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Comparison of Child Underweight and Associated Factors Among Transformed and Non-Transformed Woredas in, East Gojjam Zone, North West Ethiopia, 2022 A Comparative Cross-Sectional Study

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BAHIR DAR UNIVERSITY
COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF Nutrition and Dietetics

**Comparison of Child Underweight and it's Associated Factors Among
Transformed and Non-Transformed Woredas in, East Gojjam Zone, North
West Ethiopia, 2022**

A Comparative Cross-Sectional Study

By: Kassahun Bishaw (Bsc NURSE)

A THESIS SUBMITTED TO DEPARTMENT OF NUTRITION AND DIETETICS,
SCHOOL OF PUBLIC HEALTH, COLLEGE OF MEDICINE AND HEALTH
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THE REQUIREMENTS OF MASTER OF PUBLIC HEALTH IN NUTRITION.

AUGUST, 2022

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BAHIR DAR UNIVERSITY
COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH

FULL TITLE OF THE THESIS COMPARISON OF CHILD UNDERWEIGHT AND IT'S ASSOCIATED FACTORS AMONG TRANSFORMED AND NON-TRANSFORMED WOREDAS IN, EAST GOJJAM ZONE, NORTH WEST ETHIOPIA, 2022

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Annex IV: Candidate Declaration Form

This is to certify that the thesis entitled “comparison of child underweight and its associated factors among transformed and non-transformed woredas in, East Gojjam Zone, North West Ethiopia, 2022” submitted in partial fulfillment of the requirements for the degree of master of public health in Nutrition, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institutions to get any other degree or certificates. The assistance and helped I received during the course of this investigation have been duly acknowledged.

Name of the candidate Kassahun Bishaw (BSc Nurse)

Signature -----

Date -----

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Approval of Thesis for defense

I hereby certify that I have supervised, read and evaluated this titled “comparison of child underweight and its associated factors among transformed and non-transformed woredas in, East Gojjam Zone, North West Ethiopia, 2022” by Kassahun Bishaw prepared under my guidance. I recommended the thesis be submitted for final defense.

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Approval of Thesis for defense Result

As members of the board of examiners we examined this thesis entitled “comparison of child underweight and its associated factors among transformed and non-transformed woredas in, East Gojjam Zone, North West Ethiopia, 2022” by Kassahun Bishaw we here by certify that the thesis is accepted for fulfilling the requirements for the award of the degree of “master in public Health Nutrition”

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Approval of Thesis for defense Result

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Table of Contents

| | |
|--|-----------|
| ACKNOWLEDGEMENT | viii |
| LIST OF TABLES | xi |
| LIST OF FIGURES | xii |
| ACRONYM/ABBREVIATIONS..... | xiii |
| ABSTRACT | xiv |
| 1. INTRODUCTION..... | 1 |
| 1.1. Background..... | 1 |
| 1.2. Statement of the Problem | 3 |
| 1.3. Significance of the study | 5 |
| 2. LITERATURE REVIEW..... | 6 |
| 2.1. Prevalence of underweight | 6 |
| 2.2. Factors Associated With Underweight..... | 7 |
| 2.2.1. Demographic and Socio- Economic Factors | 7 |
| 2.2.2. Environmental factors | 8 |
| 2.2.3. Child care and feeding practice | 9 |
| 2.2.4. Maternal health service related characteristics..... | 10 |
| 2.3. Conceptual frame work | 12 |
| 3. OBJECTIVES | 13 |
| 3.1. General Objective | 13 |
| 3.2. Specific Objectives | 13 |
| 4. METHODS | 14 |
| 4.1. Study Area | 14 |
| 4.2. Study Design and Period | 15 |
| 4.3. Populations | 15 |
| 4.3.1. Source Population | 15 |
| 4.3.2. Study Population | 15 |
| 4.3.3. Study unit..... | 15 |
| 4.4. Eligible criteria..... | 15 |
| 4.4.1. Inclusion Criteria | 15 |
| 4.4.2. Exclusion Criteria | 15 |
| 4.5. Sample size determination..... | 15 |
| 4.6. Sampling procedure..... | 16 |

| | |
|--|-----------|
| 4.7. Study Variables | 18 |
| 4.7.1. Dependent variable | 18 |
| 4.7.2. Independent variables..... | 18 |
| 4.8. Operational Definitions | 19 |
| 4.9. Data Collection Instruments and Procedure | 20 |
| 4.10. Data Quality Control Measures..... | 21 |
| 4.11. Data processing and data analysis | 22 |
| 4.12. Ethical clearance | 23 |
| 5. RESULTS | 24 |
| 5.1. Demographic and socio-economic characteristics..... | 24 |
| 5.2. Environmental characteristics | 26 |
| 5.3. Child care and feeding practice | 28 |
| 5.4. Maternal health service related characteristics..... | 30 |
| 5.5. Prevalence of underweight | 32 |
| 5.6. Comparison of groups | 33 |
| 5.7. Factors associated with underweight among 6-59 months of age children in pooled analysis..... | 33 |
| 6. DISCUSSION | 36 |
| 7. LIMITATIONS OF THE STUDY..... | 39 |
| 8. CONCLUSION..... | 40 |
| 9. RECOMMENDATIONS | 41 |
| 10. REFERENCE | 42 |
| 11. ANNEXES | 47 |
| Annex-I. Information Sheet and Consent Form..... | 47 |
| Annex II English Questionnaires..... | 48 |
| Annex-III Amharic Version Information sheet and Consent form..... | 56 |
| Annex IV. Amharic Questionnaires (የአሜሪካ ምርመራ) | 57 |

LIST OF TABLES

| | |
|---|----|
| Table 1: Socio-demographic characteristics of under-five children in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022..... | 25 |
| Table 2: Environmental characteristics of the respondents in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022..... | 27 |
| Table 3: Child care and feeding practices of the respondents in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022..... | 29 |
| Table 4: Maternal health service related characteristics in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022 | 31 |
| Table 5: Factors associated with underweight among 6-59 months of age children in pooled analysis of non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022..... | 35 |

LIST OF FIGURES

| | |
|--|----|
| Figure 1: Conceptual Framework for comparison of underweight and its associated factors among Children 6-59 months of age in Transformed and non-transformed woredas in East Gojjam Zone, North west Ethiopia, 2022..... | 12 |
| Figure 2: Diagrammatic presentations of the sampling procedure | 17 |
| Figure 3: Prevalence of underweight among 6-59 months children in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022..... | 32 |

ACRONYM/ABBREVIATIONS

| | |
|--------|---|
| ANC | Antenatal Care |
| AOR | Adjusted Odd Ratio |
| EBF | Exclusive Breast Feeding |
| CBHI | Community Based Health Insurance |
| CHIS | Community Health Information System |
| CI | Confidence Interval |
| COR | Crude Odd Ratio |
| DDS | Dietary Diversity Score |
| EDHS | Ethiopian Demographic Health Survey |
| EPI | Expanded Program of Immunization |
| HFIA | Household Food Insecurity Access Scale |
| HHFS | Household Food Security |
| HSTP | Health Sector Transformation Plan |
| MOH | Ministry Of Health |
| SPSS | Statistical Package for Social Science |
| SD | Standard Deviation |
| SDG | Sustainable Development Goal |
| SSA | Sub-Saharan Africa |
| UNICEF | United Nation International Children’s Emergency Fund |
| WAZ | Weight for Age Z score |
| WHO | World Health Organization |

ABSTRACT

Background: Underweight continues as a major public health problem in Ethiopia and it increases the risk of infections, morbidity, mortality and impairing mental and cognitive development. There is paucity of evidence on underweight in transformed and non-transformed woredas in Ethiopia.

Objective: Compare child underweight and its associated factors among transformed and non-transformed woredas in East Gojjam zone, Northwest Ethiopia, 2022.

Methods: A community based comparative cross-sectional study was conducted among 627 children aged between 6-59 months (314 from non-transformed and 313 from transformed woredas) in East Gojjam zone from May 18 to June 18, 2022. Stratified random sampling was used to reach study participants. Pretested and structured questionnaire was used to collect data. The WHO Anthro software was used to convert raw anthropometric data into Z-scores. Bivariable and multivariable logistic regression analysis were done. A p-value less than 0.05 were considered to declare as statistically significant.

Results: - The prevalence of underweight among children in non-transformed and transformed woredas were 27.7% and 17.8 % respectively. Whereas, the overall prevalence of children underweight was 22.7 % (95% CI (19.0, 26.0 %)). History of diarrhea in the past two weeks [AOR 2.49 (1.56, 3.98)], food insecurity [AOR 2.67 (1.60, 4.46)], household low monthly income [AOR 3.77(2.34, 6.08)], food distributed priority to other family members [AOR 1.64 (1.02, 2.65)] and unprotected drinking water source [AOR 1.82 (1.10, 2.99)] were the factors significantly associated with underweight.

Conclusion and Recommendation: -The overall prevalence of underweight among 6-59 months of age children were 22.7 %. Factors associated with underweight were unprotected drinking water source, food distributed priority to other family members, household low monthly income, food insecurity and history of diarrhea in the past two weeks prior to data collection. Therefore, improving safe water supply, hygiene and sanitation, knowledge of mothers on child feeding, and ensure food security is recommended.

Keywords: Underweight, Under-five children, Transformed woreda, Non-transformed woredas, Ethiopia

1. INTRODUCTION

1.1. Background

Underweight is a composite measure of stunting and wasting. Children whose weight for age Z-score is below minus two standard deviations (-2 SD) from the median of the World Health Organization (WHO) reference population are considered underweight. Children who are below minus three standard deviations (-3 SD) are considered severely underweight. Underweight is recognized as the indicator for monitoring changes in the extent of malnutrition over time(1). Underweight is a significant indicator of health and nutritional status in the population(2).

Underweight does not differentiate between acute malnutrition and chronic malnutrition. Children's are underweight for their age the children's also wasted, stunted, or both. Underweight is an overall indicator of a population's nutritional health(3). Underweight reflects current undernutrition status and can be acute, chronic or both. It can manifest alone or in combination with other forms of under nutrition in under five children(4).

The most vulnerable age group for underweight is children under the age of 6-59 months, and nutritional status during childhood is a sensitive indicator of community health(5). The essential period for rapid physical growth and overall child development is when children are under the age of 59 months. If a child's nutritional needs are not met, he or she will suffer from various forms of undernutrition like underweight, wasting and stunting(6).

Ministry of Health (MOH)-Ethiopia set ambitious goals in the Health Sector Transformation Plan (HSTP) I and II with four transformation agendas; 1) Woreda Transformation, 2) Health Service Quality and Equity, 3) Information Revolution, 4) Caring, Respectful and Compassionate health workforce. The Woreda transformation agenda serves as a vehicle to achieve accessibility, quality, and equity in primary health care services; to increase community ownership, and to create irreversible Woreda health system(7).

The woreda transformation has four components; 1) Creating Model Kebele, 2) Financial protection through Community Based Health Insurance (CBHI) ,3) creating high performing Primary Health Care Unit ,4) Woreda Management Standards. Woreda transformation aims to create high performing Woredas that fulfill the vision of the health sector and meet the demands of the community they serve (8).

The woreda is called transformed when the activities like environmental sanitation and hygiene, improved latrine coverage and water with soap hand washing facility, open defecation free,

skilled delivery, CBHI, maternal and child health improvement, reduction of undernutrition, decrease communicable disease and non-communicable disease and creating model schools become achieved above 85%. Whereas, the woreda said non-transformed when, the achievement of those activities become under or less than the standard of 85% performance(7).

According to 2020/2021 MOH annual report, 57 woredas were transformed in Ethiopia. From 57 transformed woredas, 22 woredas were from Amhara national regional state. From 22 Amhara national regional state transformed woredas, 3 woredas were found in East Gojjam zone administration and the verification was carried out by the Zonal health department, Regional health bureau and MOH-Ethiopia(9).

Prevention of underweight is fully incorporated into the woreda transformation activity, such as monthly growth monitoring promotion, promote exclusive breast feeding, improving maternal and child health activities, Water, sanitation and hygiene activities, households enrolled in CBHI, controlling communicable diseases and strength multisectoral collaboration(10).

1.2.Statement of the Problem

According to the WHO, there are 178 million malnourished children worldwide, 20 million of whom are suffering from the most severe form of malnutrition, and underweight is the single largest risk factor contributing to the global burden of disease in developing countries(11, 12).

Globally underweight decrease from 105.7 million in 2010 to 85.4 million in 2020, decreased by 20.3 million but still underweight increase the risk of infections, morbidity and mortality as well as impairing mental and cognitive development(13, 14). Underweight continues to be a serious public health problem around the world, with about 45% of under-five age children deaths from it in low and middle income countries (15).

Underweight is a leading cause of child mortality around the world. Underweight children have low immunity to infections and a higher risk of dying from communicable diseases, while those who survive are exposed to recurring illnesses and have poor growth. These children are more likely to have a lower intelligence quotient which affects academic success(16).

Underweight is a worldwide problem, but their severity varies from country to country. It continues as a major public health problem in developing countries. It is the risk factor of the greatest loss of disability-adjusted life years(17).

Globally around 85.4 million children were underweight, with the majority of these living in Sub-Saharan Africa (SSA) and South Asia and underweight is still one of the leading causes of morbidity and mortality among children in these region countries (18, 19).In developing countries, malnutrition is one of the primary causes of morbidity and mortality among children under the age of five and every year, 3.5 million children die as a result of malnutrition, from this underweight accounts for nearly 1 million(20).

SSA countries account 25% underweight in under five children. This findings show that underweight remains unacceptably high in SSA despite the global progress in reduction of underweightand is far from being eradicated(21).

Many study results showedthat different factors associated with underweight in 6-59 months of age children. These include:inadequate food intake, childhood illnesses, low parental education, lack of protected drinking water, sanitation and hygiene , poor feeding practices, Antenatal Care(ANC) follow up, residence, child caring practices, economic, social, and cultural factors(22-24).Furthermore, low dietary diversity food intake, poor access to food, unequal food distribution within household, improper food handling and preparation and food taboos are also factors

associated with the occurrence of underweight among under-five children(25, 26).According to the 2019 mini Ethiopian Demographic Health Survey (EDHS) data, the prevalence of underweight in children were 21 percent in Ethiopia and in Amhara region the prevalence of underweight in children 26.7 percent. Underweight is serious public health problem in Ethiopia and in Amhara region, according to the WHO underweight public health problem classification(3).Ethiopia has significant progress in decreasing the mortality rate among children under the age of five. On the other hand, underweight among children is currently a major public health issue in the country (27).

MOH-Ethiopia set ambitious goals in the HSTP two with four transformation agendas developMultisectoral Woreda Transformation to coordinate and support woreda transformation and improve nutritional status of under five children. Moreover, efforts to enhance good nutritional practices, expand health institutions, provide nutrition counseling, food focusing on appropriate child feeding, monthly growth monitoring, Improve hygiene and sanitation and communicable disease prevention have been made. Despite, those interventions and innovations undertaken regarding childhood underweightbut underweight is still a problem and nearly one-third of the under-weight children are found in the Amhara Region, Northwest Ethiopia.

Therefore this study was derive because of the following three main reasons. First, Even in the study done in Ethiopia , did not well addressed all factors related to underweight like CBHI, monthly growth monitoring promotion program, household food security status and dietary diversity score so in my study address those factors. Second,woreda transformation is current applying MOH program, now want to see if woreda transformation activities are effective in reducing underweight in under five year children or not. Third, the prevalence of the underweight and associated factors was not assessed in transformed and non-transformed Woredas at East Gojjam Zone. Therefore, this study was conduct to comparison of child underweight and its associated factors among transformed and non-transformed woredas in, East Gojjam Zone, North West Ethiopia.

1.3. Significance of the study

The result of this study will provide information on the prevalence of underweight and associated factors among 6-59 months of age children in non-transformed and transformed woredas which is primarily important for the woreda health office for evaluating levels of children nutritional status in the woreda and knowing how much improved child underweight status by implementing woreda transformation activities and give data based mentorships and training for health extension workers and other health professionals.

The finding of the study will be used as a source of evidence for zonal and regional health bureau to monitor and revise strategies and activities of creating transformed woredas. Identification of determinants of children underweight from non-transformed and transformed woredas will be used to develop multi-sectoral collaboration to improve children nutritional status.

The result will also help non-governmental organizations working related to the child nutritional issue in the study area to understand the level and factors associated with children underweight to support woreda transformation program and develop intervention strategies regarding to non-transformed and transformed woredas children nutritional problems.

The finding of this study will also help policy makers at national and regional levels. This, in turn, will improve the overall community nutritional status of the study area. In addition, the information generated from this study will help other researchers to conduct a similar study in different areas of the country.

2. LITERATURE REVIEW

2.1. Prevalence of underweight

According to a WHO report in 2020, there were 85.4 million underweight children around the world from this Asia account for 49% and Africa contain 31%(13).

According to study conducted in Myanmar the prevalence of underweight in under five children was 19.2% (28). A community based cross sectional study conducted in Pakistan showed that the prevalence of moderate underweight children was 33.3% and severe underweight was 11.3% (29). And in India 23.8% under five children's were affected by underweight (30). Another community based cross sectional study which was conducted in Bangladesh prevalence of underweight among children under five years old in 2017 was 33% (31). A community based cross sectional study done in Eastern Nepal the prevalence of children underweight was 37% (32).

According to a survey conducted in low- and middle-income countries, 13.7% of children under the age of five were underweight. The prevalence in Africa and Asia was twice that of the Americas, four times that of Oceania, and more than ten times that of Europe. All SSA countries have a relatively high prevalence of underweight, all countries having a prevalence of greater than 30%. On the contrary, the prevalence of underweight was significantly lower in Latin America and the Caribbean than the rest of the world (33).

Another study conducted SSA countries indicated that the prevalence of underweight was 21% (34). Similar study done in developing countries also showed that the prevalence of underweight was 42.08 % (35). According to Study conducted in Ghana the prevalence of underweight in under five children was 10.4% (36). A population based cross sectional study conducted in Tanzania 28% of children was underweight(37). Another study done in Nigeria showed that the prevalence of underweight was 29% from under five children (38). Similar study conducted in South Sudan 4.8% under five children were underweight(39). Studies done in Kenya showed that the prevalence of underweight in under two year children was 10% and in Cameroon among under five children 5.2% was underweight(40, 41). Another population based cross sectional study conducted in Bussi Islands of Wakiso District, Uganda showed that the prevalence of underweight was 16.1% (42).

A cross-sectional survey conducted in Ethiopia showed that the prevalence moderate underweight was 17.1% and severe underweight was 8.1%, it indicates prevalence varies from region to region. The highest percentage of severely underweight was observed in Afar (17.02%) and moderately underweight in Benishangul Gumiz (22.37%). Whereas, the smallest percentage of severely underweight (0.25%) and moderately underweight (4.23%) was observed in Addis

Ababa(22).According to Mini EDHS 2019 report showed that the prevalence of underweight was identified 21% in Ethiopia(3).

According to studyconducted in Tigray region, Northern Ethiopia ,showed that the prevalence of underweight was 14.2%(43).And also another study conducted in Tigray region, showed that the prevalence of underweight was 23.9% (43) and study done in wonsho woreda, showed that the prevalence of underweight was 20.5%(44), Another study done inWolaita Sodo town, southern Ethiopiashowed that the prevalence of underweight was 24.6% from this moderate underweight was 19.6% and 5% was severe underweight(45).On the other handStudy which was conducted in Sodo Zuria District, South Ethiopia,indicated that the prevalence of underweight was 14% and severe underweight was 3%(46).

According to Mini EDHS 2019 report,showed that the prevalence of underweight in Amhara National Region Statewas identified as 26.7% in children under five(3).

Study done in Amhara region showed that the prevalence underweight was 28.4 %. From this 23.1 % of children were both stunting and underweight, 7.3 % were both underweight and wasting and 4.5 % of children had all three conditions (47).According to study conducted in Amhara regional state in Debretabor Town, North west Ethiopia conducted in children age between 6-59 months showed that the prevalence of underweight was 17.4% (23). Another study conducted in Takusa woreda , Northwest Ethiopia children aged between 6- 59 months showed that the prevalence of underweightwas 19.5(5). A comparative cross sectional study conducted in Gozamin woredaindicated that the prevalence of underweight in model households were 15.3% and 24.3% in non-model households(24). The study conducted in Angolalla Tera district, Northeast Ethiopia among414 mothers with child pairs the result showed that the prevalence of underweight were 15.9% (48).A community based cross sectional study conducted in Lalibela town showed that the prevalence of underweight in 6-59 months of age children was 25.6 % (49).

A comparative cross sectional study conducted in food secure and food insecure households in Sekela woreda indicated that the prevalence of underweight in food insecure households were 22.6 % and 11.8 % in food secure households (50).

2.2. FactorsAssociated With Underweight

2.2.1.Demographic and Socio- Economic Factors

A community based cross sectional study conducted in India rural area of Puducherry indicated that the age of the child, sex and household monthly income were significant factors for underweight(30).A systematic review conducted in developing countries in 2021 on child underweight whose mother's education as significant factor for underweight (35).

A population based cross sectional study conducted in Bussi Islands of Wakiso District, Uganda indicated that child age and family size were factors associated with underweight(42).A study conducted in sub-Saharan Africa showed that the sex of child,mother educational status, monthly income and residence were factors significantly associated with underweight(34).A study conducted in Nigeria showed that residence and educational status of parents were factors significantly associated with underweight and severely underweight (38).Another study conducted in Ethiopia at Afar region showed that age of childand illiterate mothers were significantly associated with the occurrence of childhood underweight(51).

A study in Oromia region in Burayu town showed that sex of child was factor significantly associated with underweight (12). Another study conducted in Sodo Zuria District, South Ethiopia showed that Children with illiterate fathers and sex of child were factorssignificantly associated with underweight(46).A study conducted in Debre tabor town Amhara region of Ethiopia showed thatfathers education level, parents who have poor wealth and sex of children were significantly associated factors with underweight (23).

Study conducted in Angolalla Tera district, Northeast Ethiopia showed that sex of child and monthly family income were significantly associated with underweight(48).Another study conducted in Afar region showed that parent education status was factor significantly associated with underweight(51).

A cross sectional surveydone in Amhara region showed that Age of child, Sex of child, residence, mother educational status and monthly income were significantly associated factors with underweight(47).

A comparative cross-sectional study conducted in Sekela District, Western Ethiopia showed that household food insecurity was significant associated factor with child underweight (50). Another study conducted in East Badawacho District, South Ethiopia showed that household food insecurity was significant associated factors with children underweight(52).

2.2.2. Environmental factors

Study done in low and middle income countries showed improved child faeces disposal was factor associated with reductions in underweight (53). AnotherStudy conducted in Indonesia showed that lack of latrine availability in the household significantly contributed factor to underweight in children (54).

A study conducted in Tanzania showed that use of surface water was factor significantly associated with underweight(55). Another study done in Berahle in Afar region, Ethiopia, showed that

unprotected source of drinking water was determinant factors of underweight(51).A study which was conducted in Burayu town, Oromia, Ethiopia showed that use of untreated drinking water was factor significantly associated with underweight(12).Study conducted in Sodo Zuria District, South Ethiopia showed that use of untreated drinking water source was factor significantly associated with underweight(46).

A comparative cross sectional study conducted in Gozamin woreda Showedthat in model households the unprotected source of drinking water wasfactors significantly associated with underweight and in non-model households, unprotected source of drinking water wasfactor significantly associated with underweight (24).

2.2.3. Child care and feeding practice

A community based cross sectional study conducted in India rural area of Puducherry indicated that duration of exclusive breast feeds, birth order, and birth weight were significant factors for underweight (30). A study conducted in Nepal showed that children who were not participate in monthly growth monitoring program was significant factor associated with underweight (32).

A community based cross sectional study conducted in Nigeria show that Children who were breastfed for a long time (>12 months) was factor significantly associated with underweight and severely underweight(38).Another study showed children who were feed unboiled cow's milk was factor significantly associated with underweightaccording to a Tanzanian study (55). A study conducted in sub-Saharan Africa showed that weight of birth wasfactor significantly associated with underweight (34).

Another study conducted in central, eastern and southern parts of Ethiopia states that traditional beliefs such as children couldn't digest meat, colostrum and thick porridges, and fruits and vegetables are excluded to eat lactating women and their children werefactors significantly associated with underweight(26).

A study conducted in Ethiopia in Afar region showed that low dietary diversity scorewas significantly associated with the occurrence of childhood underweight(51). A study conducted in Ethiopia indicated that duration of breastfeedingwas factor significantly associated with underweight (22).

A community based cross sectional study conducted in Amhara region in Takusa woreda indicated that breast-feeding during crying, child complementary feeding, and breast-feeding

frequency were factors significantly associated with underweight(5). Another population based cross sectional study conducted in Wonsho woreda, Sidama Zone, southern Ethiopia among under five children showed that immunization status of child was factors significantly associated with underweight (44).

A study conducted in Ethiopia showed that birth weight was factor significantly associated with underweight(22).A cross sectional survey done in Amhara region showed that birth weight was significantly associated factor with underweight(47).

Study conducted in Nigeria indicated that children who had diarrhoea and fever in the past two weeks prior to study were factorsignificantly associated with underweight(38). Children who had diarrhea in the previous two weeks prior to data collection was factor significantly associated with underweightaccording to a Tanzanian study (55)

A population based cross sectional study conducted in Bussi Islands of Wakiso District, Uganda indicated that the associated factor of underweight was suffering from diarrhoea disease in the past two weeks before study(42). Study conducted in Ethiopia indicated under-five children who had diarrhea in the last two weeks before study and Children who had a fever in the last two weeks prior to data collection were factors significantly associated with underweight (22).

Study conducted in Sodo Zuria District, South Ethiopia showed that diarrheal disease morbidity two weeks prior to the study was factor significantly associated with underweight(46).

Study conducted in Angolalla Tera district, Northeast Ethiopia showed that Children having diarrhea in the past two weeks before the data collection and children having diarrhea within two weeks were significantly associated with underweight(48).

A study conducted in Ethiopia at Afar region showed that diarrhea in the past two weeks before data collection wasfactor significantly associated with the occurrence of children underweight(51).

A community based comparative cross sectional study conducted in Gozamin district showed that daily meal frequency and food distribution priority to child were factors significantly associated with child underweight (24).

2.2.4. Maternal health service related characteristics

The study conducted in Pakistan showed that place of delivery was significantly associated factor with underweight(29). A community based cross sectional study conducted in Nigeria showed that

the children whose mother place of delivery and birth interval of less than 24 months were significantly associated factors with underweight(38). Another study conducted in SSA showed that mothers age and attend ANC were factors significantly associated with underweight (34).

A study conducted in Ethiopia at Afar region showed that birth interval was significantly associated factors with the occurrence of children underweight (51).

A study conducted in Amhara region, North Gonder zone, Takusa district confirmed that mothers who had no ANC follow-up and no comprehensive understanding of child nutrition were factors significantly associated with underweight in under-five children(5).

A community based comparative cross sectional study conducted in Gozamin district showed that attending ANC was factors significantly associated with child underweight (24).

As far as my search, there is no comparative cross-sectional studies done in transformed and non-transformed woredas regarding to children underweight and also no cross-sectional studies conducted in transformed woredas on children underweight.

2.3. Conceptual frame work

The conceptual framework of this study (Figure 1) was developed after reviewing related different literatures (5, 23, 30, 38, 48).

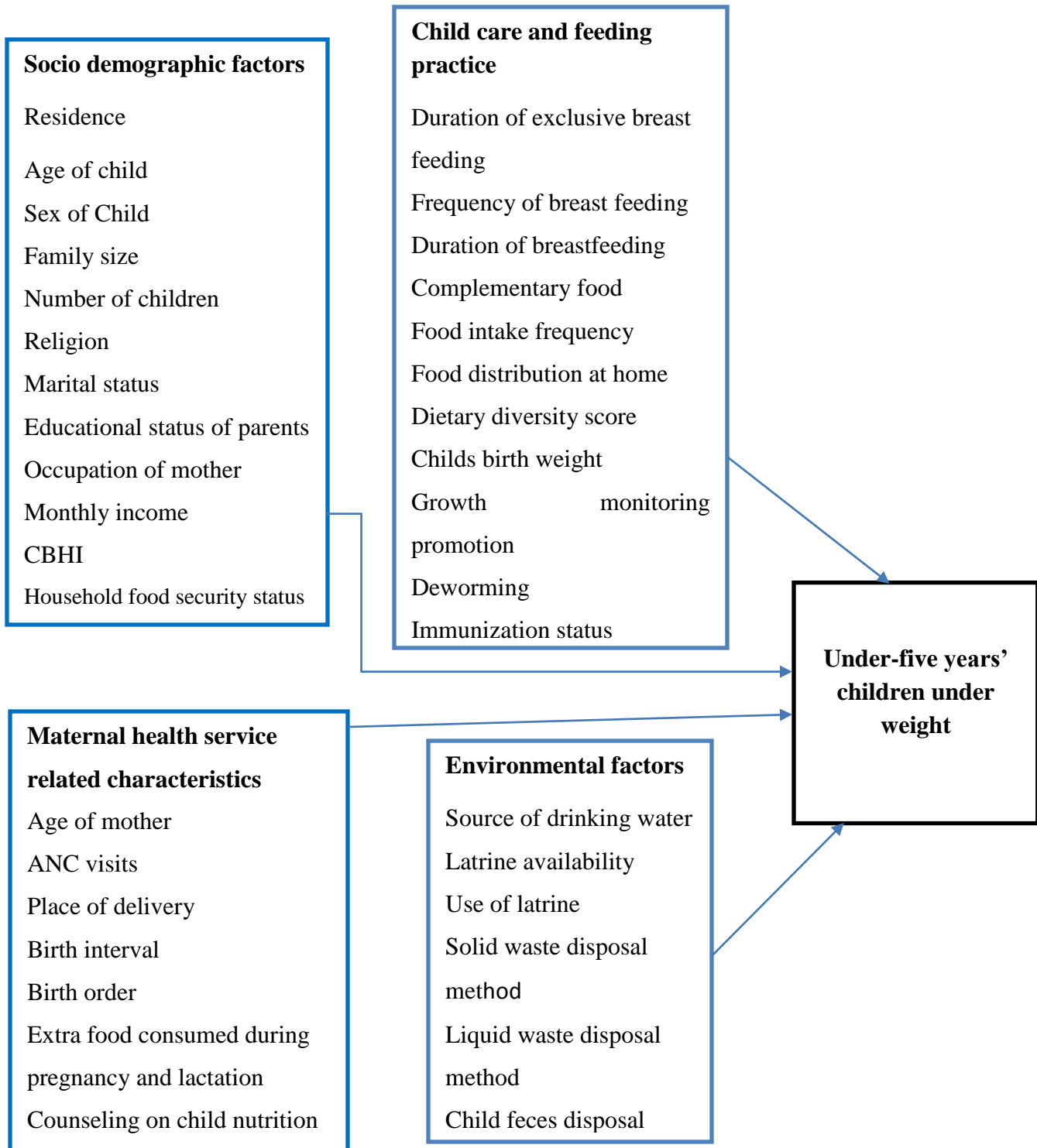


Figure 1: Conceptual Framework for comparison of underweight and its associated factors among Children 6-59 months of age in Transformed and non-transformed woredas in East Gojjam Zone, North west Ethiopia, 2022.

3. OBJECTIVES

3.1. General Objective

- To compare child underweight and its associated factors among transformed and non-transformed woredas in, East Gojjam Zone, North West Ethiopia, 2022

3.2. Specific Objectives

- To compare the prevalence of underweight among children 6-59 months of age in transformed and non-transformed woredas.
- To identify factors associated with underweight in children 6-59 months of age in transformed and non-transformed woredas.

4. METHODS

4.1. Study Area

The study was conducted in East Gojjam zone administration at Shebel Berenta transformed woreda and in Enarji Enawga and Goncha siso Enesie non-transformed woredas.

In East Gojjam zone administration there are 19 woredas from these woredas sixteen are non-transformed woredas and three are transformed Woredas. The town of East Gojjam zone administration is called Debremarkos, which is 300 km far from Addis Ababa and 250 km far from Bahir dar. According to 2021 East Gojjam zone health department report the total population was 2,745,225 with a 1.05:1 male to female ratio and number of 6-59 months of age children was 353,584.

The town of Shebel Berenta woreda is called Yeduha, which is 283 km far from Addis Ababa, 235 km far from the Bahir dar and 108 km far from Debremarkos. According to 2021 Shebel berenta woreda health office report the total population was 136,948 with a 1.05:1 male to female ratio, number of 6-59 months of age children were 17,638 and total households were 31,848. The woreda structured in to 22 kebele administrations (the smallest administrative unit) there were 1 primary hospital, 6 health centers and 22 health posts. The main staple food of the population is Teff and Sorghum.

The town of Enarji Enawga woreda is called Debre work, which is 292 km far from Addis Ababa, 190 km far from the Bahir dar and 117 km far from Bahir dar. According to 2021 Enarji Enawga woreda health office report the total population was 163,137 with a 1.05:1 male to female ratio, number of 6-59 months of age children were 21,012 and total households were 37,939. The woreda was structured in to 24 kebele administrations (the smallest administrative unit) there were 1 primary hospital, 7 health centers and 24 health posts. The main staple food of the population is Teff and barley.

The town of Goncha siso Enesie is called Gindewoyin, which is 332 km far from Addis Ababa, 150 km far from the Bahir dar and 157 km far from Debre Markos. According to 2021 Goncha siso Enesie woreda health office report the total population is 213,742 with a 1.05:1 male to female ratio, number of 6-59 months of age children's were 27,529 and total households were 49,707. The woreda was structured in to 41 kebele administrations (the smallest administrative unit) there were 8 health centers and 41 health posts. The main staple food of the population was Teff and Maize.

4.2. Study Design and Period

A Community-based comparative cross-sectional study was conducted from May 18/2022 –June 18/2022.

4.3. Populations

4.3.1. Source Population

For transformed woreda:-All 6-59 months of age children who were living in Shebel Berenta woreda.

For non-transformed woreda:-All 6-59 months of age children who were living in Enarji Enawga and Goncha siso Enesie woredas.

4.3.2. Study Population

For transformed woreda: - Mothers and 6-59 months of age children who were living in the randomly selected kebeles of Shebel Berenta woreda.

For non-transformed woreda: - Mothers and 6-59 months age of children who were living in the randomly selected kebeles of Enarji Enawga and Goncha siso Enesie woredas.

4.3.3. Study unit

Individual selected children paired with mothers in the households was used as a study unit, and all necessary data were drawn from children and mothers.

4.4. Eligible criteria

4.4.1. Inclusion Criteria

Households that have at least one 6-59 months of age children and permanent 6 Months and above residing in the transformed and non- transformed woredas.

4.4.2. Exclusion Criteria

Mothers who were seriously ill or unable to respond or answer to the questions during data collection time.

Children who were chronically ill other than chronic mal-nutrition (because of difficulty of measurement and the significant effect on child malnutrition) were excluded from the study.

4.5. Sample size determination

The sample size was calculated using two population proportion formula as follow:

$$n = \frac{[z_{\alpha} \sqrt{2p(1-p)} + z_{1-\beta} \sqrt{p_1(1-p_1) + p_2(1-p_2)}]^2}{(p_1 - p_2)^2}$$

Where, $Z_{\alpha/2} = 1.96$ (95% CI), $Z_{\beta} = 0.84$ (80% power), P_1 is the prevalence of underweight in Under-Five children in model kebele 15.3 % and P_2 is the prevalence of underweight in Under-Five children in non-model kebele 24.3% (24), one-to-one sample ratio in transformed and non-transformed woreda, design effect = 1.5 and 10% non-response rate and used one to one ratio for transformed and non-transformed woredas.

Therefore, the sample size was calculated as;

$$n = \frac{[1.96 \sqrt{2 * 0.198 * 0.802} + 0.84 \sqrt{(0.153 * 0.847) + (0.243 * 0.757)}]^2}{[0.153 - 0.243]^2}$$

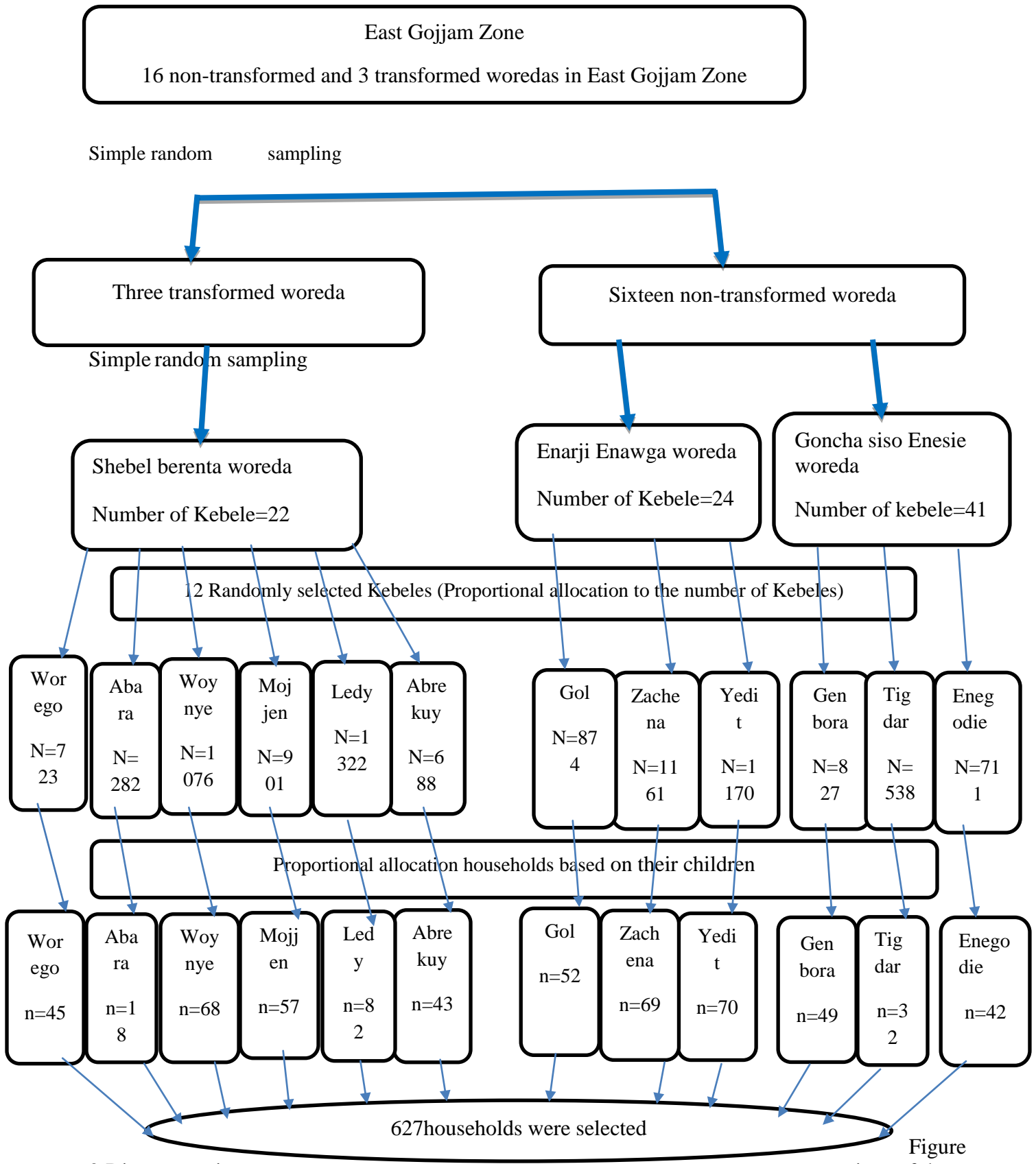
$$n = 380$$

With 1.5 design effect the sample size was 570; by adding 10% non-response rate 57, the total sample size was 627.

4.6. Sampling procedure

Stratified random sampling technique was used to stratify the study area as transformed and non-transformed woredas based on their performance. The sample was taken after the Woredas of East Gojjam Zone were grouped as strata into transformed and non-transformed woredas based on their performance, the data was obtained from East Gojjam Zone health department. From a total of three transformed Woredas and sixteen non-transformed Woredas, one transformed and two non-transformed woredas were selected randomly. The selected Woredas were Shebel berenta from transformed woredas and Enarji Enawga and Goncha siso Enesie from non-transformed woredas. Number of kebeles of selected woredas were obtained from woreda health offices then from transformed woreda six kebeles and from non-transformed woredas six kebeles were selected. The total calculated sample size 627 was shared equally into two; 314 for the non-transformed woredas and 313 for the transformed woreda. The two divided sample sizes were distributed to each selected kebele (lowest administrative levels) using proportional allocation based on 6-59 months of age children number. List of 6-59 months of age children from non-transformed and transformed woredas were extracted from community health information system (CHIS) data list in the selected kebeles health post. The study participants were selected from the CHIS lists in each Kebele using simple random sampling method.

Diagrammatic presentations of the sampling procedure



2: Diagrammatic sampling procedure

Figure presentations of the

4.7. Study Variables

4.7.1. Dependent variable

- Underweight

4.7.2. Independent variables

Socio demographic factors

- Residence
- Age of child
- Sex of Child
- Family size
- Number of children
- Marital status
- Religion
- Occupation of mother
- Educational status of parents
- Household monthly income
- Community based health insurance
- Household food security status

Environmental factors

- Source of drinking water
- Latrine availability
- Use of latrine
- Solid waste disposal method
- Liquid waste disposal method
- Child feces disposal method

Child care and feeding practices

- Duration of exclusive breast feeding
- Frequency of breast feeding
- Duration of breastfeeding
- Complementary food
- Food intake frequency
- Food distribution at home
- Dietary diversity score

- Child's weight of birth
- Growth monitoring promotion
- Deworming
- Immunization status
- Childhood illness

Maternal health service related characteristics

- Age of mother
- ANC visit
- Birth order
- Birth interval
- Place of delivery
- Post-natal care
- Extra food consumed during pregnancy and lactation
- Counseling on child nutrition

4.8. Operational Definitions

Underweight: Weight-for-age Z-score below -2SD from the median of WHO reference population (18).

Transformed Woreda: when the activities like environmental, hygiene and sanitation, improved latrine coverage and water with soap hand washing facility, skilled delivery, CBHI, maternal and child health improvement, and creating model schools become achieved above 85% , otherwise, non-transformed woreda (7).

Improved latrine: Is a facility that hygienically separates human excreta from human, animal and insect contact and have hand washing facility with soap, otherwise, unimproved latrine(56).

Protected water source: It is a type of drinking water source by its construction or active intervention of users is likely to be protected from outside contamination in particular from fecal matter(56).

Diarrhea: children having three or more loose or watery stools in a twenty-four hours period, as reported by the mother of the children(24).

Dietary Diversity: The number of different food groups consumed by children within 24 hours preceding the study(57).

Adequate dietary diversity: children who were feed four or more food groups out of seven major food groups within 24 hours preceding the study(57).

Food secure household: - Those household who experience none of the food insecurity access

questions or just experiences worry but rarely was labeled as “Food secured”(58).

Food insecure household: -the inability of households to access sufficient food at all time to lead to active healthy life includes all stage of food insecurity (mild, moderate and severe) was labeled as “Food insecure”(58).

4.9. Data Collection Instruments and Procedure

Eight diploma nurses were collected the data and two BSc public health officer were took part in the supervision. Those participation involved on anthropometric measurement, data collection and supervising the data collector.

The data collector team were selected based on familiarity with the study area, local language and interest to participate on the study. Data was collected by using semi structured questioner which was adapted from reviewing different literatures of similar studies based on the objective of this study.

The tool contains demographic, socio-economic characteristics, environmental characteristics, child caring and feeding practice, maternal health service related characteristics, household food security access scale and measurement of weight and height among 6-59 months of age children in East Gojjam Zone selected woredas.

Anthropometric data: The anthropometric data was collected using the procedure agreed by the WHO (2006) for taking anthropometric measurements. Before taking anthropometric data for children; their age was first determined to ensure the study population. Anthropometric related data of a child was entered to the WHO Anthro software and the Z-score of index, weight for Age Z-score (WAZ) was calculated using the WHO Multicenter Growth Reference Standard. The children was classified as underweight if his/her z score was less than $-2SD$ and not underweight, if Z score were $\geq -2SD$ (59).

Age: The child's age was estimated by asking the mother and confirmed by using a birth certificate or vaccination cards and also we used “local-events” calendar.

Weight measurement: Weight was measured by an electronic digital weight scale with minimum or lightly clothing and no shoes. Calibration done before weighing every child by setting it to zero. In case of children age below two years and those who are unable to stand alone, their weight was obtained from the difference between weights of mother as she/he holds the child and the weight of the mother alone. Then reading the measurement to the nearest 0.5 kilogram.

Assessment of dietary diversity

The dietary diversity of children was assessed whether they had eaten the different food groups from yesterday's sun rise to today's sun rise (24 hours recall method) prior to the study date

according to their mothers responses. Then based on reports of their mothers, food items consumed by the children were grouped in to seven food groups. The seven food groups are starchy staples (grains, roots, and tubers); legumes and nuts; vitamin-A rich fruits and vegetables; other fruits and vegetables; egg; dairy products (milk, yoghurt, and cheese) and flesh foods (meat, fish, poultry, and organ meats). Finally, dietary diversity score of children was calculated out of the seven food groups. A child with a DDS of four and above were classified as having adequate dietary diversity, otherwise classified as inadequate(57).

Assessments of house hold food security

Food security was assessed using Household Food Insecurity Access Scale (HFIAS). The HFIAS has nine questions asking household's last month experience about three domains of food insecurity: feeling the uncertainty of food supply, insufficient quality of food, and insufficient food intake and its physical consequences. It consists of two types of related questions. The first question type is called an occurrence question. There are nine occurrence questions that ask whether a specific condition associated with the experience of food insecurity ever occurred during the previous 4 weeks. Each severity question is followed by a frequency of occurrence question, which asks how often a reported condition occurred during the previous 4 weeks. There are three response options representing a range of frequencies (1 = rarely, 2 = sometimes, 3 = often). HFIAS score is calculated for each household by summing each frequency of occurrence question. The maximum score for a household is 27 (the household response to all nine frequency of occurrence questions will be "often", coded with response code of 3); the minimum score is 0 (the household responded "no" to all occurrence questions, the higher the score, the more food insecurity the household experienced. The lower the score, the less food insecurity a household experienced. A food secure household experiences none of the food insecurity (access) conditions, or just experiences worry, but rarely, other ways insecure(58).

4.10. Data Quality Control Measures

Pre-test was performed in 5% of the sample size in Enemay woreda before data collection from April 28-30, 2022 and necessary correction on the tool was performed. The pre-test data was used only for training of data collectors and to check validity and consistency of the tool. Training was given to data collectors and supervisors by principal investigator for two days about the objectives of the study, data collection instruments, data collection procedures, how to measure the child's weight and height accurately and ethical consideration during data collection. The English version questionnaire was translated to local language (Amharic) and again translated back to English to check by experts who are fluent in both languages to check consistency.

The completeness and consistency of questionnaire for each respondent was checked at the time of data collection. Data collection was supervised for correct implementation of procedures by the supervisors and principal investigator. Weight scale was calibrated at the nearest zero kilogram using weight measuring scale. Continuous checkup of measurements were performed for their reliability. During data collection days, the principal investigator and supervisors checked data for completeness and clarity and correction was made at the data collection site. Data entry, coding and cleaning was performed by the principal investigator.

4.11. Data processing and data analysis

The collected data were entered into EpiData version 3.1 software then it was exported to SPSS version 25 for analysis. WHO Anthro software was used to convert raw anthropometric data (weight, sex and age of children) into anthropometric Z-score (weight for age) of 6-59 months of age children. Children underweight was measured using weight for age Z score, which was calculated as $<-2SD$ was considered to be underweight, while $>-2SD$ was considered as not underweight based on the WHO Anthro reference. This study is a comparative study, so the chi square test was used to determine whether the two groups were comparable or not and multivariable analysis was used to determine whether the woreda status was a significant factor or not for children underweight. The results revealed that the two groups were not comparable and showed a significant difference in chi-square test but, the woreda status was not significant factor associated with underweight in multivariable analysis. By this reason, pooled analysis was performed. For the purpose of analysis underweight was taken as a dichotomous measure based on cut of point. Since the interest was in identifying child at risk of underweight, the dependent variables was coded as 1 if the child is underweighted ($<-2SD$) and coded as 0 if not. Prior to data analysis, missing values were checked and corrected by referring to the original data filled in the questionnaire. Descriptive statistic was presented using frequencies, proportions, graphs and cross tabs. Using chi-square test association was checked between the two populations. The association between underweight and the independent variables were investigated by using the logistic regression model (binary logistic regression model). A p value of <0.25 in bivariate analysis were considered a variable selection criteria. Accordingly all variables which were significant at a p value <0.25 were entered into the multivariable analysis in order to control the possible effects of confounders. Multivariable analysis was used to identify factors associated with underweight statistical significance were considered with a p value of <0.05 . The adjusted odds ratio (AOR) with a 95 % CI was used to assess the strength of association. Furthermore, the fitness of the logistic regression model was checked using the Hosmer and Lemeshow goodness of fit-test was

fitted at p-value 0.33 suggesting a non-significant discrepancy between observed and predicted score.

4.12. Ethical clearance

Ethical clearance was obtained from Ethical Review Board of Bahirdar University, College of Medicine and Health sciences, school of Public Health and it was also get granted from Shebel berenta, Enarji Enawga and Goncha siso Enesie woredas. Participation in the study was on a voluntary basis and verbal consent was obtained from study participants to confirm whether they are willing to participate or not. Those not willing to participate were given the right to refuse. The consent form was attached with each questionnaire, and before the interview each study participant gave her/his consent. The objective of the study purpose, procedure and duration, possible risk and benefit of the study will be explained to the participant using local language. Privacy and confidentiality of collected information was ensured at all level by excluding their name during the period of data collection.

5. RESULTS

5.1. Demographic and socio-economic characteristics

A total of 612 mothers with their children aged 6–59 months were participated, making the response rate of 97.6%. Of these 303 (96.4%) were from non-transformed woredas and 309 (98.7%) were from transformed woreda. The mean (\pm SD) age was 27.08 (\pm 16.3) and 30.62 (\pm 15.1) months for participants of non-transformed woredas and transformed woreda respectively. In non-transformed woredas 156 (51.5%) were male children and in transformed woreda 154 (49.8%) were male children. Regarding family, size 62 (20.5%) households of non-transformed woredas and 69 (22.3%) households of transformed woreda had a family size of above five. Regarding maternal education, 230 (75%) mothers of non-transformed woreda had no formal education compared with mothers of transformed woreda, 152 (49.2%). In non-transformed woredas 274 (90%) mothers were married compared with transformed woredas 262 (84.8%). In non-transformed woredas and transformed woredas enrolled in CBHI were 176 (58% and 260 (84%) respectively. Two hundred ninety four (97%) and 223 (72.2%) were Orthodox Christian followers in non-transformed and transformed woredas respectively (Table 1).

Table 1: Socio-demographic characteristics of under-five children in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

| Variables | Categories | Status of woreda | | |
|---|---------------------------|--------------------------------|----------------------------|---------------|
| | | Non-transformed woreda (n=303) | Transformed woreda (n=309) | Total (n=612) |
| | | Frequency (%) | Frequency (%) | Frequency (%) |
| Residence | Rural | 285 (94.1%) | 248 (80.2%) | 533 (87.1%) |
| | Urban | 18 (5.9%) | 61 (19.7%) | 79 (12.9%) |
| Age of 6-59 months of age children | 6-24 months | 169 (55.8%) | 125 (40.5%) | 294 (48%) |
| | 25-59 months | 134 (44.2%) | 184 (59.5%) | 318 (52%) |
| Sex of 6-59 months of age children | Male | 156 (51.5%) | 154 (49.8%) | 310(50.7%) |
| | female | 147 (48.5%) | 155 (50%) | 302(49.3%) |
| Marital status of mother | Married | 274 (90.4%) | 262 (84.8%) | 536 (87.6%) |
| | Divorced | 19 (6.3%) | 33 (10.7%) | 52 (8.5%) |
| | Widowed | 10 (3.3%) | 14 (4.5%) | 24 (3.9%) |
| Mothers occupation | Farmer | 270 (89.1%) | 185 (59.9%) | 455 (74.3%) |
| | Merchant | 19 (6.3%) | 97 (31.4%) | 116 (19%) |
| | Housewife | 14 (4.6%) | 27 (8.7%) | 41 (6.7%) |
| Religion | Orthodox | 294 (97%) | 223 (72.2%) | 517 (84.5%) |
| | Muslim | 9 (3.0%) | 86 (27.8%) | 95 (15.5%) |
| Educational status of mothers | Have no formal education | 226 (74.6%) | 152 (49%) | 378 (61.8%) |
| | Primary education | 46 (15.2%) | 77 (24.9%) | 123 (20.1%) |
| | Secondary education | 12 (4.0%) | 39 (12.6%) | 51 (8.3%) |
| Educational status of fathers (n1*=274 ,n2*=262,n3=536) | Above secondary education | 19 (6.3%) | 41(13.3%) | 60 (9.8%) |
| | Have no formal education | 201 (66.1%) | 121 (39.2%) | 322 (52.6%) |
| | Primary education | 56 (18.5%) | 73 (23.6%) | 129 (21.1%) |
| Family size | Secondary education | 7 (2.3%) | 25 (8.1%) | 32 (5.2%) |
| | Above secondary education | 10(3.3%) | 43(13.9%) | 53 (8.7%) |
| | ≤ 5 | 241 (79.5%) | 240 (77.7%) | 481(78.6%) |
| Family average monthly income | > 5 | 62 (20.5%) | 69 (22.3%) | 131(21.4%) |
| | Low income | 147 (48.5%) | 142(46%) | 289 (47.2%) |
| CBHI* | High income | 156(51.5%) | 167(54%) | 323 (52.8%) |
| | Yes | 176 (58%) | 260 (84%) | 436 (71.2%) |
| | No | 127 (42%) | 49 (16%) | 176 (28.8%) |

Note: n1*=non transformed woreda sample,n2*= transformed woreda sample, n3= total sample
CBHI* = Community Based Health Insurance

5.2. Environmental characteristics

The latrine coverage in non-transformed and transformed woredas were 72 (23.8 %) and 208 (67.3%) respectively. In non-transformed and transformed woredas, 20 (6.6%) and 156 (50.5%) households had improved latrine respectively. In non-transformed woredas, 72 (23.8 %) and in transformed woreda 191 (64.4%) dispose under-five child excreta inside the latrine. Fifty (16.5%) in non-transformed woreda and 134 (43.4%) in transformed woreda had solid waste disposal pit. More than 1/3rd (33.7%) and more than 2/3rd (71.8%) of households in non-transformed and transformed woredas had a protected drinking water source, respectively. (Table 2).

Table 2: Environmental characteristics of the respondents in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

| Variables | Categories | Status of the woredas | | |
|--|----------------|--|---|--------------------------------|
| | | Non-transformed woredas (n=303) Frequency (%) | Transformed woreda (n=309) Frequency (%) | Total (n=612) Frequency (%) |
| Presence of household latrine | Yes | 72 (23.8%) | 208 (67.3%) | 280 (45.8%) |
| | No | 231 (76.2%) | 101 (32.7%) | 332 (54.2%) |
| Type of latrine (n1*=72,n2*=208,n3=280) | Unimproved | 52(17.2%) | 52(16.8%) | 104 (17%) |
| | Improved | 20(6.6) | 156(50.5%) | 176 (28.8%) |
| Solid waste disposal | Yes | 50 (16.5%) | 134(43.4%) | 184 (30.1%) |
| | No | 253 (83.5%) | 175(56.6%) | 428 (69.9%) |
| Liquid waste disposal | Yes | 43 (14.2%) | 128 (41.4%) | 171 (29.9%) |
| | No | 260 (85.8%) | 181 (58.6%) | 441 (72.1%) |
| Place of under-five child excreta disposal | In the latrine | 72(23.8%) | 191 (64.4%) | 263 (43%) |
| | Any where | 231 (76.2%) | 118 (35.6%) | 349 (57%) |
| Household source of drinking water | Protected | 102 (33.7%) | 222 (71.8%) | 324 (52.9%) |
| | Not protected | 201 (66.3%) | 87 (28.2%) | 288 (47.1%) |

Note: n1*=non transformed woreda sample,n2*= transformed woreda sample, n3= total sample

5.3.Child care and feeding practice

The prevalence of EBF in non-transformed and transformed woredas were 84.8% and 88.3% respectively. Besides the breast feeding 215(71%) of non-transformed woredas and 204(66%) of transformed woreda children discontinued breastfeeding before 24 months of their age.In case of dietary diversity of the children in non-transformed woredas 227(74.9%) and 224(72.5%) of transformed woreda had inadequate dietary diversity (consumed less than four food groups in the past 24 hours proceeding the interview).Grains were the most commonly consumed food category in non-transformed woredas and transformed woredas 276 (91.1%) and 300(97.1%) respectively.Likewise among children aged 6-59 months, 217(71.6%) of non-transformed woredas and 166(53.7%) of transformed woreda did not participated in monthly GMP program.Concerning household food security (HHFS) status, in non-transformed woredas households 172 (56.8%) were suffering to food insecurity and in transformed woreda 158 (51.1%) were suffering to food insecurity(Table3).

Table 3: Child care and feeding practices of the respondents in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

| Variables | Categories | Status of the woredas | | |
|---|--------------------|---------------------------------|----------------------------|---------------|
| | | Non-transformed woredas (n=303) | Transformed woreda (n=309) | Total (n=612) |
| | | Frequency (%) | Frequency (%) | Frequency (%) |
| Food distribution at home | Priority to child | 173 (51.7%) | 242 (78.3%) | 415 (67.8%) |
| | Priority to others | 130 (42.9 %) | 67 (21.7%) | 197 (32.2%) |
| GMP*monthly participation | Yes | 86(28.4%) | 143(46.3%) | 229 (37.4%) |
| | No | 217(71.6%) | 166(53.7%) | 383 (62.6%) |
| EBF* duration | < 6 months | 29(9.6%) | 20(6.5%) | 49 (8.0%) |
| | For 6 months | 257(84.8% ⁰) | 273(88.3%) | 530 (86.6%) |
| | >6 months | 17(5.6%) | 16(5.2%) | 33 (5.4%) |
| EBF* frequency | <10 times | 138 (44.5%) | 87 (28.2%) | 225 (36.8%) |
| | ≥10 times | 165 (54.5%) | 222 (71.8%) | 387 (63.2%) |
| Duration of breast feeding | <24 month | 215 (71%) | 204 (66%) | 419 (68.5%) |
| | ≥24 month | 88 (29%) | 105 (34%) | 193 (31.5%) |
| Complementary food started (n1=276,n2=300, n3 = 576)* | <6 month | 22 (7.3%) | 20 (6.5%) | 42 (6.9%) |
| | At 6 month | 237 (78.2%) | 264 (85.4%) | 501 (81.9%) |
| | >6 month | 17 (5.6%) | 16 (5.2%) | 33 (5.4%) |
| Frequency of food intake (n1=276, n2=300, n3 = 576)* | <3 meal per day | 131 (43.2%) | 105 (34%) | 236 (38.6%) |
| | ≥3 meal per day | 145 (47.9%) | 195 (63.1%) | 340 (55.6%) |
| Dietary diversity score (n1=276,n2=300)* | Adequate | 49 (16.2%) | 76(24.6%) | 125 (20.4%) |
| | Inadequate | 227 (74.9%) | 224 (72.5%) | 451 (73.7%) |
| Diarrhea | Yes | 104 (34.3%) | 68 (22%) | 172 (28.1%) |
| | No | 199 (65.7%) | 241 (78%) | 440 (71.9%) |
| HHFS* Status | Food secure | 131 (43.2%) | 151(48.9%) | 282 (46.1%) |
| | Food insecure | 172 (56.8%) | 158(51.1%) | 330 (53.9%) |

Note: n1*=non-transformed woreda sample,n2*=transformed woreda sample, GMP*=Growth Monitoring Participation, EBF*=Exclusive Breast Feeding, HHFS*=household Food Security

5.4. Maternal health service related characteristics

The mean age of mothers of non-transformed and transformed woredas were 30.3 and 33.3 years with SD of ± 5.88 and ± 5.82 years respectively. Out of study participants, 226(74.5%) and 298(96%) of mothers of non-transformed and transformed woredas had ANC visit during pregnancy respectively and among those who had ANC visit, 137(45%) of non-transformed woredas and 254(82%) of transformed woredas got counseling on diet and nutrition during pregnancy. Regarding place of delivery, 138 (45.5%) mothers of non-transformed woredas and 254 (82%) of transformed woredas gave birth (delivered) at health facilities.(Table4)

Table 4: Maternal health service related characteristics in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

| Variables | Categories | Status of the woredas | | |
|-----------------------------|-----------------|--|---|---------------------------------|
| | | Non-transformed woredas (n=303) Frequency (%) | Transformed woreda (n=309) Frequency (%) | Total (n=612) Frequency (%) |
| Place of delivery | Health facility | 138 (45.5%) | 254 (82.2%) | 392 (64.1%) |
| | Home | 165 (54.5 %) | 55 (17.8%) | 220 (35.9%) |
| Postnatal care follow up | Yes | 67 (22.1%) | 247 (79.9%) | 314 (51.3%) |
| | No | 236 (77.9%) | 62 (20.1%) | 298 (48.7%) |
| Extra food during pregnancy | Yes | 48 (15.8%) | 229 (74.1%) | 277 (45.3%) |
| | No | 255 (84.2%) | 80 (25.9%) | 335 (54.7%) |
| Nutrition counseling | Yes | 137 (45.2%) | 254 (82.2%) | 391 (63.9%) |
| | No | 166 (54.8%) | 55 (17.8%) | 221 (36.1%) |
| Birth order children | 1-4 child | 273 (90.1%) | 266 (86.1%) | 539 (88.1%) |
| | ≥5 child | 30 (9.9%) | 43 (13.9%) | 73 (11.9%) |
| Birth interval | ≤2 years | 41 (13.5%) | 37 (12%) | 78 (12.7%) |
| | ≥3 years | 262 (86.5%) | 272 (88%) | 534 (87.3%) |
| Age of mother | 20-24 years | 48 (15.8%) | 14 (4.5%) | 62 (10.1%) |
| | 25-29 years | 95 (31.4%) | 72 (23.3%) | 167 (27.3%) |
| | 30-34 years | 73 (24.1%) | 87 (28.2%) | 160 (26.1%) |
| | 35-39 years | 62 (20.5%) | 72 (23.3%) | 134 (21.9%) |
| | 40-44 years | 22 (7.3%) | 51 (16.5%) | 73 (11.9%) |
| | 45-49 years | 3 (1%) | 13 (4.2%) | 16 (2.6%) |
| ANC* follow up | No follow up | 77 (25.4%) | 11 (3.6%) | 88 (14.4%) |
| | 1-3 follow up | 170 (56.1%) | 56 (18.1%) | 226 (36.9%) |
| | 4 follow up | 56 (18.5%) | 242 (78.3%) | 298 (48.7%) |

Note, ANC* =Antenatal Care

5.5. Prevalence of underweight

The overall prevalence of underweight among 6-59 months of age children were 139 (22.7%) with 95% CI (19.0, 26.0 %) in the study area. The prevalence of underweight among 6-59 months of age children living in non-transformed woredas were 84 (27.7%) with 95% CI (23.0, 33.0 %) and 55 (17.8 %) with 95% CI (14.0, 22.0 %) children of 6-59 months of age in transformed woreda were underweight respectively.

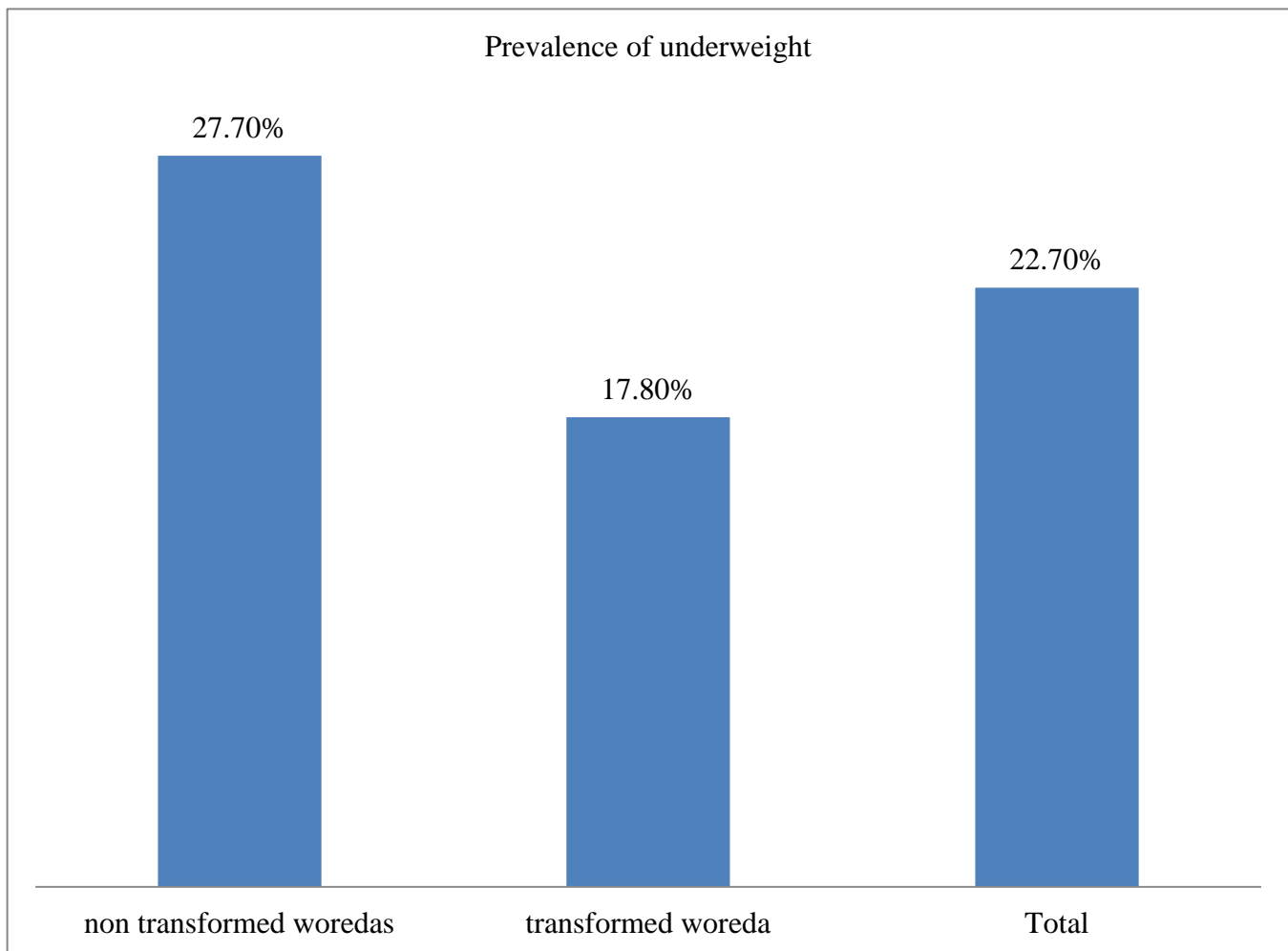


Figure 3: Prevalence of underweight among 6-59 months children in non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

5.6. Comparison of groups

This study showed that non-transformed woredas and transformed woreda groups were statistically significant difference on underweight by chi square test ($X^2 = 8.58$, p -value = 0.003), but the woreda status was not significant factor for child underweight in multivariable analysis, being non-transformed woreda children 1.06 times more likely to be underweight than transformed woreda children (AOR 1.06; CI, 0.63, 1.79). By this reason pooled analysis was conducted.

5.7. Factors associated with underweight among 6-59 months of age children in pooled analysis

All independent variables were checked for the presence of association with underweight in bivariate logistic regression analysis. The variables found to be associated with underweight in bivariate analysis (P -value < 0.25) were woreda status, mother education status, CBHI, source of drinking water, food distribution at home, GMP, history of diarrhea, monthly income, frequency of food intake, child dietary diversity score and household food security status.

Binary logistic regression analysis through enter method was employed to assess the relative effect of explanatory variable on dependent variable. The predictive ability of the model tested with the goodness-of-fit with Hosmer-Lemeshow test at p -value 0.33 suggesting a non-significant discrepancy between observed and predicted score.

After controlling for potential confounders, the final multivariable logistic regression analysis revealed that underweight among 6-59 months of age children in the final pooled model; use unprotected source of drinking water, household food distributed priority to other family members, household had low monthly income, had diarrhea in the past two weeks prior to data collection and household food insecurity were factors associated with underweight at p -value < 0.05.

Children from food insecure household were 2.67 times more likely to develop underweight as compared with children from food secure household (AOR=2.67; 95% CI: 1.60, 4.46).

Children whose household had low monthly income were 3.77 times more likely to develop underweight as compared with those children whose household had high monthly income (AOR=3.77 ; 95% CI: 2.34, 6.08).

Children who had diarrhea in the past two weeks before the data collection period were 2.49 times more likely to develop underweight than children without diarrhea in the past two weeks before the data collection period (AOR=2.49 ; 95% CI: 1.56 , 3.98)

Children whose household food distributed priority to other family members were 1.64 times more likely developing underweight as compared with children whose household food distributed priority to children (AOR=1.64 ; 95% CI:1.02, 2.65) .

Children whose household use unprotected source of drinking water were 1.82 times more likely to be underweight as compared with those household use drinking water from protected source. (AOR=1.82; 95% CI: 1.10, 2.99). (Table 8).

Table 5: Factors associated with underweight among 6-59 months of age children in pooled analysis of non-transformed and transformed woredas of East Gojjam Zone, Northwest Ethiopia, 2022

| Variables | Category | Underweight | | COR (95% CI) | AOR (95% CI) |
|--------------------------------|---------------------------|-------------|-----|-----------------|----------------------------|
| | | Yes | No | | |
| Woreda status | Non-transformed | 84 | 219 | 1.77(1.2,2.6) | 1.06(0.63,1.79) |
| | Transformed | 55 | 254 | 1 | 1 |
| Source of drinking water | Not protected | 92 | 196 | 2.76(1.86,4.11) | 1.82* (1.10,2.99) |
| | Protected | 47 | 277 | 1 | 1 |
| CBHI* | No | 56 | 120 | 1.98(1.33,2.95) | 1.33(0.80,2.20) |
| | Yes | 83 | 353 | 1 | 1 |
| DDS*(n=576) | Inadequate | 117 | 334 | 2.56(1.44,4.58) | 1.83(0.91,3.65) |
| | Adequate | 15 | 110 | 1 | 1 |
| Household food security status | Food insecure | 110 | 220 | 4.36(2.78,6.82) | 2.67** (1.60,4.46) |
| | Food secure | 29 | 253 | 1 | 1 |
| GMP* monthly participation | No | 104 | 279 | 2.06(1.35,3.15) | 1.09(0.63,1.87) |
| | Yes | 35 | 194 | 1 | 1 |
| Had diarrhea | Yes | 68 | 104 | 3.39(2.28,5.05) | 2.49** (1.56,3.98) |
| | No | 71 | 369 | 1 | 1 |
| Frequency of food intake | < 3 times | 69 | 166 | 1.85(1.25,2.75) | 1.14(0.71,1.82) |
| | ≥ 3 times | 62 | 277 | 1 | 1 |
| Food distribution | Priority to other | 64 | 133 | 2.18(1.47,3.21) | 1.64* (1.02,2.65) |
| | Priority to child | 75 | 340 | 1 | 1 |
| Monthly Income | Low | 104 | 185 | 4.62(3.02,7.07) | 3.77** (2.34, 6.08) |
| Education status of mother | High | 35 | 288 | 1 | 1 |
| | Have no formal education | 91 | 287 | 3.48(1.34,8.97) | 1.46(0.51, 4.18) |
| | Primary education | 30 | 93 | 3.54(1.30,9.68) | 2.04(0.66, 6.26) |
| | Secondary education | 13 | 38 | 3.76(1.23,11.4) | 2.24(0.65, 7.67) |
| | Above secondary education | 5 | 55 | 1 | 1 |

Note:** p<0.01, * p<0.05, 1 =Reference, CBHI*= Community Based Health Insurance, DDS*=Dietary Diversity Score, ANC*=Antenatal Care, GMP*=Growth Monitoring Promotion

6.DISCUSSION

In this study, the overall prevalence of underweight among 6-59 months of age children were 22.7 % with 95% CI (19.0, 26.0 %).

The result of this study was similar to studies conducted in Takusa woreda 19.5%(5),Lalibela town 25.6 %(49), Tigray region 23.9% (43), wonsho woreda 20.5%(44), Ethiopian mini EDHS 2019 report 21%(3) and India 23.8% (30).

This study prevalence of children underweight were higher than studies conducted in Debretabor town 17.4%(23),Angolalla tera woreda 15.9% (48), Sodo Zuria woreda 14.5%(46) ,Areka 13.5%(60), Gozamin district 15.3 %(24). This might be due to the difference in sample size, study period, poor leadership commitment, study area and HHFS status between the current and previous studies.The prevalence of children underweight were higher than studies conducted in Uganda wakiso district 16.1%(42).This might be due to the difference in main staple foods, differences in sample size, study period and area, and socio cultural difference.

This study prevalence of children underweight was lower than studies conducted in Amhara region prevalence of underweight was 26.7 %, in mini EDHS 2019 report(3) and in Medebay Zana district in Tigray region 45.3%(61). The possible reason for the difference may be due to difference in study area, leadership commitment which later ends up professional commitment difference and study period might be contributed to this variation. The prevalence children underweight was lower than studies conducted in Nigeria 29% (38),Arusha District, Tanzania 28% (37),in Pakistan 33.3%(29), in Bangladesh 32.8% (62)and in Easter Nepal 37 % (32).The possible reason for the difference may be due to difference in study participant, socio cultural difference, residence, religion,study period, study area, feeding habit and health policy being implemented might be contributed to this variation.

Factors significantly associated with children underweight in pooled analysis were use unprotected source of drinking water, household food distributed priority to others, low monthly income, had diarrhea in the past two weeks prior to data collection and household food insecurity.

Children whose household use unprotected source of drinking water were more likely to be underweight as compared with those household use drinking water from protected source. This might be due to the fact that using unprotected water source is directly related with the incidence of childhood water borne diseases like diarrhea and typhoid fever, those diseases causes for poor appetite, loss of excessive fluids and important nutrients from the body and malabsorption

which results the children to develop underweight. The result of this study is supported by studies done in Gozamin district (24) and study conducted in Berahle, Afar, North East Ethiopia (51).

The other factor associated with underweight was household food insecurity. Children from food insecure households were more likely to develop underweight as compared with children from food secure households. The rationale for household food insecurity increase the occurrence of underweight by limiting the quantity and quality of dietary intake and this finding was consistent with the UNICEF conceptual framework for causes of malnutrition. This result is supported by studies conducted in Sekela woreda (50) and East Badawacho District (52).

In the current study, presence of diarrheal disease was significantly associated with increasing prevalence of underweight. Children who had diarrhea in the past two weeks before the data collection period were 2.49 times more likely to develop underweight than children without diarrheal disease in the past two weeks before the data collection period. This might be due to the fact that underweight and diarrhea have a bidirectional relationship by which underweight cause's immune deficiency and increased susceptibility to infection such as diarrhea. Diarrhea in turn causes loss of excessive fluids and important nutrients from the body, loss of appetite, reduced energy intake, malabsorption and also increase the bowel mobility of the children which may result in child to develop underweight. This result was in line with other findings conducted in Angolella Tera district (48), in Berahle Afar region (51), Sodo Zuria district (46), Uganda (42).

In the current study, children whose household had low monthly income were more likely to develop underweight as compared with those children whose household had high monthly income. The rationale might be households had low monthly income increase the occurrence of underweight by children cannot get enough quantity and diversified food as a result the children were develop underweight. Furthermore household was low monthly income they suffer to food insecurity as a result children were more likely to develop underweight. This finding is supported by studies conducted in Angolalla Tera district, in Wolaita Sodo district and in Tigray region, Ethiopia (43, 45, 48).

In this study, children whose household food distributed priority to other family members were more likely developing underweight as compared with children whose household food distributed priority to children. This might be due to that food is distributed in the household priority to other family members were determined nutritional status of children for instance the head of the household gets first priority in eating while children get a smaller share of the family's food relative

to quantity and quality of dietary intake due to hierarchical position with intra-family food distribution so this inappropriate food distribution with in the household leading to effect on children nutrition status, thus children may be suffered by underweight due to get small amount of food because food is distributed priority to other family members in the household. This research finding is consistent with study done in Gozamin district (24).

7. LIMITATIONS OF THE STUDY

This result might be affected by social desirability bias since the mothers more likely to answer a socially acceptable response, even if not true. More confidential data collection was done for each respondent to minimize this bias.

There is potential recall bias among respondents answering questions relating to events happening in the past but efforts were made to minimize it by giving detailed instructions for participants and providing adequate time for study participants to recall as much as possible.

8. CONCLUSION

The overall prevalence of underweight among 6-59 months of age children were 22.7 %. According to this study, the prevalence of underweight among 6-59 months of age in non-transformed woreda was higher than from transformed woreda. The prevalence of 6-59 months of age children underweight remains high in the study area. Moreover, the prevalence of underweight was higher compared with WHO cut of points. This study identifies factors associated with children underweight and provided clues on the contributing factors of underweight among 6-59 months of age children in the study area. Based on this, unprotected source of drinking water, food distributed priority to other family members, household low monthly income, history of diarrhea in the past two weeks prior to data collection and food insecurity were factors associated with underweight.

9. RECOMMENDATIONS

Based on our findings, the following nutrition specific and nutrition sensitive interventions are suggested for the stakeholders to improve the nutrition condition of under-five children in the study areas:

1. For East Gojjam zone health department should strengthen regular monitoring and evaluation and fully incorporate underweight prevention strategy in woreda transformation agendas.
2. For woreda health offices should support health center and health post to prevent underweight by improve hygiene and sanitation and by control communicable disease in the community.
3. The Woreda water and energy office should strongly work to improve access and quality of drinking water.
4. For Woreda agriculture offices should strongly work and co-operate with other sectors to improve households ensure food security through productive safety-net program and support income generating activities.
5. For Health extension workers and other health professionals should focus on providing participatory nutrition education to raise awareness and develop behavior change communication, as well as strengthening house-to-house visits and support on home food distribution, water source protection, how to feed their children, communicable disease prevention, improving hygiene and sanitation, and food and water safety.
6. Further study needs to be conducted on the impact and role of woreda transformation as a package on underweight occurrences and factors associated with underweight.

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11. ANNEXES

Annex-I. Information Sheet and Consent Form

How are you? My name is I am here on behalf of Kassahun Bishaw, student in Bahir Dar University, college of Medicine and Health Science, School of Public Health, Department of Nutrition and dietetics. He is conducting a research on to compare prevalence and associated factors of underweight among children 6-59 months of age in transformed and non- transformed woredas in East Gojjam zone in Enarji Enawga, Shebel Berenta and Goncha siso Enesie for the partial fulfillment of master's degree. He has received permission from school of public health at Bahir Dar University, Woreda health offices to conduct this study. We believe that the results of this study will assist policy makers, planners and health service providers for making considerations regarding prevention of underweight. Your contribution has a great input for the study and I would greatly appreciate your participation. There is no possible risk associated with participating in this study. Your name will not be write in the questionnaire and please be assure that all the information you give will be kept strictly confidential. Only the principal investigator and the research assistants collecting the data will have access to the data. Your participation is voluntary. If you choose not to answer a particular question, that is your right. You are also permitted to withdraw any time from the study when you feel uncomfortable with it. Be like if you have any idea and question in this study, you can contact principal investigator or advisors by below address.

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Advisors

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Therefore to participate in this studies you:

A, agree

B, disagree

Date of data collection..... Study woreda Code of the interview.....

Name of interviewer-----signature

Name of supervisor signature.....

Annex II English Questionnaires

Questionnaire for the comparison of underweight and its associated factors among children 6-59 months of age in transformed and none transformed woredas in East Gojjam Zone, North West Ethiopia.

Woreda Name ----- Kebele----- Gote-----Name of data collector----- Date of data collection----- Code-----

| S.No | Questions | Response and coding category | Skip |
|------|---|--|------|
| 1 | Demographic and socioeconomic factors | | |
| 101 | What is your residence? | 1 Rural 2 Urban | |
| 102 | How many months old is your child? |(months) | |
| 103 | What is the sex of your child? | 1. Male 2. Female | |
| 104 | How many people live in your household? | _____ | |
| 105 | How many of the children are under age of five? | _____ | |
| 106 | What is your religion? | 1. Orthodox 2. Protestant 3. Muslim 4. Catholic 5. Others (specify)..... | |
| 107 | What is your main occupation? | 1. Housewife 2. Government employee 3. Merchant 4. farmer 5. Others (specify)..... | |
| 108 | What is your educational status? | 1. No formal education | |

| | | | |
|----------|--|--|-----------------------------|
| | | 2. Primary education (1-8) 3. Secondary (9-12) 4. Above secondary | |
| 109 | What is your marital status? | 1. Married 2. Divorced 3. Widowed 4. Never married | If not married skip to Q 11 |
| 110 | What is your husband's educational level? | 1. No formal education 2. Primary education (1-8) 3. Secondary (9-12) 4. Above secondary | |
| 111 | How much is your monthly income in birr? |birr | |
| 112 | Does the household is enrolled in CBHI? | 1. Yes 2. No | |
| 2 | Environmental factors | | |
| 201 | What is the main source of drinking water for members of your household? | 1. improved water source 1. Piped water 2. Borehole water (protected) 3. others 2. non improved water source 1. borehole water (not protected) 2. river water 3. spring water 4. rain water 5. others | |
| 202 | Do you have toilet facility in your house? (if possible observe it) | 1. Yes 2. No | If no skip to Q 206 |
| 203 | If yes, what is the type of the latrine? <i>(observation)</i> | 1. Unimproved 2. Improved | |
| 204 | All Household members using the latrine? | 1 Yes | |

| | | | |
|----------|---|---------------------------------------|--|
| | | 2 No | |
| 205 | Is there a hand washing basin with water and soap at the door step of the latrine? <i>(observation)</i> | 1.Yes 2. No | |
| 206 | Do you have solid waste disposal pit in your compound? | 1.Yes 2.No | |
| 207 | Do you have liquid waste disposal pit in your compound? | 1.Yes 2. No | |
| 208 | Where do you dispose your child feces? | 1.Toilet 2. Anywhere in open space | |
| 3 | Maternal caring and characteristics | | |
| 301 | Age of mothers/caretakers? | -----years | |
| 302 | Whatisthebirthorderofyourchild? | ----- | |
| 303 | How many years doesyour childhavebetweenthepreceding birthintervals? | -----years | |
| 304 | How many times you visited Antenatalcare in health institution when you arepregnantofthischild? | -----times | |
| 305 | Wheredid youdeliveryyourchild? | 1.Healthfacility 2.Home | |
| 306 | Didyouattendpostnatalcareservice afterdeliveryofyourchild? | 1.Yes 2.No | |
| 307 | Did you eat extra food during pregnancy? | 1.Yes 2.No | |
| 308 | Did you get about child nutrition counseling? | 1 Yes 2 No | |
| 4 | Child care and feeding practice | | |
| 401 | For how long exclusive breastfedyourchild? | -----months | |

| | | | |
|-----|---|---|---------------------|
| 402 | How many times breast feed your child in 24 hours? | -----times | |
| 403 | For how long the child breastfed? | (months) | |
| 404 | Did you start giving complementary foods to your child? | 1 Yes 2 No | If no skip to Q 407 |
| 405 | When did you start giving complementary food to your child? |(months) | |
| 406 | How many times you give it? | -----times | |
| 407 | How food is distributed in your home? | 1. Priority to child 2. Priority to other | |
| 408 | Food diversity/Food group in the past 24 hours children taken | | |
| | 1. Grains, roots and tubers (Potatoes, Cassava, barley, rice, ray and Teff) | 1. Yes 2. No | |
| | 2. Pulses/legumes and nuts (beans, peas, lentils, nut) | 1. Yes 2. No | |
| | 3. Dairy products (milk, yogurt and milk products) | 1. Yes 2. No | |
| | 4. Flesh food (meat, fish, poultry and liver/organ meats) | 1. Yes 2. No | |
| | 5. Eggs | 1. Yes 2. No | |
| | 6. Vitamin A- rich fruits and Vegetables (Mangos, papaya) | 1. Yes 2. No | |
| | 7. Other fruits and vegetables (Including wild fruits and vegetables) | 1. Yes 2. No | |
| 409 | How much was your child's weight at birth? | 1. Smaller than average (<2.5kg) 2. Average (2.5-4kg) 3. Large (>4kg) 4. unknown | |
| 410 | Did you attend monthly Growth monitoring promotion? | 1. Yes 2. No | |
| 411 | Do your child take de-worming regularly | 1 Yes | |

| | | | |
|----------|---|--|------------------|
| | (for children aged >2years? | 2 No | |
| 412 | What is your child vaccination status? | 1. Not vaccinated 2. Currently on vaccination 3. Fully Vaccinated 4 defaulter | |
| 413 | Does your child have diarrhea in the past two weeks? | 1. Yes 2. No | |
| 414 | What are the diseases he/she suffers from other than diarrhea? | 1. Fever 2. Cough 3 Others | |
| 5 | Household food Insecurity Access Scale (HFIAS) Measurement Tool | | |
| 1. | In the past four weeks, did you worry that your household would not have enough food? | 1. Yes 2. No | If no skip to Q2 |
| 1a | How often did this happen? | 1, Rarely (once or twice in the past four 2, Sometimes (three to ten times in the past four weeks) 3, Often (more than ten times in the past four weeks) | |
| 2 | In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? | 1. Yes 2. No | If no skip to Q3 |
| 2a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 3. | In the past four weeks, did you or any household member have to eat a limited | 1. Yes 2. No | If no skip to Q4 |

| | | | |
|-----|--|--|------------------|
| | variety of foods due to a lack of resources? | | |
| 3.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 4 | In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food? | 1. Yes 2. No | If no skip to Q5 |
| 4.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 5 | In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? | 1. Yes 2. No | If no skip to Q6 |
| 5.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 6. | In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food? | 1. Yes 2. No | If no skip to Q7 |
| 6.a | How often did this happen? | 1 = Rarely (once or twice in | |

| | | | |
|-----|---|--|------------------|
| | | the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 7. | In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food? | 1. Yes 2. No | If no skip to Q8 |
| 7.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 8. | In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food? | 1. Yes 2. No | If no skip to Q9 |
| 8.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |
| 9. | In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food? | 1. Yes 2. No(if no questionnaire is finished) | |
| 9.a | How often did this happen? | 1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks) | |

| 6 | Anthropometric measurement | One | Two | Edema (yes, no) |
|-----|----------------------------|----------|-----------|--------------------|
| 601 | Weight |K.G | K.G | |

Thanksfor yourcollaboration!

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| | | 3.ሁለተኛደረጃ 4.ከሁለተኛደረጃበላይ | |
| 109 | የጋብቻህኔታ? | 1.ያገቡ 2.የተፋቱ 3.ባላቸውንበግዙፍጡ 4.ያላገቡ | ያገቡካልሆነ ወደ ጥ 112 ይሂዱ |
| 110 | የባለቤትዎ የትምህርትደረጃስንትነት ወ? | 1.መደበኛትምህርት ያልተማረ 2.አንደኛደረጃ 3.ሁለተኛደረጃ 4.ከሁለተኛደረጃበላይ | |
| 111 | አጭኝን የቤተሰብዎ ወርሃዊ ገቢ ስንት ይሆናል? | -----ብር | |
| 112 | የሚበረሰብ አቀጣጠል ማድን አባልናችሁ? | 1. አዎ 2. አይደለንም | |
| 2. | የአካባቢ ጠፍቃትን በተመለከተ | | |
| 201 | ለቤተሰብዎ ዋና ዋና መዘገብ ወይንም ሌሎች ምን ጭን ደኑ ወ? | 1. የተጠበቀ የወሃ ጭን ጭ 1. የቧንቧ ወሃ 2. የጉድጓድ ወሃ (የተጠበቀ) 3. ሌሎች (ይግለጹ) 2. ያልተጠበቀ የወሃ ጭን ጭ 1. የጉድጓድ ወሃ (ያልተጠበቀ) 2. የወንዝ ወሃ 3. የምን ጭን ጭ 4. የዝናብ ወሃ 5. ሌሎች (ይግለጹ) | |
| 202 | በቤትዎ ማለገ ለብት መጻዳ ጃቤት አለዎት? | 1. አዎ 2. የለም | መላሱ የለም ከሆነ ወደ ጥ 206 ይሂዱ |
| 203 | መጻዳ ጃቤታችሁ ምን ዓይነት ነው? | 1 የተለጠመ 2 የተሸሻለ | |
| 204 | ሁሉም ቤተሰብ አባላት ሁልጊዜ መጻዳ ጃቤት ይጠቀሙ? | 1. አዎ 2. የለም | |
| 205 | በቤትዎ ማለገ ለብት ከመጻዳ ጃቤቱ አጠገብ ላይ እጅ መታጠብ ያለዎት? | 1. አለ 2. የለም | |
| 206 | በቤትዎ ማለገ ለብት የደረሰ ቅጥር ማስወገድ ለጃጉድጓድ አለዎት? | 1. አለ 2. የለም | |

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| | 2.ጥራጥሬ (ለውዝ፣ ባቁላ፣ አተር፣ ምክር) | 1.አዎ 2.የለም | |
| | 3.የ ወተትተዋጽኦዎች(ወተት፣ እርጎ) | 1.አዎ 2.የለም | |
| | 4.የ ሥጋምግቦች(ሥጋ፣ ዓሳ፣ ዶሮእናጉቦት) | 1.አዎ 2.የለም | |
| | 5.እንቁላል | 1.አዎ 2.የለም | |
| | 6 ቫይታሚኖች በለጸጉፍራፍሬዎችእናአትክልቶች (ማንጎ፣ ጋጋያ፣ ጎመን) | 1.አዎ 2.የለም | |
| | 7.ሌሎችፍራፍሬዎችናአትክልቶች(የ ዳር ፍራፍሬዎችእናአትክልቶችንጨምሮ) | 1.አዎ 2.የለም | |
| 409 | ልጅዎስወደየነ በረወክብሎት/መጠን ምን ያህልነ በር ? | 1.አነስተኛ(<2.5ኪ.ግ) 2.መካከለኛ(2.5-4 ኪ.ግ) 3. ከፍተኛክብሎት(>4 ኪ.ግ) 4.አላወቀዎም | |
| 410 | በየ ወሩበእድገትክትትልፕሮግ ራምላይበመጣ ኘትየ ልጅዎክብሎትያስመዘናሉ? | 1. አዎ 2. የለም | |
| 411 | ከሁለትአመቶችምበደብደብትወሩየ ሆደትላትልመከላከያክኒንይወስዳል? | 1. አዎ 2. የለም | |
| 412 | የ ልጅዎየ ክትባትሁኔታ ምን ይመስላል? | 1. አልትከተበምአልጀመረም 2.አልጩሰምአየ ወሰደነ ው 3. ክትባትጩሰል | |
| 413 | ባለፉት2ሳምንታትልጅዎትቅማጥ ታጥፎ ወቃል? | 1.አዎ 2.የለም | |
| 414 | ክትቅማጥ ወይም ብዙውን ጊዜእሱ/እሷ የ ታመወትምን ድንነ ወ? | 1. ትከሳት 2.ሳል 3.ሌላ | |
| 5 | የምግብዋስትናንበተሟላከተ | | |
| 1. | ባለፉትአራትሳምንታትቤተሰቦችዎበቁምግብአያገኘምበለ ወተጩቆወነ በር ? | 1. አዎ 2.አይ | አይከሆነ ወደጥ2 ዝለል |
| 1.ሀ | ይህስንትጊዜተከሰተ? | 1 አልፎአልፎ(ከ1-2ጊዜ) 2አንዳንድጊዜ(ከ3-10ጊዜ) 3ብዙጊዜ(ከ10ጊዜበላይ) | |
| 2 | ባለፉትአራትሳምንታትእርስዎወይምግንኛዎምሆኑ | 1. አዎ | አይከ |

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| | ተሰብአባል በሀብት እጥረት ምክንያት የሚጠቅን አይነት ትምህርት ለሌሎችም በር? | 2.አይ | ሆነ ወደጥ3 ዝለል |
| 2.ሀ | ይህ ስንት ጊዜ ተከሰተ? | 1 አልፎ አልፎ (ከ1-2 ጊዜ) 2 አንዳንድ ጊዜ (ከ3-10 ጊዜ) 3 ብዙ ጊዜ (ከ10 ጊዜ በላይ) | |
| 3. | ባለፉት አራት ዓመት ታትኦ ስድስት ወይም ስምንት ዓመት በተሰብአባል ሀብት እጥረት ምክንያት ወስን የሆኑ ምግቦችን ብቻ ይመጡ በሩ በር? | 1. አዎ 2. አይ | አይከ ሆነ ወደጥ4 ዝለል |
| 3.ሀ | ይህ ስንት ጊዜ ተከሰተ? | 1 አልፎ አልፎ (ከ1-2 ጊዜ) 2 አንዳንድ ጊዜ (ከ3-10 ጊዜ) 3 ብዙ ጊዜ (ከ10 ጊዜ በላይ) | |
| 4 | ባለፉት አራት ዓመት ታትኦ ስድስት ወይም ስምንት ዓመት በተሰብአባል ሀብት ባለሙያ ሩመባለት ያልፈለጉትን አንዳንድ ምግቦች ይመጡ በሩ በር? | 1. አዎ 2. አይ | አይከ ሆነ ወደጥ5 ዝለል |
| 4.ሀ | ይህ ስንት ጊዜ ተከሰተ? | 1 አልፎ አልፎ (ከ1-2 ጊዜ) 2 አንዳንድ ጊዜ (ከ3-10 ጊዜ) 3 ብዙ ጊዜ (ከ10 ጊዜ በላይ) | |
| 5 | ባለፉት አራት ዓመት ታትኦ ስድስት ወይም ስምንት ዓመት በተሰብአባል ከሜሊት ያነሱ ስምግብ ይመጡ በሩ በር? | 1. አዎ 2. አይ | አይከ ሆነ ወደጥ6 ዝለል |
| 5.ሀ | ይህ ስንት ጊዜ ተከሰተ? | 1 አልፎ አልፎ (ከ1-2 ጊዜ) 2 አንዳንድ ጊዜ (ከ3-10 ጊዜ) 3 ብዙ ጊዜ (ከ10 ጊዜ በላይ) | |
| 6. | ባለፉት አራት ዓመት ታትኦ ስድስት ወይም ስምንት ዓመት የተሰብአባል ቁምጥ ብስላልነት በረበቀው ወሰን ጥቁቅ ምግቦችን ብቻ ይመጡ በሩ በር? | 1. አዎ 2. አይ | አይከ ሆነ ወደጥ7 ዝለል |

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| 6.ሀ | ይህስንትጊዜተከሰተ? | 1አልፎአልፎ(ከ1-2ጊዜ) 2አንዳንድጊዜ(ከ3-10ጊዜ) 3ብዙጊዜ(ከ10ጊዜበላይ) | |
| 7. | ባለፉትአራትሳምንታትወስጥአንድም ማሳምግብበ ቤትዎወስጥያልነ በረበትወቅትነ በር? | 1. አዎ 2. አይ | አይከ ሆነ ወ ደጥ8 ዝለል |
| 7.ሀ | ይህስንትጊዜተከሰተ? | 1 አልፎአልፎ(ከ1-2ጊዜ) 2አንዳንድጊዜ(ከ3-10ጊዜ) 3 ብዙጊዜ(ከ 10 ጊዜበላይ) | |
| 8. | ባለፉትአራትሳምንቶችእርስዎወይምግንኛወም ቤተሰብአባልእራትሳይበለተኝተዋል?በቁምግብስላል ነ በረ? | 1. አዎ 2. አይ | አይከ ሆነ ወ ደጥ9 ዝለል |
| 8.ሀ | ይህስንትጊዜተከሰተ? | 1 አልፎአልፎ(ከ1-2ጊዜ) 2አንዳንድጊዜ(ከ3-10ጊዜ) 3ብዙጊዜ(ከ10ጊዜበላይ) | |
| 9. | ባለፉትአራትሳምንታትእርስዎወይምግንኛወም ቤተሰብአባልበቁምግብባለመኖሩምንምሳይበሉአንድቀንናሌሊትመሉአሳልፈዋል? | 1. አዎ 2. አይ | አይከሆነ መልሱወ ደጥያ ቁ 601 ይሂዱ |
| 9.ሀ | ይህስንትጊዜተከሰተ? | 1 አልፎአልፎ(ከ1-2ጊዜ) 2አንዳንድጊዜ(ከ3-10ጊዜ) 3ብዙጊዜ(ከ10ጊዜበላይ) | |
| 6 | የሰው ትኩረትልኬት | አንድ | ሁለት |
| | | | የእግር እብጠት (አለ፣ የለም) |

ስለትብብርዎእናመሳግናለን !!!