N=54)		Total (N=90)		Chi-square (p value)
	N	N%	N	N%	N	N%	
Grains, white/pale starchy roots, tubers and plantains	36	100	54	100	90	100	
Beans, peas, lentils, nuts and seeds	32	88.9	49	90.7	81	90	.082(.774)
Fluids/Dairy products	17	47.2	24	44.4	41	45.6	.067(.795)
Flesh foods: meat, fish, poultry, organ meats	19	52.8	33	61.1	52	57.8	.615(.433)
Eggs	17	47.2	23	42.6	40	44.4	.188(.665)
Vitamin a-rich fruits and vegetables	27	75	41	75.9	68	75.6	.010(.920)
Other fruits and vegetables	34	94.4	44	81.5	78	86.7	3.141(.076)

INFANT YOUNG CHILD FEEDING AND DIET DIVERSITY OF CHILDREN 6-23 MONTHS OLD

The dietary analysis of children aged 6-23 months in (Table 4.21-4.27) highlights key trends in breastfeeding practices, complementary feeding, and dietary diversity. While breastfeeding initiation was universal, exclusive breastfeeding in the first two days of life was observed in only 63.4% of children, with disparities between genders. The intake of staple foods such as rice (100%) and pulses (100%) was high, but dietary diversity was limited, particularly in the consumption of vitamin A-rich fruits and vegetables, animal-source foods, and nuts/seeds. The high consumption of tea/coffee (45.5%) and processed foods (36.4%) raises concerns regarding early exposure to unhealthy dietary patterns.

Breastfeeding Practices

All children in the study (100%) were ever breastfed, indicating high adherence to breastfeeding initiation. However, exclusive breastfeeding (EBF) in the first two days of life was observed in 63.4% of children, with a notable gender disparity—83.3% among boys and only 40% among girls. While this difference was not statistically significant ($p = 0.137$), it highlights the need for improved early breastfeeding practices, particularly among girl infants. Continued breastfeeding was practiced by 72.7% of children, showing a decline after infancy, a common trend due to complementary feeding introduction. No bottle feeding was reported.

Fluids/Dairy Products Consumption

Plain water consumption was universal (100%) among all children, demonstrating good hydration practices. However, no children received infant formula, malt drinks, or curd-based beverages, suggesting limited diversity in dairy intake. Only 9.1% of children consumed animal milk, with a slightly higher proportion among boys (16.7%) compared to no intake among girls ($p = 0.338$), indicating no statistically significant difference in animal milk consumption between genders. Notably, 45.5% of children consumed tea/coffee, with significantly higher consumption among girls (80%) than boys (16.7%) ($p = 0.036$). Soft drink consumption was minimal (9.1%), with only one girl child consuming it.

Consumption of Grains, Tubers, and Plantains

Rice-based foods were consumed by all children (100%), indicating their staple status. Potato and other tuber consumption was also high (81.8%), but boys (100%) had a higher intake compared to girls (60%) ($p = 0.087$), indicating no statistically significant difference in tuber consumption between genders. Other grain varieties, such as millet and chapati, were not observed in the diet, suggesting limited dietary diversification within this category.

Legumes, Nuts, and Seeds Consumption

Pulses and legumes, such as dal and chickpeas, were consumed by all children (100%). However, no children consumed nuts or seeds, indicating a potential gap in sources of healthy fats and micronutrients among the children.

Vitamin A-Rich Fruits and Vegetables

Vitamin A-rich vegetable intake was moderate, with 36.4% of children consuming carrots or pumpkin ($p = 0.819$), indicating no statistically significant difference in intake among the children. Dark green leafy vegetable intake was lower (36.4%), with more boys (50%) consuming them than girls (20%) ($p = 0.303$), indicating no statistically significant difference in dark green leafy vegetable intake among the children. No children consumed vitamin A-rich fruits like papaya or mango.

Other Fruits and Vegetables

Consumption of other vegetables was reported in 45.5% of children, with a higher intake among boys (66.7%) compared to girls (20%) ($p = 0.122$), indicating no statistically significant difference in other vegetable consumption among the children. Among fruits, citrus fruit intake was 36.4%, banana, apple, and pear consumption was low (18.2%). Notably, no children consumed cucumber, radish, grapes, or kiwi, indicating a need for promoting fruit and vegetable intake for balanced nutrition.

Consumption of Sweets and Processed Foods

Sweets, including biscuits and ladoo, were consumed by 45.5% of children, with no significant gender differences (p = 0.740). The intake of ultra-processed foods, such as potato chips (36.4%), and instant noodle consumption was absent.

Eggs and Flesh Foods Consumption

Egg consumption was observed in 54.5% of children, with significantly higher intake among girls (80%) than boys (33.3%) (p = 0.122). Flesh food consumption was low, with only 18.2% consuming chicken and fish. No children consumed red meat, organ meat, or wild meat (Table 4.21).

Gender-wise MDD

The proportion of children who met the Minimum Dietary Diversity (MDD) was slightly higher in boys 66.7% than girls 60%, but this difference was not statistically significant (p = 0.819). Similarly, 36.4% of children failed to meet the MDD criterion, with no notable gender disparity (Table 4.22).

Age-wise MDD

Among children of 6–12 months, 60% met the MDD requirement, whereas 66.7% of children aged 13–23 months met this criterion. The results indicate no significant age-wise difference in dietary diversity (p = 0.819), highlighting a uniform dietary pattern across both age groups (Table 4.23).

Initiation of Breastfeeding

Regarding breastfeeding initiation, 31.1% of all children were breastfed immediately after birth, while 48.9% were initiated it within the first day, Followed by 20% who received breast milk only after 24 hours. Gender-wise, the distribution has no significant differences (p = 0.476) (Table 4.24).

Gender-wise MDD, MMF & MAD met by the children 6-23 Years

The proportion of children meeting MDD was similar in both genders 66.7% of boys and 60% of girls, (p = 0.819). Minimum Meal Frequency (MMF) was achieved by all girls 100% but only 66.7% of boys, although the association was not statistically

significant (p = 0.154). Minimum Acceptable Diet (MAD) was met by 66.7% of boys and 60% of girls, with no significant gender difference (p = 0.819) (Table 4.25).

Age wise MDD, MMF, MAD met by the children of 6-23 Years

In age-wise analysis, 60% of children aged 6–12 months met the MDD criterion, whereas 66.7% of those aged 13–23 months met the MDD criterion, with no significant difference (p = 0.819). The MMF requirement was met by all children in the older age group 100% compared to 60% in the younger age group, but the difference did not met statistical significance (p = 0.087). The MAD criterion was met by 60% of younger children and 66.7% of older children (p = 0.819) (Table 4.26).

IYCF indicators among children aged 6-23 months

All surveyed children had been breastfed (100%). Early initiation of breastfeeding was observed in 80% of children, with no significant gender difference (p = 0.333). However, exclusive breastfeeding during the first two days was higher among boys 83.3% than girls 40%, though the difference was not statistically significant (p = 0.137).

Continued breastfeeding at 12–23 months was reported in 72.7% of children. None of the children in the 6–23 months category were bottle-fed. Egg consumption was notably higher among girls 80% than boys 33.3%, though not statistically significant (p = 0.122). Flesh food consumption was low 16.7% in boys and 20% in girls, (p = 0.887). The consumption of sweets was similar across genders (p = 0.740), and 36.4% of children consumed unhealthy foods, and 63.6% children observed to have MDD (Table 4.27).

Table 4.21: Feeding Practices of Children 6-23 Months Gender Wise

	GENDER						
	BOY (N=6)		GIRL (N=5)		TOTAL (N=11)		Chi-square (p value)
	N	N%	N	N%	N	N%	
BREASTFEEDING PRACTICES							
Number of children ever breastfed	6	100	5	100	11	100	
EBF in the first 2 days of life	5	83.3	2	40	7	63.4	2.213 (.137)
Continued breastfeeding	5	83.3	3	60	8	72.7	.749 (.387)
Bottle feeding	0	0.0	0	0.0	0	0.0	
FLUIDS/DAIRY PRODUCTS							
Plain Water	6	100	5	100	11	100	
Infant Formula	0	0.0	0	0.0	0	0.0	
Milk from animal source	1	16.7	0	0.0	1	9.1	.917 (.338)
Malt drinks (Horlics, or bornvita)	0	0.0	0	0.0	0	0.0	
Fruit juice	1	16.7	1	20	2	18.2	.020 (.887)
Soft drinks	0	0.0	1	20	1	9.1	1.320 (.251)
Tea/Coffee	1	16.7	4	80	5	45.5	4.412 (.036)*
Clear broth/soup	0	0.0	0	0.0	0	0.0	
Curd, lassi, or buttermilk	0	0.0	0	0.0	0	0.0	
GRAINS, WHITE/PALE STARCHY ROOTS, TUBERS AND PLANTAINS							
Rice, poha, poori, paratha, or upma	6	100	5	100	11	100	
Chapati, rooti, or daliya	0	0.0	0	0.0	0	0.0	
Pearl millet, finger millet, or ragi malt	0	0.0	0	0.0	0	0.0	
Potato, sweet potato, turnip, or raw banana	6	100	3	60	9	81.8	2.933 (.087)

BEANS, PEAS, LENTILS, NUTS AND SEEDS							
Dal, sambar, chickpeas, kidney beans, soya, or khichdi	6	100	5	100	11	100	
Peanuts, cashews, almonds, pistachios, walnuts, or pumpkin seeds	0	0.0	0	0.0	0	0.0	
VITAMIN A-RICH FRUITS AND VEGETABLES							
Carrots, or pumpkin that is orange inside	2	33.3	2	40	4	36.4	.052 (.819)
Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens	3	50	1	20	4	36.4	1.061 (.303)
Ripe papaya, ripe mango, or musk melon	0	0.0	0	0.0	0	0.0	
OTHER FRUITS AND VEGETABLES							
Tomato, eggplant, lady finger, french beans, cauliflower, cabbage, or beetroot	4	66.7	1	20	5	45.5	2.396 (.122)
Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd	1	16.7	0	0.0	1	9.1	.917 (.338)
Cucumber, radish, capsicum, or drumstick	0	0.0	0	0.0	0	0.0	

Orange, tangerine, or grapefruit	3	50	1	20	4	36.4	1.061 (.303)
Ripe banana, apple, pear, watermelon, guava, custard apple, pomegranate, or pineapple	1	16.7	1	20	2	18.2	.020 (.887)
Grapes, kiwi, peaches, jackfruit, chickoo, jamun, or other wild fruits	0	0.0	0	0.0	0	0.0	
SWEETS							
Cake, cream biscuit, biscuit, jalebi, or ladoo	3	50	2	40	5	45.5	.110 (.740)
Other sweets, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates	1	16.7	0	0.0	1	9.1	.917 (.338)
EGGS							
Eggs	2	33.3	4	80	6	54.5	2.396 (.122)
FLESH FOODS: MEAT, FISH, POULTRY, ORGAN MEATS							
Organ (liver, or kidney)	0	0.0	0	0.0	0	0.0	
Red meat (mutton, lamb, or beef)	0	0.0	0	0.0	0	0.0	
Pork or wild meat	0	0.0	0	0.0	0	0.0	
Chicken, or duck or turkey	1	16.7	1	20	2	18.2	.020 (.887)
Fish, or prawns	1	16.7	0	0.0	1	9.1	.917 (.338)
Termites, or ants	0	0.0	0	0.0	0	0.0	
PROCESSED AND ULTRA PROCESSED FOODS							
Potato chips, namkeen, or mixture	2	33.3	2	40	4	36.4	.052 (.819)
Instant noodles	0	0.0	0	0.0	0	0.0	

Samosa, or pakoda	1	16.7	0	0.0	1	9.1	.917 (.338)

*significant at p<0.05

Table 4.22: Gender wise MDD met by the children of 6-23 months

	GENDER						
	BOY (N=6)		GIRL (N=5)		TOTAL (N=11)		Chi square (p value)
	N	N%	N	N%	N	N%	
MDD met	4	66.7	3	60	7	63.6	.052(.819)
MDD not met	2	33.3	2	40	4	36.4	

Table 4.23: Age wise MDD met by the children of 6-23 months

	AGE						
	6-12 Months (N=5)		13-23 Months (N=6)		TOTAL (N=11)		Chi square (p value)
	N	N%	N	N%	N	N%	
MDD met	3	60	4	66.7	7	63.6	.052(.819)
MDD not met	2	40	2	33.3	4	36.4	

Table 4.24: Initiation of Breastfeeding

Initiation of Breastfeeding after birth	GENDER						
	BOY (N=36)		GIRL (N=54)		TOTAL (N=90)		Chi square (p value)
	N	N%	N	N%	N	N%	
Immediately	12	33.3	16	29.6	28	31.1	1.485(.476)
Within 1 day	15	41.7	29	53.7	44	48.9	
After 1 day	9	25	9	16.7	18	20	

Table 4.25: Gender wise MDD, MMF, MAD met by the children

	GENDER						
	BOY (N=6)		GIRL (N=5)		TOTAL (N=11)		Chi square (p value)
	N	N%	N	N%	N	N%	
MDD	4	66.7	3	60	7	63.6	.052(.819)
MMF	4	66.7	5	100	9	81.8	2.037(.154)
MAD	4	66.7	3	60	7	63.6	.052(.819)

Table 4.26: Age wise MDD, MMF, MAD met by the children

	AGE						
	6-12 Months (N=5)		13-23 Months (N=6)		TOTAL (N=11)		Chi square (p value)
	N	N%	N	N%	N	N%	
MDD	3	60	4	66.7	7	63.6	.052(.819)
MMF	3	60	6	100	9	81.8	2.933(.087)
MAD	3	60	4	66.7	7	63.6	.052(.819)

Table 4.27: IYCF indicators among children aged 6-23 months

	GENDER						
	BOY (N=6)		GIRL (N=5)		TOTAL (N=11)		Chi square (p value)
	N	N%	N	N%	N	N%	
Ever breastfed	6	100	5	100	11	100	
Early initiation of breastfeeding	27	75	45	83.3	72	80	.938(.333)
Exclusively breastfed for the first two days after birth	5	83.3	2	40	7	63.6	2.213(.137)
Continued breastfeeding 12-23 months	5	83.3	3	60	8	72.7	.749(.387)
Bottle feeding 6-23 months	0	0.0	0	0.0	0	0.0	
Egg consumption 6-23 months	2	33.3	4	80	6	54.5	2.396(.122)
flesh foods consumption 6-23 months	1	16.7	1	20	2	18.2	.020(.887)
Sweets consumption 6-23 months	3	50	2	40	5	45.5	.110(.740)
Unhealthy food consumption 6-23 months	2	33.3	2	40	4	36.4	.052(.819)
Minimum dietary diversity 6-23 months	4	66.7	3	60	7	63.6	.052(.819)

INFANT YOUNG CHILD FEEDING AND DIET DIVERSITY OF CHILDREN 24-59 MONTHS OLD

In present study the information regarding Infant and Young Child Feeding practices and diet diversity of children 24-59 months old were depicted in table (Table 4.28). While breastfeeding practices are widely followed, dietary diversity remains suboptimal. High consumption of staple grains 100% and moderate intake of legumes 88.6% contrast with the low consumption of fruits 1.3%-54.4% and nuts 1.3%. Intake of ultra-processed foods 16.5% and cake, cream biscuits 78.5% raises concerns about long-term health impacts. Protein sources such as eggs 43% and chicken 34.2% are included in diets, though fish 16.5% and organ meat 13.9% consumption remains low. Gender differences across dietary categories were statistically insignificant.

Breastfeeding Practices

All children 100% were ever breastfed, highlighting strong adherence to initial breastfeeding recommendations. However, the rate of exclusive breastfeeding (EBF) in the first two days of life was 60.8%, with slightly higher percentage among boys 63.3% than girls 59.2%. The chi-square test ($p = .714$) suggests no statistically significant gender-based difference in EBF practices.

Consumption of Fluids and Dairy Products

Among fluids, malt drinks were consumed by a small proportion 5.1%, with no significant gender disparity ($p = .583$). The prevalence of tea consumption was notable, with 36.7% consuming tea with sugar and 64.6% consuming black tea with salt. No children were observed to consume fruit juices or soft drinks.

Consumption of Grains, Starchy Roots, and Tubers

All children 100% consumed common grain-based foods such as rice, or poha reflecting their dietary staple status. The intake of chapati, roti, or daliya was relatively low (16.5%) with no significant difference by gender ($p = .506$). Root vegetables such as potatoes and sweet potatoes were consumed by 93.7% of children, with no substantial gender variation.

Legume and Nut Consumption

Dal and legume-based foods were widely consumed 88.6%, reinforcing their importance as protein sources in the diet. However, nut and seed consumption was notably low (1.3%). Gender differences were not statistically significant for either category.

Vitamin A-Rich Foods

Consumption of vitamin A-rich vegetables, such as carrots and pumpkin, was recorded in 45.6% of children, showing moderate dietary diversity. Green leafy vegetable consumption was slightly higher 57%, whereas intake of vitamin A-rich fruits like papaya and mango was minimal (2.5%). Gender-based variation was not significant for these categories.

Other Fruits and Vegetables

Tomatoes, eggplant, and similar vegetables were consumed by 78.5% of children, whereas gourd varieties were consumed by 40.5%. The intake of citrus fruits was relatively low at 54.4%, with no significant difference between boys and girls ($p = .214$). Cucumber and radish consumption was recorded at only 2.5% of children ($p = .067$), indicating a lack of statistical significance in the difference of intake across groups. Fruits such as banana and apple was extremely low (1.3%).

Sweet and Ultra-Processed Food Consumption

A high percentage of children 78.5% consumed sweets such as cream biscuits, indicating frequent exposure to sugar-rich foods. However, consumption of other sweetened items such as milkshakes and chocolates was low 2.5%. The percentage of ultra-processed foods, particularly potato chips, was notably high 85.7% in girls and total is 16.5%.

Protein-Rich Foods: Eggs and Flesh Foods

Egg consumption was moderate, with 43% of children consuming eggs regularly. Among flesh foods, chicken was the most commonly consumed 34.2%, while fish

consumption stood at 16.5%. Organ meats were consumed by 13.9% of children. The overall intake of animal protein has no statistically significant gender-based differences.

Egg consumption was moderate, with 43% of children consuming eggs regularly. Among flesh foods, chicken was the most commonly consumed 34.2%, while fish consumption stood at 16.5%. Organ meats were consumed by 13.9% of children. The overall intake of animal protein has no statistically significant gender-based differences.

Table 4.28: Feeding Practices of Children 24-59 Months Gender Wise

	GENDER						
	BOY (N=30)		GIRL (N=49)		TOTAL (N=79)		Chi-square (p value)
	N	N%	N	N%	N	N%	
BREASTFEEDING PRACTICES							
Number of children ever breastfed	30	100	49	100	79	100	
EBF in the first 2 days of life	19	63.3	29	59.2	48	60.8	.134 (.714)
FLUIDS/DAIRY PRODUCTS							
Malt drinks (Horlics, bornvita etc)	1	3.3	3	6.1	4	5.1	.301 (.583)
Tea with sugar	10	33.3	19	38.8	29	36.7	.237 (.626)
Tea with salt	21	70	30	61.2	51	64.6	.626 (.429)
Fruit juice	0	0.0	0	0.0	0	0.0	
Soft drinks	0	0.0	0	0.0	0	0.0	
GRAINS, WHITE/PALE STARCHY ROOTS, TUBERS AND PLANTAINS							
Rice, poha, poori, paratha, or upma	30	100	49	100	79	100	
Chapati, rooti, or daliya	6	20	7	14.3	13	16.5	.442 (.506)
Pearl millet, finger millet, or ragi malt	0	0.0	0	0.0	0	0.0	
Potato, sweet potato, turnip, or raw banana	27	90	47	95.9	74	93.7	1.099 (.294)
BEANS, PEAS, LENTILS, NUTS AND SEEDS							
Dal, sambar, chickpeas, kidney beans, soya, or khichdi	26	86.7	44	89.8	70	88.6	.181 (.671)
(Peanuts, cashews, almonds, pistachios, walnuts, or pumpkin seeds	1	3.3	0	0.0	1	1.3	1.654 (.198)

VITAMIN A-RICH FRUITS AND VEGETABLES							
Carrots, or pumpkin that is orange inside	15	50	21	42.9	36	45.6	.383 (.536)
Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens	17	56.7	28	57.1	45	57	.002 (.967)
Ripe papaya, ripe mango, or musk melon	1	3.3	1	2	2	2.5	.126 (.723)
OTHER FRUITS AND VEGETABLES							
Tomato, eggplant, lady finger, french beans, cauliflower, cabbage, or beetroot	25	83.3	37	75.5	62	78.5	.674 (.412)
Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd	11	36.7	21	42.9	32	40.5	.296 (.586)
Cucumber, radish, capsicum, or drumstick	2	6.7	0	0.0	2	2.5	3.352 (.067)
Orange, tangerine, or grapefruit	19	63.3	24	49	43	54.4	1.546 (.214)
Ripe banana, apple, pear, watermelon, guava, custard	0	0.0	1	2	1	1.3	.620 (.431)

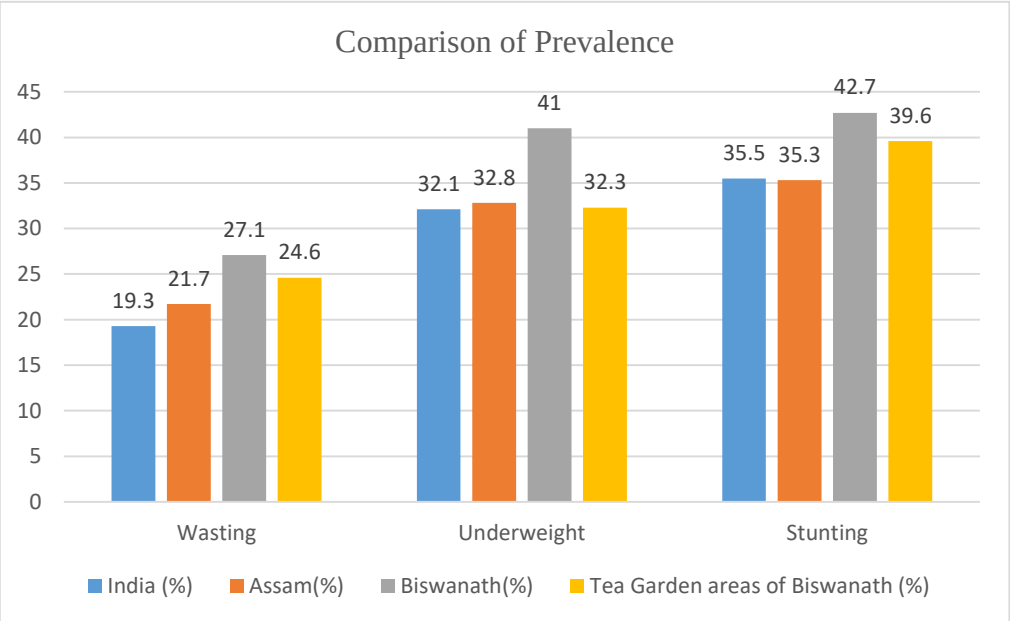
apple, pomegranate, or pineapple							
Grapes, kiwi, peaches, jackfruit, chickoo, jamun, or other wild fruits	0	0.0	0	0.0	0	0.0	
SWEETS							
Cake, cream biscuit, biscuit, jalebi, or ladoo	23	76.7	39	79.6	62	78.5	.094 (.759)
Other sweets, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates	1	3.3	1	2	2	2.5	.126 (.723)
EGGS							
Eggs	15	50	19	38.8	34	43	.956 (.328)
FLESH FOODS: MEAT, FISH, POULTRY, ORGAN MEATS							
Organ (liver, or kidney)	4	13.3	7	14.3	11	13.9	.014 (.906)
Red meat (mutton, lamb, or beef)	1	3.3	0	0.0	1	1.3	1.654 (.198)
Pork or wild meat	3	10	3	6.1	6	7.6	.399 (.528)
Chicken, duck, or turkey	10	33.3	17	34.7	27	34.2	.015 (.902)
Fish, or prawns	4	13.3	9	18.4	13	16.5	.343 (.558)
PROCESSED AND ULTRA PROCESSED FOODS							
Potato chips, or salty mixture	24	80	42	85.7	13	16.5	.442 (.506)
Instant noodles	2	6.7	0	0.0	2	2.5	3.352 (.067)
Samosa, or Pakoda	1	3.3	5	10.2	6	7.6	1.252 (.263)

DISCUSSION

The findings of the study aligns with the previous studies mentioned in review of literature on malnutrition in Biswanath district of Assam, giving the understanding that socioeconomic factors contribute significantly to the prevalence of acute malnutrition as shown in Figure 4.14. The existing research emphasizes the vulnerability of tea garden communities due to low wages, poor living conditions, and inadequate healthcare access (Mahanta et al., 2013).

The study reveals that the prevalence of acute malnutrition i.e. wasting is about 24.6% (Fig 4.15). Our results are in line with the findings of NFHS 5, which highlight a 27.1% wasting prevalence among children aged 6-59 months in the Biswanath district (Mohfw, 2021) (Fig 4.14). Furthermore, this study highlights gender-based differences, with SAM prevalence being relatively similar between boys (2.0%) and girls (2.8%), but MAM occurring at a slightly higher rate among girls (23.5%) compared to boys (20.9%). This pattern suggests potential gender disparities in intra-household food allocation, healthcare access, or cultural feeding practices that prioritize boy children over girls, a well-documented issue in various parts of India (Nair et al., 2020).

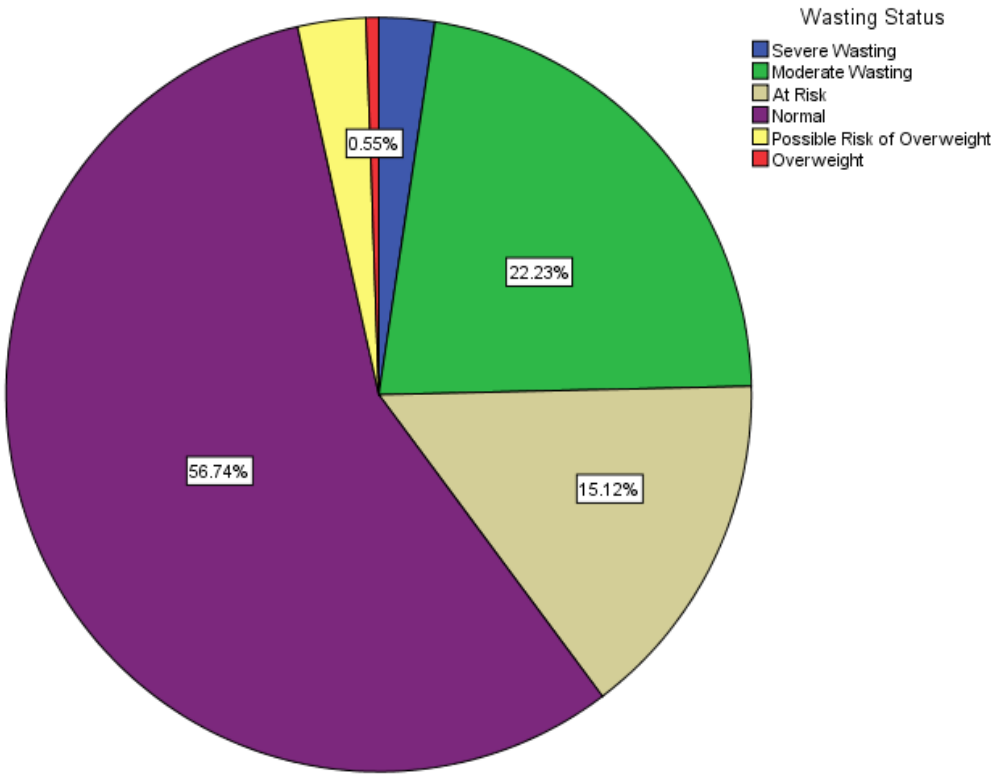
Fig 4.14: Comparison of Prevalence of Acute Malnutrition



The anthropometric data is almost similar to a study conducted in Karbi Anglong district of Assam, where mean height values of 93.28 (girls) and 93.12 cm (boys) (Kramsapi et al., 2018), whereas this study findings recorded average mean of 90.86 cm (girls) and 90.63 cm (boys). Similarly, the reported mean weights in previous study (12.92 kg for girls and 12.56 kg for boys) (Kramsapi et al., 2018), which is slightly higher than this study where observed values which is (12.03 kg and 12.27 kg, respectively).

The study found no significant gender-wise differences in weight, height, WHZ, WAZ, or HAZ scores. Boy children had a slightly higher mean weight (12.27 ± 2.39 kg) than girls (12.03 ± 2.38 kg), but the difference was not significant (p = 0.138). Mean height was nearly identical between boys (90.63 ± 10.55 cm) and girls (90.86 ± 10.15 cm) (p = 0.739).

Fig 4.15: Proportion Distribution of Wasting among Children aged 6-59 months



Age-wise, anthropometric indicators varied significantly, particularly in weight, height, WHZ, and HAZ ($p < 0.001$). Mean weight increased with age, from 7.65 ± 1.11 kg in the 6–12-month group to 13.44 ± 1.73 kg in the 36–59-month group. Height followed a similar trend. The WHZ declined with age, suggesting a rising burden of acute malnutrition, while HAZ was lowest in the 13–35-month category (-1.82 ± 1.09), indicating severe stunting in this age range. WAZ did not vary significantly across age groups ($p = 0.490$).

Fig 4.16: Proportion Distribution of Underweight among Children aged 6-59 months

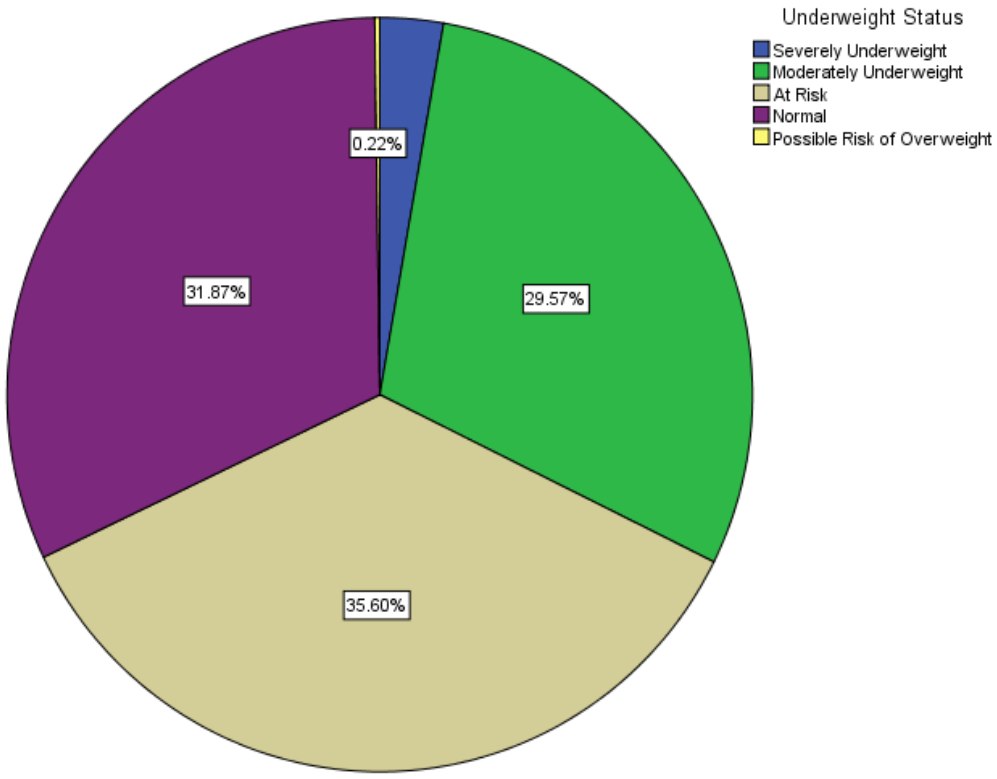
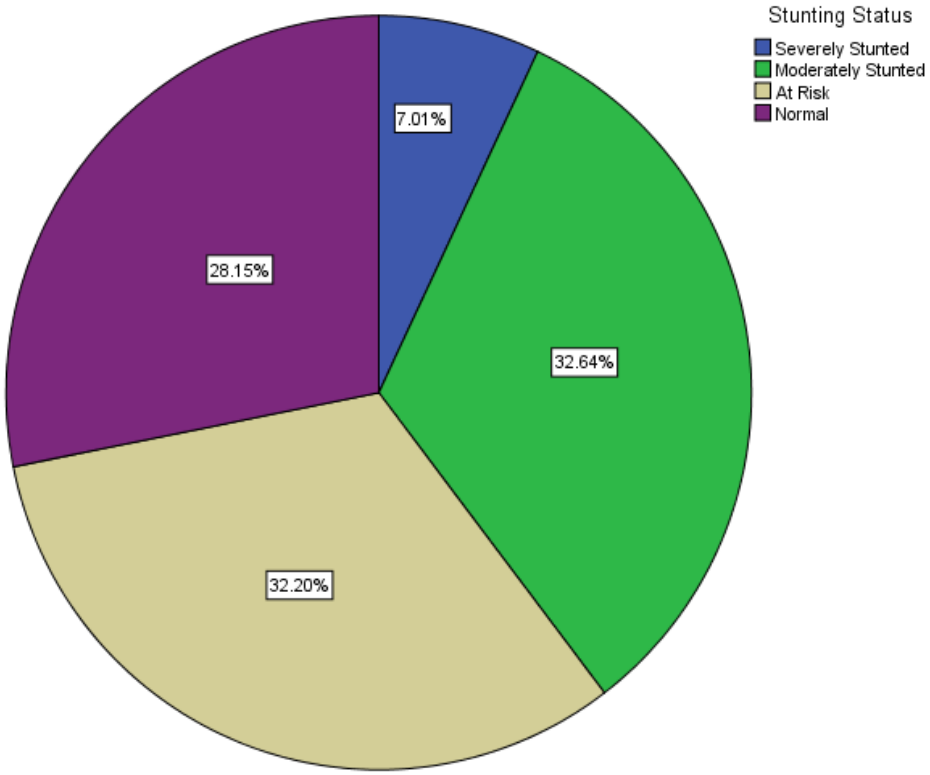


Fig 4.17: Proportion Distribution of Stunting among Children aged 6-59 months



Interviews were conducted to establish the associated risk factors contributing to the high prevalence of acute malnutrition. The socio-economic status analysis of acutely malnourished children reveals critical demographic patterns. While families with girl children had a marginally higher total monthly income (INR 11,074.07) compared to families with boy children (INR 10,361.11). While families with girl children had a marginally higher total monthly income (INR 11,074.07) compared to families with boy children (INR 10,361.11). However, the total monthly income did not vary significantly across age groups (p=0.161).

The findings suggest that maternal age remains relatively consistent across both gender and age groups of the child, with only slight variations observed, none of which were statistically significant (p=0.061). The mean maternal age at childbirth is 23 years, ranging from 19 to 28 years. Households with girl children had a significantly higher number of children (2.74) compared to those with boy children (2.41) (p=0.047), while birth order and child age distribution showed no significant variation across genders.

Comparative analysis across age groups indicates that maternal age was highest in the 36-59 month group (23.3 years) and lowest in the 13-35 month group (22.45 years). A statistically significant difference (p=0.033) was observed in the number of children per household, indicating a trend of increasing family size with the child's age. A highly significant difference (p=0.000) was noted in child age distribution across the predefined categories.

Previous studies support the socio economic status findings of this study regarding the parental education on child malnutrition status, health and wellbeing. NFHS-5 data highlighted that 29.7% of mothers in Assam had no formal education (Mohfw, 2021), whereas the present study found an even higher maternal illiteracy rate of 57.8%, with only 1.1% attaining middle school education. This aligns with previous research (Victora et al., 2010) showing that children of uneducated mothers are more prone to under nutrition due to poor dietary intake and hygiene practices. Furthermore, maternal illiteracy was highest in the youngest age group (6-12 months: 80%), highlighted that early childhood nutrition is heavily influenced by maternal education (Smith et al., 2002).

The role of parental education, the findings of this study revealed that 44.4% of household heads were illiterate, and a significant proportion of fathers are engaged in low-income occupations, restricting access to nutritious food and healthcare resources.

Although gender disparities in socioeconomic status (SES) were minimal, the high numbers of people residing in nuclear families (98.9%) and upper-lower income classification (72.2%) suggests potential financial difficulties affecting child nutrition.

The findings of this study indicate significant improvements in WASH practices compared to previous studies. Unlike NFHS-5 data, which reported that 61.6% of households in Assam used poor sanitation facilities (Mohfw, 2021), the present study shows that 97.8% of households have access to home toilets in the specific Biswanath district of Assam. This substantial improvement highlights progress in sanitation infrastructure, reducing the risk of infections associated with open defecation and unimproved sanitation (Bartram & Cairncross, 2010).

This study reveals that 55.6% of respondents perceive their drinking water as safe, and 30% use water filters. However, the use of boiling (8.9) and filtration remains limited. Hand washing practices in this study shows better results compared to NFHS-5 data (Mohfw, 2021), which indicated that only 63.8% of households in Assam regularly practice hand washing. Findings of this study reveal that 86.7% of households report using soap for hand washing in the Biswanath district of Assam, aligning with WHO recommendations on hygiene to prevent diarrheal diseases. However, comprehensive hand hygiene remains a challenge, with only 1.1% adhering to best practices. This gap suggests that further community-based hygiene promotion is necessary (Curtis et al., 2009).

The findings of this study indicate that while gender and wasting status do not significantly impact the overall distribution and consumption patterns of Supplementary Nutrition (SNP), certain gender-based differences in frequency of receipt and taste preference were observed.

A significantly higher proportion of boy children (80%) received SNP twice a month compared to girl children (68.8%), who received it only once a month ($p = 0.016$). Additionally, taste preference varied significantly, with 90% of boy children liking the taste of SNP, whereas only 43.8% of girl children liked it ($p = 0.018$). However, there were no significant gender differences in regular receipt ($p = 0.245$) and consumption

(p = 0.145) of SNP. Consumption patterns, including sharing of SNP with siblings or family members, did not differ significantly by gender (p = 0.975).

With respect to wasting status, there were no significant differences in SNP receipt, frequency, or regularity of consumption between SAM and MAM children. However, a higher proportion of SAM children (77.8%) shared SNP with siblings compared to 47.1% of MAM children. On the other hand, 41.2% of MAM children shared SNP with other family members, compared to only 11.1% of SAM children, though these differences were not statistically significant (p = 0.260). Preparation methods also varied, with MAM households more commonly preparing SNP as porridge or halwa (82.4%) compared to SAM households (44.4%), but this was not statistically significant (p = 0.125).

This study highlights universal coverage (100%) for BCG, Hepatitis B, and OPV-0, indicating strong adherence to early-life vaccinations. While O/IPV 1, 2, & 3 coverage is high (98.9%), a gradual decline is noted for Penta (95.6%), Rota (93.3%), and Measles/MMR (95.6%). Vitamin A coverage drops significantly after the first dose (96.7% to 85.6%), and booster doses show lower adherence (DPT: 87.8%, OPV Booster: 88.9%).

Compared to previous studies, this aligns with trends of high initial coverage but reduced adherence to follow-up doses, often due to caregiver complacency and accessibility issues (Singh et al., 2020; WHO, 2021). Gender-wise analysis shows no significant disparities. Previous studies have similarly noted a decline in vaccine uptake beyond primary immunization schedules, often attributed to factors such as caregiver complacency, lack of awareness, or accessibility issues (Wahl et al., 2021).

The dietary data of this study reveal significant trends in food group consumption across different age groups of children. While grains, starchy roots, tubers, and plantains were universally consumed (100%), dairy product intake significantly declined with age, with only 36.4% of children aged 13–35 months and 44.4% of those aged 36–59 months consuming dairy, compared to 100% in the youngest group (p = 0.034). In contrast, flesh food consumption increased significantly with age, with 66.7% of children aged 36–59 months consuming meat, fish, or poultry, compared to none in the 6–12 months group (p = 0.006). The consumption of legumes, nuts, and seeds showed a slight

decrease in older age groups (85.7%) compared to younger groups, but this was not statistically significant (p = 0.117). Egg consumption remained stable across all ages (40%–45.5%, p = 0.976). The intake of vitamin A-rich fruits and vegetables, as well as other fruits and vegetables, increased with age, though the differences did not reach statistical significance (p = 0.134 and p = 0.065, respectively).

Gender-wise analysis indicated no significant differences in food group consumption. Both boy and girl children had 100% consumption of grains. Legumes, nuts, and seeds were consumed by 88.9% of boys and 90.7% of girls (p = 0.774). Dairy product consumption was 47.2% in boys and 44.4% in girls (p = 0.795). Flesh food consumption was higher among girl children (61.1%) compared to boys (52.8%), but the difference was not statistically significant (p = 0.433). Similarly, egg consumption was reported at 47.2% in boys and 42.6% in girls (p = 0.665). Vitamin A-rich fruit and vegetable consumption was nearly identical (75% in boys and 75.9% in girls, p = 0.920), while other fruits and vegetables were consumed at 94.4% in boys and 81.5% in girls (p = 0.076), with no statistically significant difference.

In terms of dietary diversity, the proportion of boy children aged 6–23 months who met the Minimum Acceptable Diet (MAD) criterion was slightly higher (66.7%) compared to girls (60%), and overall was found to be 63.6%.

Breastfeeding initiation patterns revealed that 31.1% of all children were breastfed immediately after birth, 48.9% within the first day, and 20% only after 24 hours.

Regarding other key feeding indicators, the Minimum Meal Frequency (MMF) was achieved by all girl children (100%) but only by 66.7% of boys, though the association was not statistically significant (p = 0.154). Similarly, the Minimum Acceptable Diet (MAD) was met by 66.7% of boys and 60% of girls (p = 0.819). Age-wise, the MMF requirement was met by 100% of children aged 13–23 months but only by 60% of children aged 6–12 months, though statistical significance was not reached (p = 0.087). The MAD criterion was met by 60% of younger children and 66.7% of older children (p = 0.819).

Unlike earlier studies that highlight gender-based food discrimination in households (Bose, 2019), this study did not find significant differences between boys and girls in dietary intake, MDD, MMF, or MAD.

The study findings indicate high adherence to breastfeeding practices, with all acutely malnourished children have been breastfed and 80% initiating breastfeeding early. While exclusive breastfeeding within the first two days was more common among boys (83.3%) than girls (40%), this difference was not statistically significant. Continued breastfeeding at 12–23 months was observed in 72.7% of children, and none of the children aged 6–23 months were bottle-fed.

Lastly, the prevalence of acute malnutrition in Biswanath district was found to be 24.6%, which aligns with (NFHS-5) data which is 27.1% and it reveals the associated factors of acute malnutrition such as low education of the parents, poor socioeconomic status, and gender disparities in household food distribution. Additionally, limited dietary diversity, suboptimal IYCF practices, which contribute to the burden of malnutrition.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

The present study is carried out to assess the prevalence of acute malnutrition among children aged 6-59 months residing in tea garden-dominated areas of Biswanath District and to evaluate the associated risk factors.

The study was conducted in the tea garden dominated areas of Biswanath District. 30 out of 475 Anganwadi Centers (AWCs) in the 3 blocks of Biswanath district viz. Sakomatha, Baghmora and Behali were randomly selected and all 6-59 months old children were included in the study, the summary of which is shown below:

- Out of 1719 registered children in these AWCs, 913 children were considered for the study as they are belonged to the age category 6-59 months and were present in the AWCs at the time of data collection.
- The mean weight for boys was 12.27 kg and that of girls was 12.03 kg while the mean height of boys was 90.63 cm while that of girls was 90.86 cm.
- The boys had WHZ, WAZ, and HAZ of -.85±1.12, -1.43±.888, and -1.56±1.09, respectively, while the girls had WHZ, WAZ, and HAZ of -.87±-1.13, -1.47±.891, and -1.53±1.08, respectively.

Prevalence of Malnutrition

Wasting (Weight-for-height z-score)

- The prevalence of Severe Acute Malnutrition (SAM) was found to be 2.4%, prevalence of Moderate Acute Malnutrition (MAM), and at risk of wasting was found to be 22.2%, and 15.1%.
- SAM is most prevalent in the youngest age group (6-12 months) at 2.9%, while MAM is highest among children aged 36-59 months (25.9%).
- SAM prevalence remains similar between boys (2.0%) and girls (2.8%), while MAM is slightly higher among girls (23.5%) compared to boys (20.9%).

Underweight (Weight-for-age z-score)

- The prevalence of severe underweight was found to be 2.7%, prevalence of moderate underweight, and at risk of underweight was found to be 29.6 %, and 35.6%.
- Severe underweight is more pronounced in children aged 13-35 months (3.3%). The prevalence of moderate underweight is highest in the 6-12 months group (42.9%), while at risk is peaking 36.8% in 36-59 months.

- Girls were found to be more severely underweight (2.8), and moderately underweight (30.2%) as compared to boys, and children at risk of underweight is identical in both genders (35.6%).

Stunting (Height-for-age z-score)

- The prevalence of severe stunting was found to be 7%, prevalence of moderate stunting, and at risk of stunting was found to be 32.6 %, and 32.2%, respectively.
- The prevalence of severe stunting is highest among children aged 13-35 months (11.3%), while moderate stunting peaks in the same age group (42.4%). The "at risk" category is most prevalent among children aged 36-59 months (35.9%).
- The prevalence of severe stunting is slightly higher among boys (7.3%) compared to girls (6.7%). Moderate stunting is nearly identical in both groups.

Block-wise Prevalence of Acute Malnutrition

- In Baghmora block the prevalence of acute malnutrition is slightly higher, with wasting at 23.2%, underweight at 34.5%, and stunting at 30.2%.

Socio-Economic Status

- Children who are identified as acutely malnourished and further interviewed were born to mothers with mean age of 23 years, ranging from 19 to 28 years old.
- The mean of number of children in a family is 2.7.
- Most of the children comes from religion Hinduism (76.7) %.
- 93.3% of the children came from OBC caste.
- 98.9% of these children were living in nuclear type of families.
- 56.7% of these families from which these children are from owned the house that they lived in.
- In terms of education level of the mothers, 57.8% mothers were illiterate, and 41.1% of them had a primary school certificate.
- For household heads the educational status revealed that, 45.6% had primary school certificate, and 44.4% were illiterate.
- 51.1% of the household heads were involved as skilled agricultural & fishery workers, followed by 35.6% were elementary occupation.

- The average monthly income was about 10,800 rupees (10788.889±2546.17) with the lowest earning being 7000 rupees, and highest income being 15,000 rupees.
- With regards to the Kuppuswamy Scale, 72.2% of the children came from upper lower class (IV) families.

Water, Sanitation and Hygiene Practices

- 53.3% of the families had access to piped water, while 30% of the families had access to piped and well water.
- 55.6% of the families take measures to make the water safe for drinking, including boiling, use of filter or both.
- 36.7% of the families used both wood and LPG as a fuel source to cook their food.
- 97.8% families had home toilet facility while 2.2% families had no facility.
- 86.7% of the family members washed their hand with soap at various times throughout the day.
- 62.6% of the respondent does not store complementary food while 35.6% respondent store it for 2-3 hours.
- 74.4% of the respondents stated that they cut the vegetables after washing, while 25.6% respondents cut the vegetables before washing.

Supplementary Nutrition

- 92.9% of the acutely malnourished children aged between 6-36 months were receiving take home ration (THR) from the AWCs.
- Children who are more than 3 years old were receiving hot cooked meals cooked from the THR in the AWCs.
- 50% of the children receive the THR once a month, and 92.3% of children receive it regularly.
- 57.7% of the respondent shared the THR with siblings, while 30.8% of them shared the THR with family members.
- 69.2% of the children consumed the THR in the form of porridge/halwa, while 23.1% children consumed only porridge, and 7.7% children consumed it as porridge/laddu.

- 61.5% of the acutely malnourished children like the taste of THR.
- 80.8% of the respondent reported that they saw some benefits of giving their children THR.

Immunization

- Universal coverage (100%) was achieved for BCG, Hepatitis B, and OPV-0 among the acutely malnourished children.
- 98.9% children received 0/IPV 1, 2, & 3, 95.6% had received Penta 1, 2, & 3, 93.3% had received Rota 1, 2 & 3, and 95.6% had received first dose of measles/MMR.
- 96.7% reported first dose of vitamin A, while 85.6% had received subsequent doses.

Consumption of Food Groups

- Grains, starchy roots, tubers and plantains were universally consumed (100%).
- 45.6% of acutely malnourished children consumed dairy products.
- Beans, peas, lentil, nuts and seeds were consumed by 90% of the children.
- 57.8% of the children consumed flesh foods like meat, fish, poultry, organ meats, and 44.4% consumed eggs.
- Vitamin A- rich fruits and vegetables were consumed by 75.6% of children, and other fruits and vegetables were consumed by 86.7% of the acutely malnourished children.
- Minimum Acceptable Diet (MAD) were achieved by 63.6% of the chldren aged between 6-23 months.

IYCF Practices (6-23 months old children)

- 80% of the respondent reported early initiation of breast feeding.
- 63.6% of the children were exclusively breastfed in the first 2 days after birth.
- Continued breastfeeding were observed in 72.7% of the children.
- Consumption of eggs and flesh foods were (54.5%), and (18.2%), respectively.
- Consumption of sweets and unhealthy foods were (45.5%), and (36.4%), respectively.

SUMMARY AND CONCLUSION

The findings of this study highlight a concerning prevalence of acute malnutrition among children aged 6-59 months residing in the tea garden-dominated areas of Biswanath District, Assam. The data indicate that wasting, underweight, and stunting remain significant public health challenges, with severe and moderate cases particularly evident among younger children. Socioeconomic factors, including low maternal education, poor household income, and inadequate dietary diversity, have been identified as key contributors to malnutrition. Despite the availability of supplementary nutrition programs through AWCs, issues such as irregular distribution, sharing of Take-Home Rations, and poor dietary practices hinder their effectiveness. Additionally, limited access to clean drinking water and sanitation facilities further worsen the nutritional vulnerabilities of children in these tea garden communities.

Recommendation

- To enhance the effectiveness of SNP, ensuring the consistent daily delivery of supplementary meals for children aged 36–59 months is essential.
- Standardizing the serving size of supplementary nutrition based on the nutritional status of children will help to optimize their dietary intake and improve overall nutrition outcomes.

Limitations

This study encountered several limitations which may have impacted the data collection process and overall findings.

- Many children were not cooperative during MUAC data collection due to fear of injections and unfamiliarity with the MUAC tape, resulting in incomplete MUAC data.
- Data collection took place during the winter months (November to February), leading to lower participation of younger children.
- Some children had incorrect birth records, resulting in their exclusion from the study.
- The limited operational hours of AWCs, along with delays caused by fog and cold weather, reduced the available time for data collection.

- A high illiteracy rate among mothers made it difficult to gather accurate information on vaccination history and dietary intake.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. M., & -, H. H. B. (2024). Malnutrition among Under-five Children in India: Trends and Determinants. *International Journal For Multidisciplinary Research*, *6*(1). https://doi.org/10.36948/ijfmr.2024.v06i01.13649

Aguayo, V. M., Nair, R., Badgaiyan, N., & Krishna, V. (2016). Determinants of stunting and poor linear growth in children under 2 years of age in India: an in-depth analysis of Maharashtra's comprehensive nutrition survey. *Maternal & Child Nutrition, 12 Suppl 1*(Suppl 1), 121–140. https://doi.org/10.1111/MCN.12259

Astini, D. A. A. A. S. (2018). Nutritional status of children in Bali-Indonesia. *IOP Conference Series: Materials Science and Engineering*, *434*(1). https://doi.org/10.1088/1757-899X/434/1/012153

Bartram, J., & Cairncross, S. (2010). Hygiene, sanitation, and water: forgotten foundations of health. *PLoS Medicine*, *7*(11). https://doi.org/10.1371/JOURNAL.PMED.1000367

Baruah, M. N. (2018). Clinical Profile of Children with Severe acute Malnutrition Admitted to the Nutritional Rehabilitation Centre of a Tertiary Care Teaching Hospital of Assam. *Journal of Medical Science And Clinical Research*, *6*(3), 944–948. https://doi.org/10.18535/jmscr/v6i3.157

Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., Webb, P., Lartey, A., & Black, R. E. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet (London, England)*, *382*(9890), 452–477. https://doi.org/10.1016/S0140-6736(13)60996-4

Biswas, D., Hazarika, N. C., Hazarika, D., Doloi, P., & Mahanta, J. (2002). Study on Nutritional Status of Tea Garden Workers of Assam with Special Emphasis to Body Mass Index (BMI) and Central Obesity. *J. Hum. Ecol*, *13*(4), 299–302. https://doi.org/10.31901/24566608.2002/13.04.10

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., de Onis, M., Ezzati, M., Mathers, C., & Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. In *The Lancet* (Vol. 371, Issue 9608, pp. 243–260). Elsevier B.V. https://doi.org/10.1016/S0140-6736(07)61690-0

Cabrera, N. J., Tamis-LeMonda, C. S., Bradley, R. H., Hofferth, S., & Lamb, M. E. (2000). Fatherhood in the twenty-first century. *Child Development*, *71*(1), 127–136. https://doi.org/10.1111/1467-8624.00126

Curtis, V. A., Danquah, L. O., & Aunger, R. V. (2009). Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Education Research*, *24*(4), 655–673. https://doi.org/10.1093/HER/CYP002

Doepke, M., & Zilibotti, F. (n.d.). *The Macroeconomics of Child Labor Regulation*.

BIBLIOGRAPHY

Eastwood, M. A. (1988). Nutrition Overview. *Current Opinion in Gastroenterology*, *4*(2), 287–288. https://doi.org/10.1097/00001574-198803000-00020

Goswami, C. (2020). Health status of children in assam. *Indian Journal of Forensic Medicine and Toxicology*, *14*(3), 210–214. https://doi.org/10.37506/ijphrd.v11i1.544

How Centre's "Poshan Maah" Drive Is Helping In Fight Against Malnutrition In Assam. (n.d.). Retrieved March 3, 2025, from https://www.ndtv.com/india-news/how-centres-poshan-maah-drive-is-helping-in-fight-against-malnutrition-in-assam-2561880

Konwar, P., Vyas, N., Hossain, S., Gore, M., & Choudhury, M. (2019). Nutritional Status of Adolescent Girls Belonging to the Tea Garden Estates of Sivasagar District, Assam, India. *Indian Journal of Community Medicine : Official Publication of Indian Association of Preventive & Social Medicine*, *44*(3), 238. https://doi.org/10.4103/IJCM.IJCM_357_18

Kramsapi, R., Kh, N. S., & Mondal, N. (2018). *Composite Index of Anthropometric Failure (CIAF) among pre-school (2-5 years) tribal children of Assam (India)*. Human Biology Review. https://www.researchgate.net/profile/Mondal-Nitish/publication/322910313_Composite_Index_of_Anthropometric_Failure_CIAF_among_pre-school_2-5_years_tribal_children_of_Assam_India/links/5a759a4e0f7e9b41dbced983/Composite-Index-of-Anthropometric-Failure-CIAF

lowast, S. D. (2024). Double Burden of Malnutrition and Other Associated Factors among Reproductive Age Group Women in Assam, India. *Indian Journal of Science and Technology*, *17*(26), 2719–2726. https://doi.org/10.17485/IJST/V17I26.2177

Mahanta, T. G., Joshi, R., Mahanta, B. N., & Xavier, D. (2013). Prevalence of modifiable cardiovascular risk factors among tea garden and general population in Dibrugarh, Assam, India. *Journal of Epidemiology and Global Health*, *3*(3), 147–156. https://doi.org/10.1016/j.jegh.2013.04.001

Mandal, D., Bhattacherjee, S., Biswas, A. K., & Samanta, S. (2023). Determinants of malnutrition among the tea garden workers of Darjeeling district in 2021: an ordinal regression analysis. *International Journal Of Community Medicine And Public Health*, *10*(6), 2132–2137. https://doi.org/10.18203/2394-6040.ijcmph20231692

Medhi, G. K., Hazarika, N. C., Borah, P. K., & Mahanta, J. (2006). Health problems and disability of elderly individuals in two population groups from same geographical location. *Journal of Association of Physicians of India*, *54*(JULY), 539–544.

Mihret, S. T., Biset, G., & Nurye, N. A. (2023). Prevalence of Acute Malnutrition and Associated Factors among Children aged 6-59 months in South Wollo Zone, East

Amhara, Northeast Ethiopia: a Community-based cross-sectional study. *BMJ Open*, *13*(10), 8–10. https://doi.org/10.1136/bmjopen-2022-062582

Mohfw. (2021). *Government of India Ministry of Health and Family Welfare COMPENDIUM OF FACT SHEETS INDIA AND 14 STATES/UTs (Phase-11)*.

RedR India, & Unicef office for Assam and North East State. (2022). *WASH Situation Analysis in Tea Estates of Assam*. https://www.unicef.org/india/reports/water-sanitation-and-hygiene-wash-situational-analysis-tea-gardens-assam

Ronghangpi, P., Mahanta, T. G., & Boruah, M. (2023). Determinants of Severe Acute Malnutrition in under-five children in Dibrugarh District, Assam. *Indian Journal of Community Health*, *35*(4), 471–480. https://doi.org/10.47203/IJCH.2023.V35I04.013

Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., & Martorell, R. (2002). *The Importance of Women's Status for Child Nutrition in Developing Countries About This Report*. www.ifpri.org

Study of health problems and nutritional status of tea garden population of Assam - PubMed. (n.d.). Retrieved March 3, 2025, from https://pubmed.ncbi.nlm.nih.gov/17130664/

UNICEF, WHO, & WORLD BANK. (2021). Levels and trends in child malnutrition; UNICEF/WHO/World Bank Group-Joint child malnutrition estimstes 2021 edition. *World Health Organization*.

UNICEF. (2021). UNICEF Conceptual Framework on Maternal and Child Nutrition. *Nutrition and Child Development Section, Programme Group 3 United Nations Plaza New York, NY 10017, USA*, 2–3. www.unicef.org/nutrition%0Afile:///C:/Users/HP/Documents/KULIAH/S E M E S T E R - 6/Proposal Skripsi/Jurnal Pola Makan & Status Gizi/Bagan UNICEF Conceptual Framework.pdf

Victora, C. G., De Onis, M., Hallal, P. C., Blössner, M., & Shrimpton, R. (2010). Worldwide timing of growth faltering: Revisiting implications for interventions. *Pediatrics*, *125*(3). https://doi.org/10.1542/peds.2009-1519

Wahl, B., Gupta, M., Erchick, D. J., Patenaude, B. N., Holroyd, T. A., Sauer, M., Blunt, M., Santosham, M., & Limaye, R. J. (2021). Change in full immunization inequalities in Indian children 12–23 months: an analysis of household survey data. *BMC Public Health*, *21*(1), 1–15. https://doi.org/10.1186/S12889-021-10849-Y/TABLES/5

Welfare, F. (2015). *Study on contributing factors of IMR and MMR in Tea Gardens of Assam -2015 Phase – II*.

WHO. (2019). *malnutrition fact Sheets*. Who.Int. https://www.who.int/news-room/fact-sheets/detail/malnutrition

ANNEXURES

ANNEXURE I

ETHICAL COMPLIANCE CERTIFICTE

Institutional Ethics Committee for Human Research (IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2024-2025

This is to certify Mr. Aditya Ranjan Goswami study titled; "Prevalence of Acute Malnutrition among 06-59 months old children residing in tea garden dominated areas of Biswanath District, Assam." from Department of Foods and Nutrition has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number IECHR/FCSc/M.Sc./10/2024/33.

Prof. Komal Chauhan
Member Secretary
IECHR

Prof. Mini Sheth
Chairperson
IECHR

Chair Person
IECHR
Faculty of Family & Community Sciences
The Maharaja Sayajirao University of Baroda

ANNEXURE II

PEMISSION LETTER FROM DSW, BISWANATH

सत्यं शिवं सुन्दरम्
Estd. 1949
Accredited Grade "A+" by NAAC

DEPARTMENT OF FOODS AND NUTRITION
FACULTY OF FAMILY & COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA
VADODARA 390 002 - INDIA

No. F. C. Sc./ FND /
Date: 24/09/2024

To.

Mr. Moinul Haque Choudhury
District Social Welfare Officer,
Biswanath District, Assam.

Subject: Permission to conduct a research study on "Prevalence of Acute Malnutrition among 0-5 year old children residing in tea garden dominated areas of Biswanath District, Assam"

Respected Sir,

Greetings from the Department of Foods and Nutrition, The maharaja Sayajirao University of Baroda, Vadodara! The Department is involved in teaching and research in the field of Nutrition. Myself, Dr. Swati Dhruv from the Department of Foods and Nutrition is also involved in carrying out research on undernourished children. This year we are interested in carrying out Masters research in the state of Assam, where my student Mr. Aditya Ranjan Goswami is interested in conducting a research study on " Prevalence of Acute Malnutrition among 0-5 year old children residing in tea garden dominated areas of Biswanath District, Assam " from October 27, 2024, to March 30, 2025.

In this regard, I kindly request your permission to carry out the study in the Anganwadi Centres under your jurisdiction in Biswanath District. The study will be conducted during the working hours of the centers and all necessary precautions will be taken to ensure the smooth functioning of the Anganwadi Centres.

Please note that all data and findings collected during the research will remain confidential and used only for study purpose.

Thank you for your time and consideration.

Yours sincerely,

Dr. Swati Dhruv
Assistant Professor & Guide,
Dept. of Food and Nutrition
Faculty of Family and Community Sciences
Maharaja Sayajirao University of Baroda,
Vadodara- 390002

Through,

Prof. Mini Sheth
I/c Head, Department of Foods and Nutrition
Faculty of Family and Community Sciences
Maharaja Sayajirao University of Baroda,
Vadodara- 390002

Prof. & Head
Dept. of Foods and Nutrition

Ok allowed to conduct research and study.

District Social Welfare Officer,
Biswanath
5/10/24

OFFICE OF THE DISTRICT SOCIAL WELFARE OFFICER
BISWANATH

ANNEXURE III

INFORMATION LETTER

I, Aditya Ranjan Goswami, a student of Sr. MSc. in Dept of Foods and Nutrition at The Maharaja Sayajirao University is carrying out research under the guidance of Dr. Swati Dhruv.

The proposed topic of my research is "Prevalence of Acute Malnutrition among 6-59 months old children residing in tea garden dominated areas of Biswanath District, Assam" This letter contains the information regarding the research.

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. Many children are lacking to meet their nutritional requirements and have compromised physical growth because of faulty dietary practices, inappropriate knowledge, dislikes for particular food etc.

With the help of an interview, I will ask you some questions, answers of which will be noted. The questions will be regarding socio-economic status, diet diversity, feeding practices, immunization and morbidity profile of the child. If you do not want to answer certain questions or do not want to disclose certain information, then you are free to omit them.

The information given by you will be confidential and used only for study purpose.

At the end of the research, the results will be shared with you. By taking part in this research, no remuneration will be provided to child, neither would it harm child.

We thank you for your willingness and participation in this research.

Investigators

Dr. Swati Dhruv
Guide
Department of Foods and Nutrition
Faculty of Family and Community Sciences
The Maharaja Sayajirao University of Baroda
Vadodara, Gujarat
Mobile No. 9898078988
E-mail id: swati.dhruv-fn@msybaroda.ac.in

Aditya Ranjan Goswami
Sr. M.Sc. Public Health Nutrition
Department of Foods and Nutrition
Faculty of Family and Community Sciences
The Maharaja Sayajirao University of Baroda
Vadodara, Gujarat
Mobile No. 8638463881
E-mail id: Ranjan.aditya.goswami@gmail.com

তথ্য পত্র

মই, আদিত্য ৰঞ্জন গোস্বামী, ছিনিয়ৰ এম এছ চিৰ ছাত্রয়ে খাদ্য আৰু পুষ্টি বিভাগ, মহাৰাজা সয়াজিৰাও বিশ্ববিদ্যালত ডঃ স্বাতী ধ্রুৰৰ নির্দেশনাত গৱেষণা চলাই আছো।

মোৰ গৱেষণাৰ প্রস্তাৱিত বিষয় হৈছে "অসমৰ বিশ্বনাথ জিলাৰ চাহ বাগিচা প্রধান অঞ্চলত বাস কৰা ০-৫ বছৰীয়া শিশুৰ মাজত তীব্র পুষ্টিহীনতাৰ প্রাদুর্ভাৱ" এই চিঠিখনত গৱেষণা সম্পর্কীয় তথ্য সন্নিবিষ্ট কৰা হৈছে।

পুষ্টিহীনতাই ব্যক্তিৰ শক্তি আৰু/বা পুষ্টিকৰ উপাদান গ্রহণৰ অভাৱ, অতিৰিক্ততা বা ভাৰসাম্যহীনতাক বুজায়। খাদ্যাভ্যাসৰ বিসংগতি, অনুপযুক্ত জ্ঞান, বিশেষ খাদ্যৰ প্রতি অপছন্দ আদিৰ বাবে বহু শিশুৱে নিজৰ পুষ্টিৰ প্রয়োজনীয়তা পূৰণৰ অভাৱত ভোগে আৰু শাৰীৰিক বৃদ্ধিত আপোচ কৰা দেখা যায়।

এটা সাক্ষাৎকাৰৰ সহায়ত মই আপোনালোকক কিছুমান প্রশ্ন সুধিম, যাৰ উত্তৰ লক্ষ্য কৰা হ'ব। প্রশ্নসমূহ হ'ব শিশুৰ আর্থ-সামাজিক অৱস্থা, খাদ্যৰ বৈচিত্র্য, খাদ্য খোৱাৰ পদ্ধতি, প্রতিষেধক আৰু ৰোগজনিত ৰোগৰ প্রফাইল সম্পর্কে। যদি আপুনি কিছুমান প্রশ্নৰ উত্তৰ দিব নিবিচাৰে বা কিছুমান তথ্য প্রকাশ কৰিব নিবিচাৰে, তেন্তে আপুনি সেইবোৰ বাদ দিবলৈ স্বাধীন।

আপুনি দিয়া তথ্যসমূহ গোপনীয় আৰু কেৱল অধ্যয়নৰ উদ্দেশ্যে ব্যৱহাৰ কৰা হ'ব।

এই গৱেষণাত অংশগ্রহণ কৰিলে শিশুক কোনো ধৰণৰ পাৰিশ্রমিক প্রদান কৰা নহ'ব, ইয়াৰ দ্বাৰা শিশুৰ কোনো ক্ষতিও নহ'ব।

এই গৱেষণাত আপোনালোকৰ ইচ্ছা আৰু অংশগ্রহণৰ বাবে আমি আপোনাক ধন্যবাদ জনাইছো।

দ্বাৰা,

আদিত্য ৰঞ্জন গোস্বামী (৮৬৩৮৪৬৩৮৮১)
(ছাত্র)
ডঃ স্বাতী ধ্রুৰ
(গাইড)
খাদ্য আৰু পুষ্টি বিভাগ,
মহাৰাজা সয়াজীৰাও বিশ্ববিদ্যালয় বৰোদা

CONSENT FORM

I am here by ready to allow participation in this research. I have understood that in this interview, I will be answering certain questions. I have read all the information regarding this research or the information has been read out to me. I have got an opportunity to ask questions regarding the same and I have got satisfactory answers to my questions.

Therefore, I willingly consent to participate.

NAME:_____

AGE: _____

MOBILE No.:_____ **DATE:** _____

সন্মতি পত্র

মই এই গৱেষণাত অংশগ্রহণ কৰিবলৈ সাজু হৈছো । মই বুজি পাইছো যে এই সাক্ষাৎকাৰত মই কিছুমান বিশেষ প্রশ্নৰ উত্তৰ দিম। এই গৱেষণা সম্পর্কীয় সকলো তথ্য পঢ়িছো বা তথ্য মোক পঢ়ি শুনাই দিয়া হৈছে। একেটা সন্দর্ভত প্রশ্ন কৰাৰ সুযোগ পাইছো আৰু মোৰ প্রশ্নৰ সন্তোষজনক উত্তৰ পাইছো।

নাম:_____

বয়স: _____

মোবাইল নং.:_____ তাৰিখ: _____

ANNEXURE IV

QUESTIONNAIRES

SCREENING FORM
Date: _____

CHILD NAME: _____

DATE OF BIRTH: _____ **GENDER:** _____

MEASURED

WEIGHT (kg): _____ HEIGHT (cm): _____

WHZ: _____ CLASSIFICATION: _____

EDEMA: Yes / No GRADE: _____

ANGANWARDI CENTRE NAME: _____

RECORDED

WEIGHT (kg): _____ HEIGHT (cm): _____

WHZ: _____ WAZ: _____ HAZ: _____

QUESTIONNAIRE: ASSOCIATED FACTORS

IDENTIFICATION
ANGANWARDI CENTRE NAME:
NAME OF INTERVIEWEE:
NAME OF THE HOUSEHOLD HEAD:
ADDRESS OF HOUSEHOLD:
CONTACT NUMBER:
CHILD'S NAME:

SOCIO-ECONOMIC STATUS

1. How old are you? _____
2. How many children do you have? _____
3. What is your religion?
   1. Hindu
   2. Muslim
   3. Sikh
   3. Christian
   4. Jain
   5. Others
4. What is the caste of the household?
   1. Scheduled cast
   2. Scheduled tribe
   3. Other backward class
   4. General
5. What is the type of family?
   1. Nuclear
   2. Joint
   3. Extended
6. Does your family own the house you live in?
   1. Yes
   2. No
7. What is your education level?
   1. Illiterate
   2. Primary School Certificate
   3. Middle School Certificate
   4. High School Certificate
   5. Intermediate or Diploma
   6. Graduate
   7. Profession or Honors
8. What is the educational level of the household head?
   1. Profession or Honors
   2. Graduate
   3. Intermediate or Diploma
   4. High School Certificate
   5. Middle School Certificate
   6. Primary School Certificate
   7. Illiterate
9. What is the occupation of the household head?
   1. Legislators, Senior Officials & Managers
   2. Professional
   3. Technicians and Associate Professionals

4. Clerks
5. Skilled Workers and Shop & Market Sales Workers
6. Skilled Agricultural & Fishery Workers
7. Craft & Related Trade worker
8. Plant & Machine Operators and Assemblers
9. Elementary Occupation
10. Unemployed

10. What is the total monthly income of the family?
    1. 2,13,814 and above
    2. 1,06,850-2,13,813
    3. 80,110-1,06,849
    4. 53,361-1,06,849
    5. 31,978-53,360
    6. 10-703-31,977
    7. ≤10,702

WATER, SANITATION AND HYGEINE

11. What is your source of drinking water?
    1. Piped water 2. Ground water
    3. Well water 4. Spring water
12. Do you do anything to the water to make it safer to drink?
    1. Yes 2. No 3. Don't know
13. What do you usually do to make the water safer to drink?
    1. Boil 2. Add bleach/chlorine 3. Strain through a cloth
    4. Use water filter 5. Solar disinfection 6. Let it stand and settle
14. What type of fuel do you use?
    1. Electricity 2. LPG/natural gas 3. Biogas
    4. Kerosene 5. Coal/lignite 6. Charcoal
    7. Wood
15. What type of toilet facility do you have?
    1. Home toilet 2. Community toilet 3. No facility
16. Do members of your household wash their hands with soap?
    1. Yes 2.No
17. When do they wash their hands?
    1. After toilet 2. Before cooking 3. Before eating
    4. After cleaning baby's backside 5. Before feeding baby
18. For how long do you store cooked complementary foods?
    1. Doesn't store 2. For 2 – 3 hours
    3. More than 4 hours 4. More than 1 day
19. When do you cut the vegetables?
    1. Before washing 2. After washing

CHILD PROFILE

20. What is the gender of the child?
    1. Male 2. Female
21. How old is (NAME)? _____
22. When was the child born? _____
23. What is the birth order of (NAME)? _____

SUPPLEMENTARY NUTRITION

24. Do you get SNP?
    1. Yes 2. No
    If no, why? _____
25. How often do you get SNP?
    1. Once a month 2. Twice a month 3. Thrice a month
26. How many packets are received in a month? _____
27. Do you receive it regularly?
    1. Yes 2. No
28. Does your child consume it regularly?
    1. Yes 2. No
29. How are the packets consumed?
    1. Solely by the child 2. Shared by the family members
    3. Shared by siblings 4. Others
30. Does your child like the taste?
    1. Yes 2. No
31. In which form do you get SNP_____
32. Do you find any benefit in your child consuming SNP?
    1. Yes 2. No

IMMUNIZATION

S/N	VACCINATION	YES/NO
34.	BCG	
35.	Hepatitis B	
36.	OPV-0	
37.	OPV 1, 2, & 3	
38.	DPT 1, 2, & 3	
39.	Hep B 1, 2, & 3	
40.	Measles 1st dose	
41.	Vitamin A (1st dose)	
42.	DPT booster	
43.	Measles 2nd dose	
44.	OPV booster	
45.	Vitamin A (2nd to 9th dose)	
45 a.	Number of Vitamin A doses recorded	

MORBIDITY PROFILE

S/N	ILLNESS/DISEASE	PRESENCE IN THE LAST 15 DAYS (Y/N)
46.	Fever	
47.	Diarrhoea	
48.	Acute Respiratory Infection (ARI)	
49.	Measles	
50.	Malaria	

IYCF PRACTICES & DIETARY DIVERSITY

If child is between 0-35 months use the table questions below. If between 36-59 months, use the later table of questions.

S/N	QUESTION	YES or NO	DON'T KNOW (DK)
51.	Was (NAME) ever breastfed?		
52.	How long after birth was (NAME) first put to the breast?		
	If immediately, indicate "000"		
	If less than one hour, record "00" hours		
	If less than 24 hours, record hours		
	Otherwise, record days		
53.	In the first 2 days after delivery, was (NAME) given anything other than breast milk to eat or drink – anything at all like water, infant formula, condensed milk, cinnamon water, or sugar water?		
54.	Was (NAME) breastfed yesterday during the day or at night?		
55.	Did (NAME) drink anything from a bottle with a nipple yesterday during the day or at night?		
Now I would like to ask you about liquids that [NAME] may have had yesterday during the day or at night. Please tell me about all drinks, whether [NAME] had them at home, or somewhere else. *Yesterday during the day or at night, did [NAME] have...*			
56.	Plain water?		
57.	Infant formula or baby milk such as Amul, Lactogen, or Dexolac?		
45a.	IF YES: How many times did (NAME) drink infant formula? (IF 7 OR MORE TIMES, RECORD '7').		
58.	Milk from animals, including fresh, packaged or powdered?		

IYCF PRACTICES & DIETARY DIVERSITY

If child is between 0-35 months use the table questions below. If between 36-59 months, use the later table of questions.

0-35 months

S/N	QUESTION	Yes or No	Don't know (DK)
51.	Was (NAME) ever breastfed?		
52.	How long after birth was (NAME) first put to the breast?		
	If immediately, indicate "000"		
	If less than one hour, record "00" hours		
	If less than 24 hours, record hours		
	Otherwise, record days		
53.	In the first 2 days after delivery, was (NAME) given anything other than breastmilk to eat or drink – anything at all like water, infant formula, condensed milk, cinnamon water, or sugar water?		
54.	Was (NAME) breastfed yesterday during the day or at night?		
55.	Did (NAME) drink anything from a bottle with a nipple yesterday during the day or at night?		
Now I would like to ask you about liquids that [NAME] may have had yesterday during the day or at night. Please tell me about all drinks, whether [NAME] had them at home, or somewhere else. *Yesterday during the day or at night, did [NAME] have...*			
56.	Plain water?		
57.	Infant formula or baby milk such as Amul, Lactogen, or Dexolac?		
45a.	IF YES: How many times did (NAME) drink infant formula? (IF 7 OR MORE TIMES, RECORD '7').		
58.	Milk from animals, including fresh, packaged or powdered?		
46a.	IF YES: How many times did (NAME) drink milk? (IF 7 OR MORE TIMES, RECORD '7').		
46b.	IF YES: Was any of the milk a sweet or flavored type of milk?		
59.	Bournvita, Horlicks, or Boost?		

60.	Fruit juice, packet juice such as Rasna or Frooti, sugarcane juice, or nannari sarbath?		
61.	Soft drinks such as Sprite, Pepsi, Mirinda, or energy drinks?		
62.	Tea, coffee, or herbal drinks?		
51a.	IF YES: was the drink sweetened?		
63.	Clear broth or clear soup?		
64.	Any other liquids?		
52a.	IF YES: What was the liquid or what were the liquids?		
52b.	IF YES: Was the drink sweetened?		
Now I would like to ask you about foods that [NAME] had yesterday during the day or at night. I am interested in foods your child ate whether at home or somewhere else. Please think about snacks and small meals as well as main meals. 0 *I will ask you about different types of foods, and I would like to know whether your child ate the food even if it was combined with other foods. Please do not answer 'yes' for any food or ingredient used in a small amount to add flavor to a dish.* Yesterday during the day or at night, did [NAME] eat:			
65.	Curd, lassi, buttermilk, or raita?		
53a.	IF YES: How many times did (NAME) have curd, lassi, buttermilk, or raita?		
53b.	IF YES: Did (NAME) have any lassi or buttermilk to drink?		
53c.	IF YES: Was it a sweet type of drink? YES or NO DK		
	Yesterday, did (NAME) eat any of the following foods:		
66.	Rice, idli, dosa, poha, naan, kulcha, paratha, upma, Cerelac, or Farex?		
67.	Chapati, roti, dalia, roasted maize?		
68.	Pearl millet, finger millet, or ragi malt?		
69.	Potato, sweet potato, turnip, arum root, tapioca, or raw banana?		
70.	Daal, sambar, chickpeas, kidney beans, soya, or khichdi?		
	Yesterday, did (NAME) eat any of the following vegetables:		
71.	Carrots, or pumpkin that is orange inside?		
72.	Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens?		
73.	Tomatoes, eggplant, okra/lady finger, French beans, cauliflower, cabbage, or beetroot?		
74.	Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd?		
75.	Cucumber, radish, capsicum, German turnip, or drumstick?		

	Yesterday, did (NAME) eat any of the following fruits:		
76.	Ripe papaya, ripe mango, orange musk melon, or apricots?		
77.	Orange, tangerine, or grapefruit?		
78.	Ripe banana, apple, pear, watermelon, guava, custard apple, pomegranate, or pineapple?		
79.	Grapes, kiwi, peaches, jackfruit, chickoo, jamun, palmyra palm fruit, or other wild fruits?		
	Yesterday, did (NAME) eat any of the following sweets:		
80.	Cakes, cream biscuits, biscuits, suji halwa / kesari bath, jalebi, or ladoo?		
81.	Other mithai, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates?		
	Yesterday, did (NAME) eat any of the following foods of animal origin:		
82.	Eggs?		
83.	Paneer or cheese?		
84.	Liver or kidney?		
85.	Sausages or salami?		
86.	Mutton, beef, or lamb?		
87.	Pork or wild meat?		
88.	Chicken, duck, or turkey?		
89.	Fish, prawn, crab, or seafood?		
90.	Termites, ants, or locusts?		
	Yesterday, did (NAME) eat any of the following other foods:		
91.	Peanuts, cashews, almonds, pistachios, walnuts, pumpkin seeds, or sunflower seeds?		
92.	Potato chips, namkeen or mixture?		
93.	Instant noodles such as Maggi noodles or Wai Wai?		
94.	Samosa, pakora, puri, vada, mathri, kachori, murukku, or bonda?		
95.	Any other solid, semi-solid, or soft food?		
83a.	IF YES: What was the food?		
	Yesterday, did (NAME) eat food from any place like...		
96.	McDonald's, KFC, Pizza Hut, Domino's, Burger King, or other places that serve pizza or burgers?		
	Note for interviewer: *If not a single "yes" for foods is recorded, ask 85. If at least one "yes" for foods, skip to 86.*		
97.	Did (NAME) eat any solid, semi-solid, or soft food yesterday during the day or night?		

98.	How many times did [NAME] eat any solid, semi-solid or soft foods yesterday during the day or night? *If 7 or more times, record "7"*		

36-59 months

S/N.	QUESTION	YES / NO	DON'T KNOW (DK)
99.	Was (NAME) ever breastfed?		
100.	How long after birth was (NAME) first put to the breast?		
	If immediately, indicate "000"		
	If less than one hour, record "00" hours		
	If less than 24 hours, record hours		
	Otherwise, record days		
101.	In the first 2 days after delivery, was (NAME) given anything other than breastmilk to eat or drink – anything at all like water, infant formula, condensed milk, cinnamon water, or sugar water?		

No.	Question	YES or NO
Now I'd like to ask you some yes-or-no questions about foods and drinks that (NAME) consumed yesterday during the day or night, whether he/she had it at home or somewhere else. *First, I would like you to think about yesterday, from the time (NAME) woke up through the night. Think to yourself about the first thing they ate or drank after they woke up in the morning … Think about where they were when they had any food or drink in the middle of the day … Think about where they were when they had any evening meal … and any food or drink they may have had in the evening or late-night... and any other snacks or drinks they may have had between meals throughout the day or night.* *I am interested in whether they had the food items I will mention even if they were combined with other foods.* Please listen to the list of foods and drinks, and if they ate or drank ANY ONE OF THEM, say yes.		
	Yesterday, did (NAME) eat any of the following foods:	
102.	Rice, idli, dosa, poha, naan, kulcha, paratha, or upma?	
103.	Chapati, roti, dalia, or roasted maize?	

104.	Pearl millet or finger millet?	
105.	Potato, sweet potato, turnip, arum root, tapioca, or raw banana?	
106.	Daal, sambar, chickpeas, kidney beans, soya, or khichdi	
	Yesterday, did (NAME) eat any of the following vegetables:	
107.	Carrots, or pumpkin that is orange inside?	
108.	Mustard leaves, spinach, radish leaves, cassava leaves, taro leaves, drumstick leaves, amaranth leaves, or wild greens/other greens?	
109.	Tomatoes, eggplant, okra/lady finger, French beans, cauliflower, cabbage, or beetroot?	
110.	Bitter gourd, bottle gourd, pointed gourd, ivy gourd, apple gourd, ridged gourd, or snake gourd?	
111.	Cucumber, radish, capsicum, German turnip, or drumstick?	
	Yesterday, did (NAME) eat any of the following fruits:	
112.	Papaya, mango, orange musk melon, or apricots?	
113.	Orange, tangerine, or grapefruit?	
114.	Ripe banana, apple, pear, watermelon, guava, custard apple, pomegranate, or pineapple?	
115.	Grapes, kiwi, peaches, jackfruit, chickoo, jamun, palmyra palm fruit, or other wild fruits?	
	Yesterday, did (NAME) eat any of the following sweets:	
116.	Cakes, cream biscuits, biscuits, suji halwa / kesari bath, jalebi, or ladoo?	
117.	Other mithai, rice pudding, kulfi, ice cream, milkshake, toffees, or chocolates?	
	Yesterday, did (NAME) eat any of the following foods of animal origin:	
118.	Eggs?	
119.	Paneer or cheese?	
120.	Curd, lassi, buttermilk, or raita?	
121.	Sausages or salami?	
122.	Mutton, beef, lamb, or liver?	
123.	Pork or wild meat?	
124.	Chicken, duck, or turkey?	
125.	Fish, prawn, crab, or seafood?	
	Yesterday, did (NAME) eat any of the following other foods:	
126.	Peanuts, cashews, almonds, pistachios, walnuts, pumpkin seeds, or sunflower seeds	
127.	Potato chips, namkeen or mixture?	

128.	Instant noodles such as Maggi noodles or Wai Wai?	
129.	Samosa, pakora, puri, vada, mathri, kachori, murukku, or bonda?	
	Yesterday, did (NAME) have any of the following beverages:	
130.	Milk, flavored milk, chai with milk, or coffee with milk?	
131.	Tea with sugar, coffee with sugar, milk with sugar, flavored milk, Bournvita, Horlicks, or Boost?	
132.	Fruit juice, packet juice such as Rasna or Frooti, sugarcane juice, or nannari sarbath?	
133.	Soft drinks such as Sprite, Pepsi, Mirinda, or energy drinks?	
	Yesterday, did (NAME) get food from any place like...	
134.	McDonald's, KFC, Pizza Hut, Domino's, Burger King, or other places that serve pizza or burgers?	