



*DETERMINANTS OF ACUTE MALNUTRITION AMONG UNDER FIVE CHILDREN WITH  
DIARRHOEA IN TWO PUBLIC HOSPITALS IN JIMMA TOWN, SOUTHWEST ETHIOPIA*

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## Abstract

Background: Acute malnutrition problem is still a major concern in Ethiopia based on WHO Crisis Classification using rates of Global Acute Malnutrition (GAM) for which the prevalence lies between 10% - 14% is considered to be as serious problem in which the Ethiopian acute malnutrition prevalence lies between in this ranges. In Ethiopia eleven percent (11%) of children under five are wasted and two percent (2%) are severely wasted. It is associated with an increased risk of child morbidity and poor diet or a lack of food the diet does the children they consume. The control of acute malnutrition in children is essential to prevent delayed growth, morbidity, depression, cognitive development and others. In order to design an intervention for treatment and prevention of acute malnutrition in children, a study assessing risk factors for acute malnutrition has paramount importance.

Objective: The objective of this study was to identify determinants of acute malnutrition among under five children with diarrhea attending in jimma town public hospital.

Method: unmatched case control study was employed for this study from march 1- April 30 town public hospital jimma town which is 345km away from the capital city of Ethiopia, Addis Ababa. Case control study with two population proportion formula was used to calculate the sample size so that the total sample size with 10% non response rate recruited for this study were 200 with 100 cases and 100 controls which was selected from under five children with diarrhea visiting JUSH and SGH during the study period in fulfilling required criteria using systematic sampling method.

Results: The finding of this study were child family drinking water source (OR=3.26; 95% CI : 1.04- 10.25), child diarrheal duration (OR=2.57; 95% CI : 1.06- 6.38), mother living with other (OR=29.85, 95% CI : 1.78- 50.88), father educational status (OR=0.11; 95% CI : 0.03- 0.47), residence (OR=3.89, 95% CI 1.03- 14.68) and house hold head (OR=0.31, 95% CI 0.001- 0.22).

Conclusion: The socio- demographic and environmental factors described in this study are determinants in increasing the risk of acute malnutrition among under five

children with diarrhea. It includes drinking water source, residence, diarrheal duration, house ownership, child father educational status, house hold head. To reduce child acute malnutrition in conjunction with other strategies due emphasis should be given the knowledge and practice of parents on appropriate infant and young child feeding practices, environmental sanitation, promoting drinking water treatment for the child, piped water to be constructed for rural community, standardized toilet for individual house hold to be owned, mother or care taker hand washing practices and availing water and soap near toilet for each house hold.

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## Acronomy

BMI	Body mass index
HFA	Height for age
JUSH hospital	Jimma University Specialized hospital
MAM	Moderate acute malnutrition
MUAC	Mid- upper arm circumference
NCHS statistics	National center for health statistics
SAM	Severe acute malnutrition
SGH	Shenen Gibe Hospital
WASH	Water, sanitation and hygiene
WFA	Weight for Age
WFH	Weight for Height
WHO	World health organization

## Chapter one: Introduction

### 1.1 Background

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients (1). Malnutrition includes: Protein-energy malnutrition which results from any deficiencies in any or all nutrients and micro-nutrient deficiency which results from a deficiency of specific micro nutrients. Again also protein-energy malnutrition in children includes acute malnutrition which have wasting or thinness appearance caused by inadequate nutrition over a short period of time leading to rapid weight loss or failure to gain weight normally, chronic malnutrition which have stunting or shortness appearance which happen as a result of inadequate nutrition over long period of time leading to failure of linear growth, and acute and chronic malnutrition which do have underweight appearance – a combination measure, therefore, it could occur as a result of wasting, stunting, or both (2).

Acute malnutrition is a recent and severe weight loss (wasting) as a result of acute food shortage and/or illness. In children, acute malnutrition is synonymous with growth failure in which the malnourished child is shorter and lighter than they should be for their age. Protein energy malnutrition has been identified as a major health and nutritional problem. It is not only an important cause of mortality and morbidity but also leads to physical and mental impairment in children (3). Acute malnutrition includes both moderate acute malnutrition (MAM) and severe acute malnutrition (SAM) where; MAM is in which WFH is in between 70% and 80% or MUAC  $\geq 110$  mm &  $\leq 120$  mm ( $\geq 11$ cm &  $\leq 12$ cm) and SAM is in which visible severe wasting or WFH  $< 70\%$  or by the presence of bilateral pitting edema of nutritional origin or MUAC  $< 110$ mm ( $< 11$  cm) in children aged 6–59 months, is also an indicative of severe acute malnutrition (4).

In addition to PEM, children may be affected by micronutrient deficiencies, which also have a detrimental effect on growth and development. The most common and clinically significant micronutrient deficiencies in children and childbearing women

throughout the world include deficiencies of iron; iodine, zinc, and vitamin A are estimated to affect as many as two billion people. Although fortification programs have helped diminish deficiencies of iodine and vitamin A in individuals in the United States, these deficiencies remain a significant cause of morbidity in developing countries, whereas deficiencies of vitamin C, B, and D have improved in recent years. Micronutrient deficiencies and protein and calorie deficiencies must be addressed for optimal growth and development to be attained in these individuals (5).

Symptoms of under nutrition include lack of appetite or interest in food or drink, tiredness and irritability, inability to concentrate, always feeling cold, loss of fat, muscle mass, and body tissue, higher risk of getting sick and taking longer to heal, longer healing time for wounds, higher risk of complications after surgery, depression, breathing becomes difficult, skin may become thin, dry, inelastic, pale, and cold, the cheeks appear hollow and the eyes sunken, as fat disappears from the face, hair becomes dry and sparse, falling out easily, etc. (5).

Under nutrition can be assessed in children with a history of adequate food intake and signs/symptoms of malnutrition, focus on identifying the cause of malnutrition and physical examination. Under nutrition are also assessed by biochemical tests which include hematological studies which include CBC count with RBC indices and a peripheral smear. This could also help exclude anemia from nutritional deficiencies such as iron, folate, and vitamin B-12 deficiencies. Measures of protein nutritional status include serum albumin, retinol-binding protein, pre-albumin, and transferrin, creatinine, and BUN levels. Under nutrition are also assessed by using anthropometry measurements in which MUAC, Weight-for-height, height-for-age, BMI which are most commonly used for assessment (6).

Under nutrition can be managed in children with chronic malnutrition may require caloric intakes of more than 120-150 kcal/kg/day to achieve appropriate weight gain. Most children with mild malnutrition respond to increased oral caloric intake and supplementation with vitamin, iron, and folate supplements. The requirement for increased protein is met typically by increasing the food intake. Management must be

carried out in centers by physicians familiar with nutritional disorders as nutritional recovery syndrome may include excessive sweating and hepatomegaly. Re-feeding syndrome is a potentially life threatening condition that occurs with administration of high calorie feeds in severely malnourished children. This potentially fatal condition is associated with electrolyte disturbances including hypokalemia and hypophosphatemia (6).

The prevention of under nutrition in children starts with an emphasis on prenatal nutrition and good prenatal care. Promotion of breastfeeding is particularly crucial in developing countries where safe alternatives to human milk are unavailable. Health care providers should also counsel parents on the appropriate introduction of nutritious supplemental foods (6).

### **1.2 Statement of the problem**

Malnutrition has become a serious health issue, threatening the progress of developing countries across the entire world. Malnutrition is a serious problem in the world; currently, 195 million under- five children are affected by malnutrition globally; 55 million of them suffer from acute malnutrition and around 26 million under- five children are severely acute malnourished. Among the total under- five children suffering from malnutrition, 90% lives in sub- Saharan Africa and South Asia. Every year, 3.5 million children die of malnutrition- related causes in the world (7). Hence, it is at third level in the world of the disease burden in this age group (8). Even though childhood acute malnutrition declined relatively during the year 1990's globally; its burden in Africa was increased. Thus, in the developing countries more than 25% (143 million) under- five children are malnourished. Among these, nearly three quarters live in just 10 countries in Sub- Saharan Africa region and more than one- quarter of children under- five are malnourished in Nigeria and Ethiopia alone which accounts more than 33% (7).

About 1.7 to 5 billion cases of diarrhea occur per year. It is most common in developing countries, where young children get diarrhea on average three times a year (9). Total deaths from diarrhea are estimated at 1.26 million in 2013 – down from 2.58 million

in 1990(10). In 2012, it was the second most common cause of deaths in children younger than five (0.76 million or 11%) (9,11). Frequent episodes of diarrhea are also a common cause of malnutrition and the most common cause in those younger than five years of age. Other long term problems that can result includes stunted growth and poor intellectual development (9)

In 2016 globally, 44.5- 58.9 millions children under five were wasted of which 13.3- 20.5 millions were severely wasted. This translates into a prevalence of 6.6% - 8.7% and 2.0% - 3.0% respectively. In which half of all wasted children lived in South Asia and about one quarter in sub-Saharan Africa, with similar proportions for severely wasted children. The prevalence of south Asia's wasting was 13.4% - 19.1% which represents a 'critical' public health problem; that of the Middle East and North Africa is 5.0% - 11.0% of wasting prevalence approaching a 'serious' need for intervention with appropriate treatment programmes. Under- five wasting and severe wasting are highly sensitive to change (12).

According to 2016 global wasting malnutrition Percentage of under five children trends by regions are central America 0.7% - 1.2%, Southern America 0.7% - 2.3%, Caribbean 1.8% - 5%, South Asia 13.4% - 19.1%, East Asia and the pacific 1.6% - 6.5%, sub-Saharan Africa 6.5% - 9.3%, Eastern and South Africa 4.8% - 9.1%, and North Africa 4.4% - 13.8% (12).

Globally, child malnutrition is a public health problem with major consequences for child survival, damaging the cognitive and physical development of children and the economic productivity of individuals and societies (13, 14). Malnutrition contributes to 50% of all child deaths and 11% of the total global disability- adjusted- life- years worldwide. Geographically, 70–80% of undernourished children worldwide lives in lower and middle income countries, including Ethiopia (15). Under nutrition accounts for 45% of deaths of children younger than 5 years, and contributes to more than three million deaths every year (13, 16, 17). Acute malnutrition is an indicator of an emergency that requires urgent action. The UN estimates that acute malnutrition affects 8% of children (52 million) across the world (1 in 12 children in this age group

(18). Globally, acute malnutrition accounts for >50% of cases of childhood mortality (about 3.5 million deaths) in children under 5 each year (19).

Ethiopia is one of the many countries facing this dangerous health condition. Malnutrition in Ethiopia affects 2.7 million people who are acutely food insecure. Perhaps the worst part of this health issue is the effect malnutrition has on children. According to USAID, 44 percent of Ethiopian children under the age of 5 suffer from chronic malnourishment, also known as “stunting.” The World Food Programme’s “The Cost of Hunger in Ethiopia” report revealed that since a maximum of 81 percent of all the reported malnutrition cases go untreated, 28 percent of children younger than 5 die from malnourishment every year in Ethiopia alone. Since malnourishment is a lifelong condition, it also affects the quality of education and productivity in countries like Ethiopia. In addition, the amount of individuals in the workforce has decreased by 8 percent due to the high rates of child mortality. Not only does malnutrition in Ethiopia threaten the lives of millions, it also keeps this country from escaping the cycle of poverty. According to the “Oxford Poverty and Human Development Initiative Multidimensional Poverty Index,” Ethiopia is the second poorest country in the world for the fourth year in a row. Child malnutrition alone costs the Ethiopian government about 5.5 million dollars every year, which is 16.5 % of Ethiopia’s GDP (20).

According to the latest WHO data published in May 2014 malnutrition Deaths in Central African Republic reached 3,674 or 5.92% of total deaths which ranks Central African Republic #1 in the world, in Eritrea reached 1,931 or 5.36% of total deaths which ranks Eritrea #8 and in Ethiopia reached 28,560 or 4.75% of total deaths which ranks Ethiopia #14 in the world (21)

The magnitude of wasting is substantial and persistent in the Sub-Saharan Africa (SSA) (22) including Ethiopia where many children are suffering from the effects of acute malnutrition (23). In Ethiopia despite recent economic progress, nutritional status of children is among the worst in the world and it remains major public health problem (24).

Across the globe, an estimated 16 million children under the age of 5 are affected by severe acute malnutrition. This number is staggering – most importantly, because children with severe acute malnutrition are nine times more likely to die than well-nourished children. These deaths are the direct result of malnutrition itself, as well as the indirect result of childhood illnesses like diarrhea and pneumonia that malnourished children are too weak to survive. Ethiopia is facing its worst drought in decades, with over 10.2 million people requiring food aid in 2016. An estimated 435,000 children are in need of treatment for severe acute malnutrition (SAM), and more than 1.7 million children, pregnant and lactating women with moderate acute malnutrition (MAM) will require supplementary feeding. Its face is a child – frail and skeletal – who requires urgent treatment to survive (25).

A child with severe acute malnutrition has very low weight for their height and severe muscle wasting. They may also have nutritional edema – characterized by swollen feet, face and limbs. About two thirds of these children live in Asia and almost one third live in Africa. Severe acute malnutrition is a major cause of death in children under five years, and its prevention and treatment are critical to child survival and development. But, the majority of cases occur in developing countries not affected by emergencies. These settings are plagued by chronic poverty, lack of education, poor hygiene, limited access to food and poor diets. The result is significant barriers to sustainable development in these nations (26).

Severe acute malnutrition (SAM) is a major cause of child mortality under 5 years of age (27). Severe acute malnourished children are nine times more likely to die than healthy children, moderate acute malnutrition (MAM), faces a three times greater risk of dying than a well-nourished child (28). Globally, it is estimated that there are nearly 20 million severe acute malnourished children (29). The UN estimates that around one million children under the age of 5 die every year from SAM (28). Similarly, the prevalence of wasting among children younger than 5 years is 3.6% (12.9 million) in Asia and 3.3% (18.5 million) in low and middle income countries (30).

In Ethiopia 47% of children under five are stunted and 24% are severely stunted.



11% of children under five are wasted and 2% are severely wasted. The weight for age indicator shows that 38% of children under five are underweight and 11% are severely underweight (31).

***Rational of the study.*** Literature review revealed that some of acute malnutrition risk factors are age of child, income of family, education status of mothers, family size, lack of exclusive breast feeding, house hold food insecurity, etc. Acute malnutrition problem is still a major concern in Ethiopia based on WHO Crisis Classification using rates of Global Acute Malnutrition (GAM) for which the prevalence lies between 10% - 14% is considered to be as serious problem in which the Ethiopian acute malnutrition prevalence lies between this ranges. No study was conducted before about determinants of acute malnutrition amongst under- five children with diarrhea; in general in Ethiopia and in particular in study area. Again in jimma zone the agricultural production is based on coffee cash crops and khat use which is directly or indirectly have an effect on nutritional status of children. Also culturally under nutrition is considered as 'bird diseases' that are caused by supernatural forces which is far apart from the truth. Therefore, this study is aimed to determine factors associated with the nutritional status of the children 0- 59 months with diarrhea in jimma zone public hospitals.

In contexts of most developing countries, it has been difficult to elucidate the relative contributions of different risk factors of acute malnutrition under five children with diarrhea. Efforts to improve nutrition have focused on the immediate causes of under nutrition, including the quantity and quality of foods and micronutrients. Much less attention has been paid to the underlying causes of under nutrition, particularly the role of water, sanitation and hygiene. Though randomized trials are highly efficacious interventions in demonstrating causal relationships, relatively few such trials have been conducted, and very few have reported attributing risks in developing countries. The independent contributions of underlying factors are not well investigated in Ethiopian context. Although the immediate causes of acute malnutrition among children are known (such as food insecurity), environmental, community

socioeconomic and demographic determinants is not well explored, and the interrelationship between such contextual and individual factors remains understudied. Thus, this study will explore knowledge about factors associated with acute malnutrition in large pool of children with diarrhea in jimma town where khat use are common and is also essential for building effective prevention programs.

## **Chapter two: Literature review**

Adequate food and nutrition are essential for proper growth and physical development to ensure optimal work capacity, normal reproductive performance, adequate immune mechanism, and resistance to infection. Inadequate diet may produce several forms of malnutrition in children, the most important being protein energy malnutrition (PEM), nutritional anemia, vitamin A deficiency and Iodine deficiency disorder. These and other nutritional disorders may also serve as predisposing factors for several chronic and crippling diets related non-communicable diseases and have lasting effects throughout the life span (32). Deficiencies of key vitamins and minerals continue to be pervasive, and they overlap considerably with problems of general under nutrition (underweight and stunting). A recent global progress report states that 35 percent of people in the world lack adequate iodine, 40 percent of people in the developing world suffer from iron deficiency, and more than 40 percent of children are vitamin A deficient (33). The three commonly used indicators of malnutrition are height- for age, weight- for- age, and weight- for height. Children whose measurements fall below two standards deviations from the reference median are generally considered malnourished. Each indicator captures different aspects of malnutrition (35). There are a number of potential disruptions to global food supply that could cause widespread malnutrition. Major causes of malnutrition include poverty and food prices, dietary practices and agricultural productivity, with many individual cases being a mixture of several factors. Malnutrition can also be a consequence of other health issues such as diarrheal diseases or chronic illnesses (35).

### **2.1 House hold food security**

Food Security generally defined as all people, at all times, have physical and economic access to sufficient safe and nutritious food for a healthy and active life. Insufficient household food security was assessed by mothers daily meal frequency and monthly diversity of foods consumed. A food crisis is defined as unusual and severe food insecurity that threatens peoples' lives/livelihoods. It will depend on the underlying vulnerability of the affected population, the intensity and nature of the external shock, the duration of the crisis, the coping capacity of the population, and the response of government and humanitarian agencies (36).

## **2.2 Feeding Frequency and Diversity of food**

Feeding Frequency and diversification is among the immediate cause for malnutrition. Based on the WHO and UNICEF guidelines, minimum dietary diversity for breastfed children aged 6- 23 months include foods from at least four of the following categories: 1) grains, roots and tubers; 2) legumes and nuts; 3) dairy products; 4) fresh foods; 5) eggs, 6) vitamin- A rich vegetables and fruits; and 7) other fruits and vegetables. Minimum meal frequency is defined as solid, semi- solid or soft food twice per day for breastfed children aged 6- 8 months and three times daily for breastfed children 9- 23 months. The surveillance also assessed prevalence of minimum acceptable diet, which is a composite indicator of dietary diversity and meal frequency (37).

A study in Nepal shows for children aged 6- 8 months, 90.9% received complementary food in accordance with minimum meal frequency requirements, and 82.5% of children aged 9- 23 months received the appropriate number of meals per day. However, only 18.0% of children aged 6- 23 months received the minimum in dietary diversity. These two indicators combined resulted in only 17.0% of children in this age group receiving the minimum acceptable diet. Of particular concern is the fact that only 49.0% of children aged 6- 23 months in the sample received animal source foods, and an even smaller proportion (37.0% ) received vitamin- A rich fruits and vegetables. Due to this 30.0% of children aged 0- 59 months from the probability sample had suffered from diarrhea, 17.0% had an acute respiratory infection and 36.7% suffered from another illness. Accounting for the overlap of illnesses, 55.5% of

children were recorded as suffering an illness (38).

Study from Somali region shows that with the exception of the youngest age group, increases in feeding meat are all below 10% in children of all ages. Frequencies are associated broadly with improvement in prevalence of underweight. Similarly, increases in dietary diversity are also associated with improvements in underweight, with the exception of the youngest group. After 12 months consumption of cereals and milk increases to at least 80% of children. And oil to 50%. Consumption of carotene containing foods, tubers, legumes, and fruit (36).

Study done in India on SAM category increased significantly if they have the same food utilized more than once in a day, give prelacteal feeds, have a lower frequency of breast feeding, do not use semisolid food during the weaning period, exclusively breast feed for less than four months or more than six months, had low birth weight, have five or more episodes of illness in the previous year, have  $\leq 3$  feeds per day apart from breast milk, and not initiation of breast feeding within 30 min of birth(39).

The overall prevalence of wasting was 18.2%; 10.3% and 7.9% of the children were moderately and severely wasted, respectively. Poor dietary diversity (AOR = 2.08), late initiation of breastfeeding (AOR = 1.43, no postnatal vitamin- A supplementation (AOR = 1.55), and were independently associated with wasting in the study area (40).

### **2.3 Socio- economic and demographic variables**

A study conducted in Mali shows that; socio- economic variables are strongly related to stunting and wasting. In other words, chronic malnutrition of children under- five is very important among children whose parents grow millet and sorghum as main crops i.e. zone of lakes (43%). The stunting rate is less in the zones where development potentials exist i.e. livestock zone (32%), village irrigated perimeter zone (35%), river zone (37%). The stunting rate decreases when one moves toward the city. Based on this result, the diversification of agricultural production systems, for example the cultivation of beans or sweet potato in the lakes for household food consumption might be one of the solutions to child under- five malnutrition in the study zone (41). Early marriage and early first delivery are common, particularly in Maradi Region where acute malnutrition rates have been very high over time. This cultural tradition

contributes to a high fertility rate and as well as to the associated problems of high maternal and child mortality and poor infant and young child feeding. Furthermore educational status and literacy rates are particularly low among women. School attendance is estimated at 27 percent for females and adult literacy for women is less than 15 percent (42).

The study done in the Kampala shows that SAM among children under the age of 5 years was 4.14%. Factors that were significantly associated with SAM are low socioeconomic status (AOR 17.13), mother's age at birth <20 or >35 years (AOR 3.21, birth interval <24 months (AOR= 4.09), illiterate father (AOR= 3.65) bottle feeding (AOR= 2.19), and not initiating complementary feeding at the age of 6 months (AOR= 2.91), mother's educational level, initiation of breastfeeding, colostrums feeding, and exclusive breastfeeding were not significantly associated with SAM (43). Study done in afar shows rural residence (AOR = 2.42), illiterate father (AOR = 2.47), Monthly income of less than 1000 birr (AOR = 3.98), and food served together with family (AOR = 2.18), were associated with acute malnutrition (44).

Research conducted in Gondar university hospitals revealed that severe acute malnutrition were associated with maternal illiteracy (OR=3.83), paternal illiteracy (OR=2.04), monthly family income of less than USD (OR=3.44, 95% CI 1.66- 7.20) and large family size with the number of children greater than three (OR=1.96) (45).

Study done on SAM in India shows the factors associated with SAM were age (OR= 0.97), nuclear family (OR= 1.25), lower occupation of head of family (OR= 1.29), and lower paternal education (OR: 1.49) as independent predictor of SAM (46).

#### **2.4 Child factors**

Also Risk factors for acute malnutrition in under five children in Gondar university hospital were showed that supplementation with pre-lacteal feeds (OR= 2.31), lack of exclusive breast feeding practices in the first six month age (OR 3.00), late initiation (at 12 months or later) age of complimentary diet (OR= 4.03), and bottle feeding (OR= 3.01) (45).

## 2.5 Environmental and health services factors

According to research done in Nekemt and Gida Ayana Hospital wasting was associated with absence of latrine (AOR =2.99), of less frequent hand washing (AOR =14.39) (47).

Inadequate access to clean water and proper sanitation increases the risk of a range of health problems. Globally, children under five are the victims of 80% of sanitation-related illnesses and diarrheal disease, primarily because of their less-developed immunity and because their play behavior can bring them into contact with pathogens. Diarrheal diseases also results in higher levels of malnutrition and increased vulnerability to other illnesses, with effects on overall development (48).

As found by the study conducted in northwestern Uganda, children whose families used water from unprotected sources were more underweight than their more fortunate counterparts. However, the source of water had no effect on the incidence of stunting (49). The five percent of rural households with access to piped water have to travel one hour, on average, to get to the water source. A significantly higher proportion of urban households nearly 80 percent have access to piped water in or outside their compound. In general, water obtained from surface sources, such as river, lake, pond or dam, is considered unsafe. These sources are likely to be contaminated in an environment where there is a lack of sanitation facilities. A significant proportion of the rural populations 42.1% obtain their drinking water from these surface sources. These water sources are likely to be contaminated. It includes piped water whether inside or outside of the compound as well as water from a well, as long as access to those sources is less than 30 minutes away from the household (50).

The odds of a child being in the SAM category increased significantly in India if the family: was below the poverty line, have less rooms in the house, have a working mother, has a mother with a lower level of education, have an unemployed father, did not use any water purification measure, did not always ensure parents washed their hands before feeding a child, did not wash hands with soap and water after defecation (b) The factors that were found to be significantly associated with child malnutrition parent's unemployment (AOR=50.3, 95% CI 4.86- 52.1)

Study done on the socio-demographic factors associated with malnutrition in Ghana Accra hospital revealed that interventions, inadequate antenatal visits, faltering growth and not de-worming one's child were associated with malnutrition. Immunizations and Vitamin A supplementation were not associated with malnutrition (51).

## **2.6 Diseases**

According to research done in Nekemt referral hospital and Gida Ayana hospital Wasting was associated with diarrheal diseases in the previous two weeks (AOR= 3.94), and febrile illness in the previous two weeks (AOR= 1.89) (47).

## **2.7 Vaccination**

A study conducted at Somali region shows children who were vaccinated against measles had a reduced risk of malnutrition. The coverage of vaccination was not uniform, but tended to focus on the more accessible kebeles, so there is concern that vaccination was just a marker of better access to communications in general. In the multiple logistic regression models, however, this association was also apparent, suggesting that the vaccination itself was protective against stunting (36).

## 2.1 Conceptual frame work

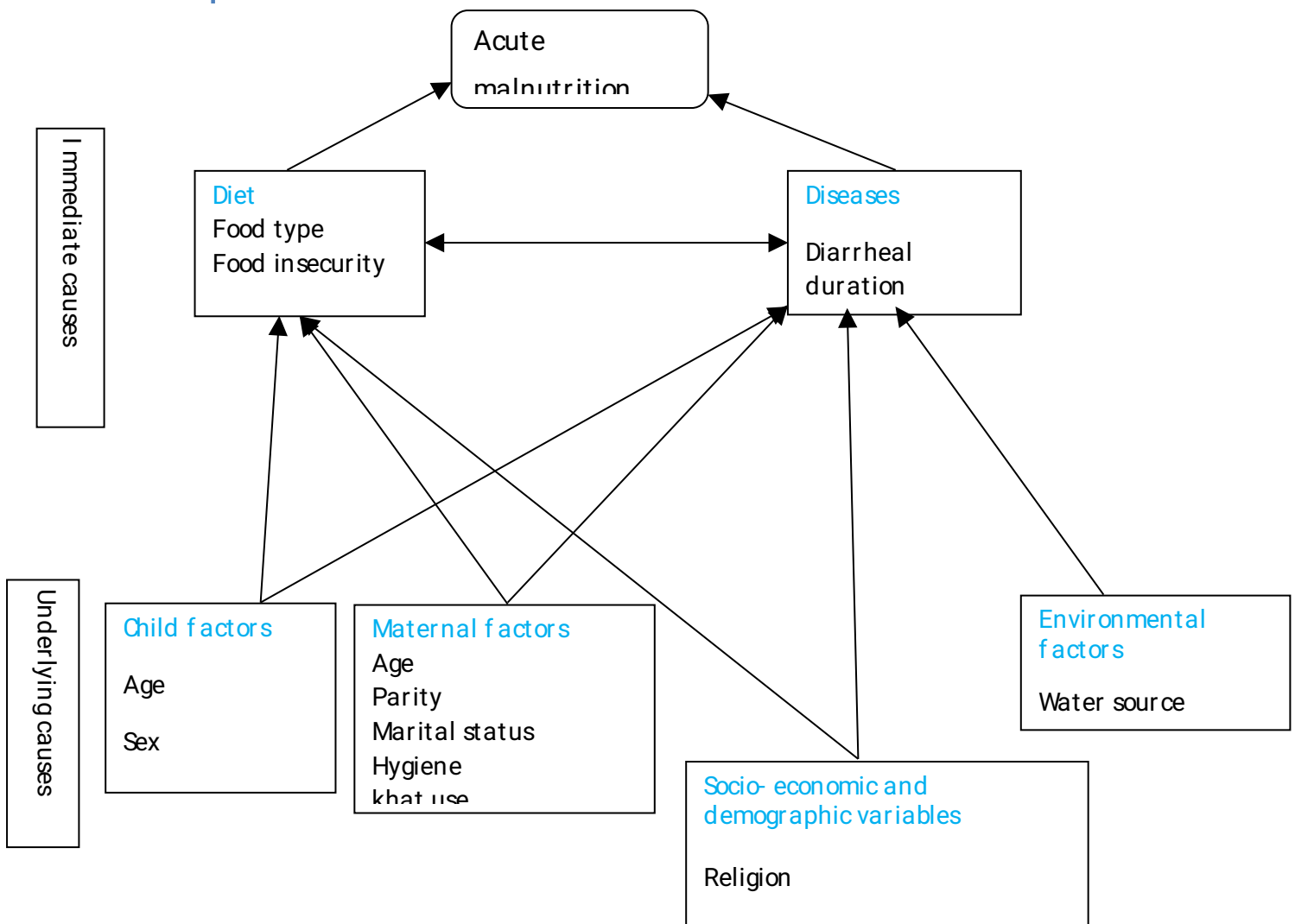




Fig. 1 Adapted from UNICEF Malnutrition Conceptual framework (2013)

## 2.2 Significance of the study

Currently, global warming is a great challenge in the world especially for developing countries this causes drought, which in turn causes food insecurity, malnutrition, and diarrheal diseases in children's. In another way in the community the nutritional problems are affected by different socio-cultural factors and in some society they consider that it is caused by supernatural force and in another places they consider as bird diseases so that to tackle this problems this study is going to create awareness on nutritional determinants and house hold food diversity for all community especially pregnant women and children.

By providing empirical evidence, the results of this study contribute to the growing of the body of knowledge about the factors influencing malnutrition in under-five children with diarrhea.

They could also influence the formulation of appropriate policies aimed at addressing those factors. Relevant interventions could then be designed on under nutrition with the view to reduce the incidence of malnutrition in under-five children with diarrhea. To address this issue, this study will be conducted in jimma town public hospital, Southwest Ethiopia. Through identification of risk factors of child malnutrition, the study is expected to alleviate the burden of acute malnutrition and its consequences in low awareness area. Also this study helps in preventing economic crises of the

community that will happen as a result of direct and/or indirect result of costs for medical costs.

## **Chapter 3: Research questions and objective of the study**

### **3.1 Hypothesis**

1. To compare determinants of acute malnutrition among under five children with diarrhea and without diarrhea.
2. Does socio-economic and demographic variable increase the occurrence of acute malnutrition in under five children with diarrhea?
3. Does the environmental factor increases the occurrences of acute malnutrition among under five children with diarrhea.

### **3.2 General objective**

T assesses determinants of acute malnutrition among under five children with diarrhea in jimma town public hospital, Jimma, southwest Ethiopia March 1- April 30, 2018.

### 3.3 specific objectives

- ✓ To identify determinants of acute malnutrition among children with diarrhea younger than fifty nine months.

## Chapter four: Method and material

### 4.1 Study area and period

This study was conducted in Jimma University specialized Hospital and shenen Gibe hospital in Jimma town, Oromia region, south- western part of Ethiopia which is 345km away from Addis Ababa, capital city of Ethiopia. Jimma town is an administrative center of the jimma zone with total population of 199,575 in 41,578 households in seventeen kebeles with the latitude time 740'0.012"N, longitude time 36491'.59.880"E, and an altitude of 1763m . The town does have two public hospitals and one private hospital, four public health centers, seventeen health posts, and 72 private health institutions (34 clinics, 34 drug store and 4 whole sellers) to give the required health services. Both hospitals offers a range of services, including maternity care (antenatal, labor, postnatal), gynecological care (outpatient and inpatient care, post abortion care), neo- natal and follow up care for premature infants, voluntary counseling and testing of women and child health care services. The study was carried

out from March 1- April 30, 2018.

## 4.2 Study design

Case- control study design was used to determine risk factors of acute malnutrition among under five children with diarrhoea in JUSH and SGH.

## 4.3 Population

### 4.3.1 Source population

All under five children with diarrhea who attend JUSH and SGH during the study period

### 4.3.2 Study population

Cases: under five children with diarrhea and who had WFH<80% from NCHS median value or bilateral pitting edema.

Controls: under five children with diarrhea and who had WFH≥80% from NCHS median value or without bilateral pitting edema.

## 4.4 Eligibility criteria

### 4.4.1 Inclusion criteria

- ✓ Cases: Selected under five children with diarrhea who had acute malnutrition (WFH<80% from NCHS median value or bilateral pitting edema)
- ✓ Controls: selected under five children with diarrhea who hadn't acute malnutrition (WFH≥80% from NCHS median value or no bilateral pitting edema)
- ✓ Diarrhea: selected cases and controls under five children having three or more watery stool in the last two weeks.

### 4.4.2 Exclusion criteria

- ✓ Those who refuse to participate and/or seriously ill

- ✓ Those who are unable to communicate for different reasons
- ✓ Children who had physical deformities (children born without hands due to congenital deformities, wounded, and burned hands)

#### 4.5 Sample size determination

The sample size was calculated by using formula for matching case-control study. The sample size was calculated by considering the proximate determinants (main exposure variables) such as age of the child, family monthly income, educational status of the mother, BMI of the mother, residence, lack of exclusive breast feeding, marital status of the mother, sanitation were considered as an independent variable. BMI of the mother was chosen as an independent variable since it gave maximum sample size as compared to other proximate determinants. The BMI of the mother was considered as a main exposure variable with an odds ratio of 2.8 and expected proportion of the cases among the controls 14.3% (48) from study done in Bangladesh at 95% CI, 80% power of the study and control to case ratio of 1:1. Sample size was calculated by binary exposure using difference in proportion formula.

$$n = \left( \frac{r+1}{r} \right) \frac{(\bar{p})(1-\bar{p})(z_{\beta} + z_{\alpha/2})^2}{(p_1 - p_2)^2}$$

Where:

n=Sample size in the case group

r= ratio of controls to cases

$Z_{\beta}$ = desired power (80% power,  $Z_{\beta}$ =.84)

$Z_{\alpha/2}$ = desired level of statistical significance (95% confidence level,  $Z_{\alpha/2}$ =1.96)

$P_1 - P_2$ = Effect Size (the difference in proportions)

P= measure of variability

To get proportion of cases among exposed:

$$P_{\text{casesexposed}} = \frac{OR \cdot P_{\text{controlsexp}}}{P_{\text{controlsexp}} (OR - 1) + 1}$$

$$\begin{aligned} P_{\text{casesexposed}} &= \frac{(2.8) (.143)}{(.143)(2.8 - 1) + 1} \\ &= 0.318 \end{aligned}$$

$$\begin{aligned} P &= P_{\text{average}} = \frac{P_{\text{casesexp}} + P_{\text{controlsexp}}}{2} \\ &= \frac{0.318 + 0.143}{2} \\ &= 0.2305 \end{aligned}$$

$$\begin{aligned} \text{So, } n &= \frac{(1 + 1/1) (0.2305) (1 - 0.2305) (0.84 + 1.96)^2}{(0.318 - 0.143)^2} \\ &= \frac{(2) (0.2305) (0.7695) (7.84)}{(0.030625)} \\ &= 91 \end{aligned}$$

By adding 10% non response rate the final sample size was 200 with 100 cases and 100 controls were enrolled for this study.

#### 4.6 Sampling technique

Both Jimma town public hospitals were included in which 100 children who were acutely malnourished and 100 well nourished but visited/ admitted to the hospitals for health care issues were selected. Children aged 0–59 months with or without acute malnutrition were allocated to the hospitals depending on the average previous month's acutely malnourished children flow to the hospitals.

From prior to data collection time, four months of acute malnutrition data report was taken in consideration, an average of 88 children with acute malnutrition were reported at Shenen Gibe hospital. Depending up on this; 64 samples were allocated to Shenen Gibe hospital and systematic sampling technique was used to select every 3rd child until the allocated sample reached. Depending on this 32 cases and 32 controls

were enrolled for study in which random start was selected randomly from the first interval.

Similarly in Jimma university referral hospital prior to data collection time four months of acute malnutrition data report was taken in which an average of 184 children with acute malnutrition were reported .Based up on this, 136 samples were allocated to JUSH and systematic sampling technique was used to select every 2<sup>nd</sup> child until the allocated sample reached. Depending on this 68 cases and 68 controls were enrolled for this study in which random start was selected randomly from the first interval.

## 4.7 study variables

### 4.7.1 Dependent Variables

- ✓ Acute malnutrition

### 4.7.2 Independent variables

- ✓ Socio –economic & demographic variables

- o *Family size*

- o *Parental occupation*

- o *Religion*

- o *Ethnicity*

- o *Income*

- o *Asset*

- o *Residence*

- ✓ *Child factors*

- o *Age*

- o *Sex*

- o Feeding practices*
  - o Immunization status*
- ✓ Maternal factors
  - o Age*
  - o Hygiene*
  - o parity*
  - o Marital status*
  - o Khat use*
- ✓ Nutritional factors
  - o Food type*
  - o Feeding frequency*
- ✓ Environmental factors
  - o Sanitation*
  - o Water sources*
  - o Latrine*
- ✓ Diseases
  - o Acute febrile illness*
  - o Diarrheal duration*
  - o Pneumonia*

## 4.8 Data collection

### 4.8.1 Data collection instrument

The source of data for the study was obtained from mothers' interview by using structured



questionnaire which was adapted after thorough review of different literatures which is used to collect data related to the objectives of the study. It includes basic demographic factors, dietary factors, maternal factors, child factors and environmental factors. The questionnaire was prepared originally in English and then translated to Afan Oromo/Amharic by English teachers qualified with degree and who can speak Afan Oromo and Amharic. Translation back to English was done to check its consistency was done by another English teacher qualified with degree and who can speak both Afan Oromo and Amharic. The questionnaire was administered in Afan Oromo/Amharic.

#### **4.8.2 Data collection technique**

Face to face mother interview were used to collect data of past exposure status of all eligible children, and respective mothers/ care takers by data collectors with under close supervision of the assigned supervisors and principal investigator. Also observational data collection method was used in the case of anthropometric measurements like weight, height, and edema. Edema was diagnosed if a bilateral depression (pitting) remained after the pressure was released. Assessment for all children that are enrolled for study participants after the proper training and standardized procedure was set.

Record review data collection method was also used for immunization status of the children by reviewing from immunization card or by asking mother/care taker does the child has completed or not.

#### **4.8.3 Pre- testing**

Pre- testing of the questionnaires was done on 30 patients in order to assess the clarity of each question (whether the question is capturing information it is intended to measure to meet the goals and objectives of the study) and analyzing the various aspects of questionnaire as a whole in Agaro hospital and adjustments were made on the questionnaire based on the identified problems.

#### **4.8.4 Data quality assurance**

The data collectors were trained for one and half days as long as how go for data collection and daily supervision and support were made at facility level during data

collection. The questionnaires were pre- tested in Agaro hospital to assess the clarity, sensitivity, reaction, interview time to questionnaires. A supervisor and principal investigator were closely following the day to day data collection process and ensure completeness and consistency of the collected questionnaires on a daily basis.

Edema was assessed by applying normal thumb pressure on both feet for three seconds. Those study participants showed shallow print persists on the both feet, then the child was present edema. Only children with bilateral edema were recorded as having nutritional edema.

Weights of children was weighed by using weighing sling (spring balance), also called 'Salter scale' of 25 kg hanging spring scale graduated to 0.100kg for those ages less than two year. The child was placed on the plastic washing basin which is attached to the Salter scale after the pointer of the scale was adjusted to zero level and taking off the child's heavy clothes and shoes, and the result was read at eye level soon. For those children ages in between two and five years they were weighed with beam balance and the scale was re- adjusted to zero before each weighing. Each day during data collection, data was collected after the scale is checked by using a known weight; the measurement record was done to the nearest 100 grams.

The heights of children, those less than two year were measured using wooden measuring board (sliding board) after placed on leveled ground. The child was placed, lying along the middle of the board. The data collector was holds the sides of the child's head and positions the head until it firmly touches the fixed headboard with the hair compressed. The measurers were places his/her hands on the child's legs, gently stretches the child and then keeps one hand on the thighs to prevent flexion. While positioning the child's legs, the sliding foot- plate was pushed firmly against the bottom of the child's feet. The measure was read, after the foot- plate perpendicular to the axis of the board and vertical. The height was read to the nearest 0.1 centimeter. For height of children between two years and five years, the measuring board was fixed upright where the ground is level. Then the child was stand, upright in the middle, against the measuring board. The child's head, shoulders, buttocks, knees,

heels was held against the board by the assistant, while the other person was positioned the head and the cursor. The height was read to the nearest 0.1 centimeter. Diarrhoea also assessed by the duration of diarrhea, frequency of diarrhea in the past 24 hours, stool consistency, presence of blood in the stool, and dehydration.

#### **4.9 Operational definition**

Case: Child with WFH < 80% from NCHS median value or presence of bilateral pitting edema of nutritional origin with diarrhea complain.

Control: child with WFH  $\geq$ 80% from NCHS median value or without bilateral pitting edema of nutritional origin with diarrhea complain.

Diarrhea: a child having three or more loose or watery stools per day.

Low family income: Households earning monthly income below 50 USD.

Anthropometry: The study and technique of taking body measurements, especially for use on a comparison or classification basis.

Permanent Residency: Parents/ caretaker living in the current place for more than six months

Wasting: It is the result of a weight falling significantly below the weight expected of a child of the same length or height. Wasting indicates current or acute malnutrition resulting from failure to gain weight or actual weight loss.

#### **4.10 Data process and analysis**

Data were checked for completeness, coded and entered in to EpiData version 3.1 software and exported to Statistical Package for Social Sciences (SPSS) for Windows version 20. Descriptive statistical techniques were used to obtain summary values for

cases and controls separately.

Bivariate analyses were done to select the candidate variable for multivariate analysis. Twenty two variables were candidates for multivariable logistic regression were their p-value 0.25 or less. These variables are child family residence, house hold head, child father education, child father occupation, house ownership, income sources, child father monthly income, domestic animal ownership, stable food, child age, breast feeding frequency, febrile illness, diarrheal duration, mother marriage age, pregnancy number, mother khat chew status, khat chew frequency, wash and drinking water separation, house cleaning frequency, washing food preparation surface, water source, and treating drinking water. Then, multivariable logistic regression analysis was carried out to isolate significantly associated independent variables with acute malnutrition. To assess the association between acute malnutrition and predictor variable both crude odd ratio (COR) and adjusted odd ratio (AOR) with 95% CI were reported. All tests were two sided and p-value <0.05 was considered to be statistically significant.

#### **4.11 Ethical clearance**

A letter of ethical approval was taken from Ethical Clearance Committee Jimma University (Ref No: JUIH/7095/2010), institute of health science, school of postgraduate to conduct the study in the JUSH and SGH. Then the ethical clearance

was taken to JUSH and SGH medical directory and all concerned officials at all levels were communicated and informed about the purpose of the study, and assured confidentiality of the response and informed consent was obtained from the parents or caregiver of the child. Participation on the study was on voluntary basis. Those children diagnosed as cases and developing diseases were treated accordingly in the Hospital or nearby health center.

#### **4.12 Communication and dissemination of findings**

The results of the study will be disseminated to relevant bodies such as JU epidemiology department, jimma zone health office, JUSH, SGH, OHB, nutrition stake holders etc. This will be done through submission of reports and presenting findings at appropriate trainings, seminars, workshops and conferences. Besides publication of the study findings on the reputable peer-reviewed local/international journal will be considered.

### **Chapter five: Result**

#### **5.1. Result**

##### **5.1.1. Soci- odemographic and economic variables**

A total of 200 under five children with diarrhea attending jimma town public hospital were included in the study, i.e. 100 cases and 100 controls were enrolled. The mean age of cases and controls were 20.2 ( $\pm 14.8$ ) and 22.3 ( $\pm 16.7$ ) months respectively. Majority of cases and controls age were in between 6- 24 months in which 69(69%) of cases and 57(57%) of controls were reported. Nine percent (9%) of cases and thirteen percent (13%) of controls were less than six months age. Among study participants, 60(60%) of cases and 33(33%) of controls were reside in rural and 40(40%) of cases and 67(67%) of controls were live in urban. Child families living in rural were 3.05 times more likely at risk for acute malnutrition than child family living in urban (OR=3.05; 95% CI : 1.71- 5.43).

Based on child father educational level, 48 (48%) of cases and 30(30%) of controls were child father with no formal educational level, 24(24%) of cases and 36(36%) of controls were child father with primary level educated father, and 28(28%) of cases and 34(34%) of controls were secondary and above level educated father. Regarding child father monthly income 21(21%) of cases and 12 (12%) of controls were child father whose monthly income was 500 or less, 45(45%) of cases and 44(44%) of controls were child father monthly income were 501- 100 and 34(34%) of cases and 44(44%) of controls were those child father monthly income were above 1000. In case of asset, child family living dependently with other and those live in a house given by meschein were 4.57 times more likely at risk for child under nutrition than private house owner child family (OR=4.57; 95% CI : 1.25- 16.7).

Table1. Association of socio-demographic and economic factors with acute malnutrition among under five children with diarrhea attending jimma town public hospital, Southwest Ethiopia, March1- April 30, 2018.

Variables	Category	Cases number (%)	Control number (%)	COOR
house hold head	Male	96(96.0%)	88(88.0%)	1
	Female	4(4.0%)	12(12.0%)	3.27(1.02-10.52)*
Residence	Urban	40(40.0%)	67(67.0%)	1
	Rural	60(60.0%)	33(33.0%)	3.05(1.71-5.43)*
Father education status	no education	48(48.0%)	30(30.0%)	1.94(0.99- 3.82)
	primary education	24(24.0%)	36(36.0%)	.810(0.39- 1.66)
	secondary and	28(28.0%)	34(34.0%)	1

	above			
child's father occupational status	Farming	24(24.0%)	22(22.0%)	1
	government employee	13(13.0%)	21(21.0%)	1.51(0.60- 3.78)
	self employee	50(50.0%)	39(39.0%)	0.86(0.32(2.34)
	Laborer	13(13.0%)	18(18.0%)	1.78(0.78- 4.06)
house owner ship	Owned	72(72.0%)	76(76.0%)	1
	Rented	15(15.0%)	21(21.0%)	0.75(0.36- 1.58)
	Other	13(13.0%)	3(3.0%)	4.57(1.25- 16.7)*
Families income source	Animal prod	46(46.0%)	35(35.0%)	1.67(0.74- 3.73)
	Trading	35(35.0%)	45(45.0%)	0.99(0.44- 2.21)
	Salary	15(15.0%)	19(19.0%)	1
child's father monthly income	<=500	21(21.0%)	12(12.0%)	2.27(0.98- 5.23)
	501- 1000	45(45.0%)	44(44.0%)	1.32(0.72- 2.44)
	>=1001	34(34.0%)	44(44.0%)	1

\*p- value <0.05

### 5.1.2 Child hood characteristics

For frequency of feeding, 27(27%) of cases and 17(17%) of controls were children

that fed 1- 4 times per day and (44%) of cases and 42(42%) of controls were fed 5- 8 times per day. Children those fed 1- 4 times per day were 2.24 times more likely at risk for acute malnutrition than those fed nine or more per times (OR=2.24; 95% CI : 1.04- 4.85) . Most children 73(73%) of cases and 55(55%) of controls were reported do have more than three days diarrheal duration and 27(27%) of cases and 45(45%) of controls children diarrheal duration stayed 1- 2 days. For acute malnutrition, three or more day's diarrheal duration on child was 1.56 times more likely at risk than that stay 1- 2 days(OR=1.56;95CI :1.2- 4.6).

Table 2: Associations of child factors with acute malnutrition among under five children with diarrhea attending jimma town public hospital, southwest Ethiopia, March1- April 30, 2018.

Variables	Category	Case number (%)	Control number (%)	COR
Child age in months	<6	9(9.0%)	13(13.0%)	0.94(0.34- 2.59)
	6- 23	69(69.0%)	57(57.0%)	1.65(0.86- 3.17)
	24- 59	22(22.0%)	30(30.0%)	1
Child breast feeding frequency per day	1- 4	27(27.0%)	17(17.0%)	2.24(1.04- 4.85)*
	5- 8	44(44.0%)	42(42.0%)	1.48(0.78- 2.79)
	>=9	29(29.0%)	41(41.0%)	1
Acute febrile illness	Yes	33(33.0%)	46(46.0%)	.58(0.33- 1.03)



	No	67(67.0%)	54(54.0%)	1
Child diarrheal duration in days	1- 2	27(27.0%)	45(45.0%)	1
	>=3	73(73.0%)	55(55.0%)	1.56(1.2- 4.6)*

\*p- value <0.05

NB Acute febrile illness: malaria, meningitis, typhoid and diarrhea that occur in the last two weeks

### 5.1.3 Maternal factors

Based on wash and drinking water separation, 74 (74%) of cases and 86 (86%) of controls were reported as those child family separates for drinking and wash for their child where as 26 (26%) of cases and 14 (14%) of controls were not separate it. Childs family those not separates washing and drinking water for child from adults washing and drinking water were 2.16 times more likely at risk for the acute malnutrition than those separates it (COR=2.16; 95% CI : 1.05- 4.44).

Table 3 Associations of mother factors with acute malnutrition among under five children with diarrhea attending jimma town public hospital, southwest Ethiopia, May, 2018.

Variables	Category	Cases number (%)	Control number (%)	COR
Parity	1	32(32.0%)	42(42.0%)	1
	2- 4	56(56.0%)	48(48.0%)	1.53(0.84- 2.79)
	>=5	12(12.0%)	10(10.0%)	1.58(0.61- 4.10)

mother khat chewstatus	Yes	35(35.0%)	55(55.0%)	.44(0.25- 0.78)*
	No	65(65.0%)	45(45.0%)	1
mother khat chewfrequency	Daily	19(19.0%)	25(25.0%)	.54(0.27- 1.10)
	>=2day interval	18(18.0%)	30(30.0%)	.43(0.21- 0.86)
	Not at all	63(63.0%)	45(45.0%)	1
Child's wash and drinking water separation	Yes	74(74.0%)	86(86.0)	1
	No	26(26.0%)	14(14.0%)	2.16(1.05- 4.44)*

\*p- value<0.05

#### 5.1.4 Environmental factors

According to latrine hand washing facility report large number 63(63%) of cases and 46(46%) of controls do not have latrine hand washing facility and 37 (37%) of cases and 54(54%) of controls child family do have latrine hand washing facility. Those child family who didn't have latrine hand washing facility were 1.29 times more likely at risk for acute malnutrition than those do have latrine hand washing facility (OR=1.29; 95% CI :0.36- 4.73). In case of child's family drinking water source usage almost more than half 56(56%) of cases and 31 (31%) of controls were used river water drinking source (surface water, well water, running water) and 44 (44%) of cases and 69 (69%) of controls used drinking water from piped water source. Those child family used river water as drinking water source were 2.83 times more likely at risk for acute malnutrition than those used piped water source for drinking (OR= 2.83; 95% CI :1.59- 5.06). Table 4 Associations of environmental factors with acute malnutrition among under five children with diarrhea attending jimma town public hospital, southwest Ethiopia, March 1- April 30, 2018.

Variables	Category	Case number	Control number	OR
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		(%)	(%)	
House cleaning frequency per day	1	57(57.0%)	45(45.0%)	1.62(0.93-2.83)
	>=2	43(43.0%)	55(55.0%)	1
latrine hand washing facility	Yes	37(37.0%)	54(54.0%)	1
	No	63(63.0%)	46(46.0%)	2.00(1.14-3.52)*
food preparation surface wash	Yes	70(70.0%)	83(83.0%)	1
	No	30(30.0%)	17(17.0%)	2.09(1.06-4.11)*
drinking water source	pipd water	44(44.0%)	69(69.0%)	1
	River	56(56.0%)	31(31.0%)	2.83(1.59-5.06)*
drinking water treatment	Yes	17(17.0%)	37(37.0%)	1
	No	83(83.0%)	63(63.0%)	2.09(1.48-5.55)*

\*p- value <0.05

The final model was run using back ward stepwise logistic regression method. All the variable which had shown p- value 0.25 or less during the bivariate analysis such as child family residence, house hold head, child father education, child father occupation, house ownership, income sources, child father monthly income, domestic animal ownership, child age, child breast feeding frequency, febrile illness, diarrheal duration, pregnancy number, mother khat chew status, khat chew frequency, child wash and drinking water separation, house cleaning frequency, availability of latrine hand washing facility, washing food preparation surface, drinking water source, and

treating drinking water were collectively entered in to multivariate analysis. After conducting Multivariate logistic regression analysis, child family residence (AOR=3.89;95% CI :1.03- 14.68), child family drinking water source (AOR=3.26;95% CI :1.04- 10.25), diarrheal duration on child (AOR=2.57; 95% CI :1.06- 6.38), house ownership (other) (AOR=29.85;95% CI :1.78- 50.88), child father educational status AOR=0.29;95% CI :0.06- 1.44), and child family house hold head (AOR=0.31; 95% CI : 0.001- 0.225)were independent predictor for the occurrences of acute malnutrition among children with diarrhea.

As shown below in table 5, those child families reside in rural were 3.89 times more likely at risk for acute malnutrition compared to those child family reside in urban. Respondents on child family drinking water source, were those child family used river as a drinking water source were 3.26 times more likely at risk for acute malnutrition than those child family who used piped water as drinking water source. By considering diarrheal duration on child, diarrheal duration three or more days in the previous two weeks of respondents' interviewee were 2.57 times more likely at risk for acute malnutrition compared to diarrheal duration stayed 1- 2 days. Regardless of the asset house ownership status, child family living dependently with other family and house given by meschein (other) were 29.85 times more likely at risk for acute malnutrition than those child families living in their own house. Based on child father educational status, no educational father were 89% times less likely at risk for acute malnutrition in comparison to child father with secondary and above level of education. Those child family female house hold were 69% times less likely at risk for acute malnutrition for acute malnutrition in comparison to child family male house hold.

Table 5 | Independent predictors of acute malnutrition among under five children with diarrhea in jimma town public hospital, southwest Ethiopia march1- april 30.

Variables	Category	Case number (%)	Controls Number (%)	OR	AOR(95% CI)
Child family residence	Urban	40(40.0%)	67(67.0%)	1	1
	Rural	60(60.0%)	33(33.0%)	3.05(1.71-5.43)	3.89(1.03-14.68)*
Child family house own	Own	72(72.0%)	76(76.0%)	1	1
	Rent	15(15.0%)	21(21.0%)	.75(0.36-1.58)	2.50(0.70- 9.01)
	Other	13(13.0%)	3(3.0%)	4.57(1.25-16.71)	29.85(1.78-50.88)*
Child diarrheal duration	1- 2	27(27.0%)	45(45.0%)	1	1
	>=3	73(73.0%)	55(55.0%)	1.56(1.2-4.6)	2.57(1.06- 6.38)*
Drinking water source	pipd water	44(44.0%)	69(69.0%)	1	1
	River	56(56.0%)	31(31.0%)	2.83(1.59-5.06)	3.26(1.04-10.25)*
House hold head	Male	96(96.0%)	88(88.0%)	1	1

	Female	4(4.0%)	12(12.0%)	3.27(1.08-10.52)	0.31(.001-0.225)*
Father educational level	No education	48(48.0%)	30(30.0%)	1.94(0.99-3.82)	0.29(0.06- 1.44)
	Primary	24(24.0%)	36(36.0%)	.810(.39-1.66)	0.11(0.03- 0.47)*
	Secondary and above	28(28.0%)	34(34.0%)	1	1

\* P- value <0.05

## Chapter six: Discussions

Determinants which significantly associated with acute malnutrition in this finding were, child's family residence, child family drinking water source, diarrheal duration on child, house ownership, child's families' house hold head, and child's father educational status were found significantly associated with the occurrence of under five children under nutrition.

Among socio- demographic factors, those child family residence in rural were significantly associated with acute malnutrition in children. The risks of acute malnutrition were estimated to be 3.89 times higher in child family who reside in rural as compared to child family who lived in urban. This is consistent with study done in Afar (44). This might it be due to by unsafe water, sanitation and hygiene (WASH) practices. It is estimated to lead to 860,000 deaths per year in children under five years of age caused by WASH problem (WHO, 2008)

Among environmental factors, Source of drinking water was showed statistically significant association with acute malnutrition. Those children who used drinking water from unprotected source were 3.26 times more likely to have acute malnutrition as compared to those children who used drinking water from protected source. This finding was similar to study done in Uganda (50). This can be because of the fact in the rural population of Ethiopia, there is lack of access to safe drinking water is the major environmental problems for the transmission of common diseases. Lack of access to safe drinking water and unprotected drinking water is closely related to incidence or episode of water borne diseases like diarrhea which contribute malnutrition. In addition to this lack of access to drinking water (it estimated that more than two thirds of the population has no access to drinking water) is a direct causes of malnutrition.

Diarrheal duration was seen as a risk factor in this study similar to study done in Nekemt and Gida Ayana hospital (47). Three or more day's diarrheal duration was 2.57 times higher risk for child under nutrition compared to child diarrheal duration 1 - 2 days. The result of this study suggests that children suffered from longer and repeated episodes of diarrhea which determine to their nutritional status. This can be due to longer time lasting of diarrheal disease on child results in increased needs and high energy expenditure, lower appetite, nutrient losses due to vomiting, diarrhea, poor digestion, mal- absorption and the utilization of nutrients and disruption of metabolic equilibrium.

Again also child family living dependently with other family and those lived in house given by meshein was significantly associated with acute malnutrition in which 29.85 times more likely to develop acute malnutrition as compared with those child family lived in their own houses. This result is similar with study done in Uganda (43) and India (51). This is the fact that child family who do not support their family and do not get sufficient income to fulfill child feeding demand. As a result of this low economic status, their child may develop acute malnutrition. This can be due to low

socioeconomic status of the child family.

Being female households were 69% times less likely at risk for child under nutrition than male house hold. This result is similar to research done in India (46). This can be due to decision- making power or controls of resources (asset) were higher in being female house hold than wife which does have effect on child health. A woman's asset level could affect child health through her spouse's characteristics (Duflo, 2000)

Primary level educated child father was 89% times less likely at risk for under nourished children than secondary and above level of education. This study finding is similarly to study done in Uganda (43), Afar (44), and Gondar (45). This can be due to lower level educated father stays more times with his family so that more caring practices they perform and secondary and above level educated father stay most of the time on working separately from their family, or live in other places so that child caring practices becomes lower.

#### Strength and limitation

##### Strength

- ✓ Using daily check list for monitoring the activities during data collection
- ✓ Having a concern for vulnerable population group

##### Limitation

- ✓ Participants might not gave true information on the type of food they used, drinking water separation for their child, child age and theirs age, immunization status of children that leadsto bias.

## Chapter seven: Conclusions and recommendation

### 7.1 Conclusion

The results of this study provide information on socio-demographic and environmental factors potentially influencing under nutrition of children with



diarrhea in Jimma town public hospital. These factors are: child family drinking water source, child family residence, child diarrheal duration, child family house ownership, child father educational status and child family house hold head. The result of this study gives a clue on the factors contributing to under nutrition and provide a base line data for other investigators and policy makers and priority focus for intervention of this type problem since the prevalence of acute malnutrition is increasing from time to time, having the determinant factor is the key point to solve at the grass root level.

## 7.2 Recommendation

The result of this study were emphasizes on the socio- demographic and environmental risk factors apart from dietary and other causes of under nutrition, provide information for healthcare and nutrition policies that aim to solve the problem. As a preventative measure, in conjunction with other strategies, due emphasis should be given in improving the knowledge and practice of parents on appropriate infant and young child feeding practices, developing protected water source accessibility and improving water quality by using different filtration, health education should be given on personal and environmental sanitation by health profession, promoting drinking water treatment for the child, care givers need to wash their hand with clean water and soap before preparing food, before feeding baby and after visiting of toilet or disposing of child feces.

Piped water to be constructed for rural community, standardized toilet for individual house hold to be owned.

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## **Annex- I**

Jimma University institute of health science school of post graduate department of Epidemiology

Questionnaires for assessing determinants of acute malnutrition among under five children with diarrhea complain in jimma town public hospital, JUSH and SGH, in Jimma zone, Oromia Regional State, south west Ethiopia.

Hello, my name is\_\_\_\_\_ and I am working as a data collector in this survey. I

would like to inform you that I am going to have a short discussion concerning this study. Before we go to our discussion, I will ask you to listen carefully to what I am going to read to you about the purpose and general condition of the study and tell me whether you agree or disagree to participate in this study. As part of this survey we are collecting information on acute malnutrition risk factors on children below the age of 5 years in the sampled children. Your child selected to be one of the participants in this study. The acute malnutrition risk assessment is being done to find out what factors are involving. This enables the concerning and pertinent bodies to develop programs to prevent and treat acute malnutrition. But to do this it needs reliable information. That is why we are now collecting a data from under five children based on anthropometric measurement and child care givers interviewee.

The instruments I use for taking the data are anthropometric measurement, child care givers interviewee and physical examination will be used with anthropometric equipment. The data will be analyzed systematically. The results will be kept confidential. If a report of the result to be published, only summarized information of the total group will appear. If your child develops severe condition of the diagnosed disease, will be given emphasis immediately and will get the treatment.

Do you have any questions?

May I be able to ask you now about your child and take anthropometric measurement to participate in acute malnutrition associated factors assessment? However, if you decide not to participate in the study, it is your right and I will respect your decision. Now please tell me if you want to be involved in.

Yes \_\_\_\_\_ continue the interview

No \_\_\_\_\_ stop the interview and thanks the respondent

Name and signature of interviewer \_\_\_\_\_

Questionnaire

Jimma University institute health science school of post graduate department of

## Epidemiology

### General information

1. Questionnaires I D

-----

2. Status of the patients

1. Cases

2. Controls

3. Interviewer name

-----

4. Health facility name

-----

### SECTION I. Socio- demographic and economic characteristics instruction: Asking the child's mother/ caretaker

Sn o	Questions	Response category	Code
1	What is your name?(Respondent)	-----	
2	How old are you? (In completed year?)	-----	
3	Name of the child's father?		
4	Number of 0- 59 months age children living in the house?	-----	
5	Who is the head of the house?	1. Male 2. Female	
6	What is your religion?	1. Orthodox	



		<ul style="list-style-type: none"> <li>2. Muslim</li> <li>3. Catholic</li> <li>4. Protestant</li> <li>5. Others-----</li> <li>----</li> </ul>	
7	Where is your residence?	<ul style="list-style-type: none"> <li>1. Urban</li> <li>2. Rural</li> </ul>	
8	How much long you stayed in the current place you live?	<ul style="list-style-type: none"> <li>1. &lt; 6 months</li> <li>2. 6 + months</li> </ul>	
9	What is your educational status?	<ul style="list-style-type: none"> <li>1. None</li> <li>2. Primary</li> <li>3. Secondary</li> <li>4. Tertiary</li> </ul>	
10	What is father's educational status?	<ul style="list-style-type: none"> <li>1. None</li> <li>2. Primary</li> <li>3. Secondary</li> <li>4. Tertiary</li> </ul>	
11	What is child's mother or car taker occupational status?	<ul style="list-style-type: none"> <li>1. House wife</li> <li>2. Government employee</li> <li>3. Self employee</li> <li>4. Student</li> <li>5. Daily laborer</li> <li>116. Merchant</li> <li>7. Others</li> </ul>	

		-----	
12	What is child's father occupational status?	1. Government employee 2. Self employee 3. Student 4. Daily laborer 5. Merchant 6. Others -----	
13	What is your ethnicity?	1. Oromo 2. Amhara 3. Gurage 4. Tigre 5. Others specify ----- -	
14	What is your marital status?	1. Married and in union 2. Married lived separately 3. Divorced 4. Widow 5. not married 6. No response	
15	What is the ownership of your house?	1. Owned 2. Rented 3. Dependent (with other)	

		4. Others----- ---	
16	How many rooms are there in the house?	1.1  2.2  3. ≥ 3	
17	Does your household have electricity?	1. Yes  2. No	
18	Do you have a radio?	1. Yes  2. No	
19	Do you have a television?	1. Yes  2. No	
20	Does your house have a ceiling?	1. Yes  2. No	
21	What is your occupation?	1. Farming  2. Private Sector Employee  3. Government employee  4. NGO employee  5. Self employee  6. Daily laborer  7. Merchant  8. No work  9. Others specify -----	
22	What is the main source of income for your family? (tick one)	1. Sell cattle/other animals  2. Sell agricultural products	

		3. Sell milk/other dairy product 4. Others _____	
23	What is the monthly income of your husband/partner? (A) in cash ( B) In kind	1. Less than Birr 500 2. Birr 500 - Birr 1000 3. Birr 1001- Birr 1500 4. More than Birr 1500	
24	Do you have domestic animal?	1. yes 2. No	
25	If yes, how many do you have of the following?	oxen ---- Sheep ---- Goat ---- Camel ----- Horse ----- Donkey ---- Mule ---- Poultry ----- Others -----	
26	What is your staple food?	1. Tef f 2. Maize 3. Barley 4. Sorghum 5. others specify ----- -	

Section II : children factors aged 0- 59 Months' instruction: The next set of questions is about your child.

S.No	Question	Response category	Code
27	What is the name of the child?		
28	Birth space		
29	How old your child?	In months----- -----	
30	What is the sex of your child?	1. Male 2. Female	
31	Did you ever breast feed your child?	1. Yes 2. No	
32	If yes for Q.31 for how many months did you breast feed your child exclusively?	In months_____	
33	Is the child breast feed now?	1. Yes 2. No	
34	Frequency of breast feeding per day?	1. None 2. <3 3. 3- 6 4. 6 <sup>+</sup>	
35	For how long do you think should a child exclusively breast feed?	In months_____	
36	At what age do you think that a child given supplementary feeding?	1. Before 4 months 2. 4 to 6 month	

		3. 7 to 9 months 4. 10 to 12 months 5. After 12 months	
37	At what age was your child weaned?	In months _____	
38	What was the first supplementary food given to the child?	1. Milk 2. Genfo 3. Soup 4. Other	
39	At this age, how many time your child get food per day?	1. Less than 3 times 2. 3- 4 times 3. 5- 6 times 4. Greater than six times	
40	At this age, how many time your child eat food per day?	1. Less than 3 times 2. 3- 4 times 3. 5- 6 times 4. Greater than six times	
41	Has the child been ill with Febrile illness at any time in the last two weeks?	1. Yes 2. No	
42	If the answer for Q.41 is yes, did you seek advice or treatment for the Febrile illness?	1. Yes 2. No	
43	Has the child been ill with cough at any time in the last two weeks?	1. Yes	

		2. No	
44	If the answer for question 43 is yes, during a cough, did he/she breathe faster than usual with short, fast breaths?	1. Yes 2. No	
45	Has the child had diarrhea in the last two weeks?	1. Yes 2. No	
46	How long is the duration of diarrhea in your child?	In days - - - - - - - - - -	
47	If the answer for question number 45 is yes, number of bowel movements	1. ≤3 2. >3	
48	Is your child vaccinated? (See card)	1. Yes 2. No	
49	If Q.48 is yes, what type of vaccination does he/she take?(circle one of the two) A) From Card (B) Mother's Report	1. BCG only 2. BCG, DPT1, Polio1 3. BCG, DPT1 - 2, Polio1 - 2 4. BCG, DPT1 - 3, Polio1 - 3 5. Meseales	
50	Is your child got additional food from aiding organizations?	1. Yes 2. No	
51	If yes for Q. 50 where he/she get the food?	1. TFS 2. Safety net 3. WFP	

		4. MERLI N 5. Others/ specify	
52	For how long period did the child get this food?	In months _____	
53	Anthropometric measurement	1st                  2nd 3rd Weight ----- -- Height ----- ----- Average	
54	MUAC measurement	-----	
55	Does the child have edema?	1. Yes  2. No	

Section III: Questions about mother/ caretaker

S.No	Question	Response category	Code
56	At what age you get your first marriage?	In year _____	
57	At what age you get your first delivery?	In year _____	
58	Number of pregnancies	-----	
59	Are they all alive?	1. Yes  2. No	
60	If there is death, specify the cause?	1. Diarrhea -----  2. Cough -----  3. Febrile illness  4. chills -----  5. Accidents -----	



		6. Others-----	
61	Do you usually work out- side home?	1. Yes 2. No	
62	Have you got enough time to prepare food?	1. Yes 2. No	
63	How do you usually prepare food for children under five year of age?	1. Together with adult food 2. Separately for them	
64	Do you chewkhat?	1. Yes 2. No	
65	If yes for Q. 63 how often?	1. Daily 2. Within three days 3. Weekly	
66	Do you wash your child?	1. yes 2. No	
67	Do you wash your breast before the child wants to feed breast?		
68	If yes for Q.65 how many times per day?	1.1 2.2 3.≥3	
69	Does it separate for child's washing and drinking water?	1. Yes 2. No	

#### Section 4: Environmental factors

No	Category	Response	Remark
70	Do you clean your house?	1.Yes 2.No	
71	If yes for Q. 68 how many times per day?	1.1 2.2 3.3	
72	Do you have latrine?	1.yes 2.no	
73	What kind of toilet facility does your household have?	1.Flush/pour toilet 2.Ventilated improved pit latrine 2. Pit latrine, private 3. Pit latrine, shared 4. No facility / Bush / Field	
74	Do hand washing facility available in/by latrine facility	1.yes 2.no	
75	When do you wash your hands?	1.after food preparation 2.before food preparation 3.after toilet 4.after work 5.after blowing your nose, cough, sneeze 6.before food eating	
76	Do you use soap or ash every time you wash your	1.yes	

	hand?	2.no	
77	Do you wash food preparation surfaces?	1.yes 2.no	
78	Where do you get your drinking water?	1. Piped water 2. Well water 3.Surface water (river, spring) 4. Others specify- - - - - - - -	
79	Do you treat your drinking water?	1.yes 2.no	
80	Where do you store treated drinking water?	1.Jarikan 2.Pot 3.Metal materials 4.Other specify_ - - - -	
81	How do you serve/ give people water to drink?	1.pour from jug 2.dipping 3.others	

Appendix II : QUESTIONNAIRES – AFAN OROMO VERSION

Gaafilee Haadhaaf / Guuddistuu Daa`imaaf

Foormii Wal barruu akkasumas waligaltee

Akkam jirtuu maqaan koo, ----- ani kanan as dhufe yuniversitii Jimmaarra yoo ta`u naanoo keessan kana irratti rakkoo hanqina nyaataa ijoolee ji`a 0- 59 jidduu jirtuu irratti wajin jiruu ilaalchisee sababnii rakkoo fayyaa kun maal akka ta`ee qoo`annaa adeemsisuuf waan ta`eef isin illee kana beektanii daa`ima keetif akkasumas ofi kee qoo`anoo kanaaf akka qopheesituu si gaafannaa.daa`imti kee madaalin adda addaa waan irrattii adeemsifamuuf isiin illee kana beektani daa`ima keesaniis akka nuuf qopheesitan kabajjaan isin gaafannaa.Gabaasni isin nuf keenitan icitiin isaa kan eegamee ta`u isaa dursee isinif beeksisuu barbaadaa.

Qo`annaa kana keessati hirmaachuuf fedhii ni qabdaa?

Eyyeen ----- Mitti -----

Lakkofsa kodi Gaafichaa.....

Maqaa nama gaafatu----- Guyyaa gaafatamee-----  
---- Mallatto-----

Maqaa supervizaraa ----- Guyyaa gaafatamee -----  
--- Mallatto-----

Dhaabbata fayyaa ----- Maqaa Gandaa -----

Sa`aa itti jalqabamee ----- Sa`aa xumuramee -----  
-----

Kutaa- I . Gaaffilee Haala wali gala maatii Sana irratti xiyyeeffatu

Lakk.	Deebii	Deebii	Yaada
1	Maqaan kee enyuu?		
2	Ganni kee meeqaa (waggaan?)	-----	
3	Maqaa abbaamanaakee?	-----	
4	Bay`ina maatii		
5	Baay`ina ij oolee ji`a 0- 59	-----	
6	I ttigaaf atama abbaa manaa	1.Dhiira 2.dhalaa	
7	Amantiin keessan maal?	. Ortdoksii 2. Musiliima 3. kaatoolikii 4. Pheenxee 5. kan biroo ----- -----	
8	Eessa jiraatttu?	1.magaala 2.baadiyaa	
9	Yeroo hammamiif bakka amma jiraattu turte?	1.ji`a jaha gadi 2.ji`a jahaaf isaa ol	

10	Sadarkaan barumsa kee?	<ul style="list-style-type: none"> <li>1.kan hin baratiin</li> <li>2.Dubisuuf berressu</li> <li>3. sadarkaa tokkoffa (1- 6)</li> <li>4. sadarkaa lammaffa (7- 12)</li> <li>5.(12+)</li> </ul>	
11	Sadarkaan abbaamanaakeetii kee? barumsa	<ul style="list-style-type: none"> <li>1.kan hin baratiin</li> <li>2.Dubisuuf berressu</li> <li>3. sadarkaa tokkoffa (1- 6)</li> <li>4. sadarkaa lammaffa (7- 12)</li> <li>5.(12+)</li> </ul>	
12	Hojii kee maal?	<ul style="list-style-type: none"> <li>1.hojii mana keessaa</li> <li>2.kan mootummaa</li> <li>3.dhuunfaa</li> <li>4.miti mootummaa</li> <li>5.barataa</li> <li>6.Dafqaan bulaa</li> </ul>	
13	Hojii abbaamanaa keetii maal?	<ul style="list-style-type: none"> <li>1.kan mootummaa</li> <li>2.dhuunfaa</li> <li>3.barataa</li> <li>4.Dafqaan bulaa</li> <li>5.daldalaa</li> </ul>	

		6.kan biroo_____	
14	Sabnii keessan maal?	1.Oromo 2. Amhara 3.Tigre 4.Gurage 5. Others	
15	Haalli fuudhaaf heerumaa?	1. kan heerumeefi kan waliin jiraatu 2. kan fuudheefi kan waliin hin jiraane 3. addaan baanee jirra 4. abbaan manaa du`e jira 5. Hin funee 6. deebin hin jiru	
16	Mannii isin keessa jiraattan kan eenyutii	1. kan dhunfaa 2. kiraa 3. Nama waliin jiraachuu 4. kan biraa ----- --	
17	Baay'inni kutaa mana keessani meeqaa?	1.1 2.2 3.3 <sup>+</sup>	

18	Ibsaa qabduu?	1.eeyee 2.lakki	
19	Radio qabduu?	1.eeyee 2.lakki	
20	TV qabduu	1.eeyee 2.lakki	
21	Manni keessan koornisii qabaa?	1.eeyee 2.lakki	
22	Hoj iin abbaa manaa kee maal?	1. Horsisee bulaa 2. Horsisaaf qotee bulaa 3. qotee bulaa 4. Qacaramaa hojii dhunfaa 5. Hojjataa motumaa 6. Hojjataa NGO 7. hojii dhunfaa/ofii 8. hojjataa guyyaa 9. Daldaalaa 10. Hojii hin qabu 11.kan biraa - - - - -	
23	Maddi galii keessanii maal?	1.gurgurtaa horii 2.gurgurtaa qonnaa 3.gurgurtaa bu'aa horii	



		4.kan biroo-----	
24	Galiin keessan ji`aan meeqaa?	1. Birri 500 gad 2. Birri 500 - 1000 3. Birri 1001- 1500 4. Birri 1500 ol	
25	Hoorii manaa ni qabduu?	1. Eyeen 2. mitii	
26	Yoo qabaatan, bay`inii isaanii meeqaa?	horii----- qootiyyo---- Holaa---- Re`e----- harree---- lukkuu----- kan biroo-----	
27	Nyaanii yeroo baay`ee nyaattan maal?	1. xaafii 2. Boqollo 3. Garbuu 4.Misingaa 5. Qamadii 6. kan biraa-----	

Kutaa II Gaafilee Daa`ima irratti xiyyeffatuu

s/no	Gaaffii	deebii	
28	Maqaa daa`imaa?		
29	Daa`ima meeqafaatii?		
30	Ganii isaa meeqaa?	Ji`aan	
31	Saala	1.Dhira 2. Dhalaa	
32	Eessatii dhalattee/tte?	1.Dhabbilee fayyaatii 2.Manatti	
33	Daa`imtii yoo dhalatu ulfinii isaa madaalamee jiraa?	1.Eyeen 2.mitii	
34	Yoo madaalamee jiraatee ulfinii isaa haamamturee?	Graamii kaardirra yaadachuu ---- 98 = Hin beekuu	
35	Daa`ima kee harma hoosistee beektaa?	1.Eyeen 2.mitii	
36	Yoo hoosistee jiraatee ji`a meeqaatiif harma qofaa hoosistee?	1. ji`a 4 gad 2. Ji`a 4- 6	

		<p>3. Ji`a 7 – 9</p> <p>4. Ji`a 10 – 12</p> <p>5. Ji`a 12 ol</p>	
37	Yeroo ammaa daa`imti kee harma hodhaati jiraa?	<p>1. Eyeen</p> <p>2. mitii</p>	
38	Yoo daa`imtii yeroo ammaa hodhutii jiraatee, yeroo kamitti haarma keenitaaf?	<p>1. yoo daa`imti booyu</p> <p>2. Haala yerootin wal qabate</p> <p>3. Feedhi Haadharraa ka`udhaan</p> <p>4. Kan biraa - - - - -</p>	
39	Daa`imti tookko nyaata dabalataa yoom argachuu qabaa j attee yaaddaa?	<p>1. j i`a 4 dura</p> <p>2. Ji`a 4- 6</p> <p>3. Ji`a 7- 9</p> <p>4. Ji`a 10- 12</p> <p>5. Ji`a 12n boodatii</p>	
40	Ji`a meeqatii nyaata dabalataa egale?	Ji`aan	
41	Nyaani dabalataan yeroo duraatiif daa`imaaf keenamee maal ture?	<p>1. Aannan</p> <p>2. Marqa</p> <p>3. shoorbaa</p> <p>4. kan biraa - - - - -</p>	
42	Ganna kanatti (yeroo ammaa) guyyati yeroo meeqaa daa`imti kee nyaachu qabaa j attee yaaddaa?	<p>1. yeroo 3 gad</p> <p>2. Yeroo 3- 4</p>	

		3. Yeroo 5- 6 4. Yeroo 6 ol	
43	Ganna kanatti (yeroo ammaa) guyyati yeroo meeqaa daa`imti kee nyaachutii jiraa?	1. yeroo 3 gad 2. Yeroo 3- 4 3. Yeroo 5- 6 4. Yeroo 6 ol.	
44	Daa`imti kun torban lamaan darban keessatti dhukkuba ho`ina qaamaatiin qabamee beekaa?	1. eyyen 2. miti	
45	Daa`imti kun torbaan lamaan darban keessatti dhukkuba qufaatiin qabamee beekaa?	1.Eyyen 2.mitii	
46	Yoo deebin gaafii keennamee yoo eyyen ta`e, yeroo qufaan jiru daa`imtii daf ee haafura fudhataa?	1.Eyyen 2.mitii	
47	Daa`imti kun torbaan lamaan darban keessatti dhukkuba Garaa kaasaatiin qabamee beekaa?	1.eeyyeen 2.hin beeku	
48	Yoo deebin gaafii 45 tiif keennamee eyyen ta`e, yeroo meqaaf isa Garaa kaasee?	1.1 2.2 3.3+	
49	Daa`imti kee talaalamee beekaa?(kaardii ilaalii)	1.Eyyen 2.mitii	

50	Yoo deebiin gaafii 47 eyeen ta'e, talaali gosa kamii fudhate/tte?(tokko filadhu) A) kaardii irraa B) Gabaassa Haadharraa	1. BCG qoof a 2. BCG, DPT1, Polio1 3. BCG, DPT1 – 2, Polio1 – 2 4. BCG, DPT1 – 3, Polio1 – 3 5. Meseales	
51	Daa`imtii kee nyaata dabalataa madda biro irraa argatee beekaa?	1. Eyeen 2. mitti	
52	Yoo argatee/ttee essarraa argatee/tte?	1. TFS 2. Safety net 3. WFP 4. MERLIN 5. Kan biro- - - - -	
53	Yeroo meeqaaf daa`imti kee nyaata dabalataa kan argate?	Ji`aan - - - - -	
54	Anthropometric measurement	1ffaa 2ffaa 3ffaa Average Ulfina - - - - - - - - - - Dheerina - - - - - - - - - -	
55	MUAC(harka irree olii saf aruu)	- - - - -	
56	Dhiitoo ni qabaa dhaqni kee?	1. Eyeen 2. Mitii	

kutaa III : Gaafii Haadhaaf / Guudistuuf qoohaayee

s.n o	Gaafii	Deebii	Yaada
57	Ganni kee meeqa turee yeroo duraa futu?	Waggaa meeqa - - - - -	
58	Yoo daa`ima kee isa duraa deessu ganni kee meeqa turee?	Waggaa meeqa- - - - - -	
59	Bay`ina ulfaa?	Lakkoofsaan- - - - -	
60	Baay`ina ijoollee nagaan dhalatte?	Dhiira - - - - - Dhalaa - - - - -	
61	Hundinuu lubuun jirti?	1.Eyeen 2.mitii	

62	Ijoolleen duute yoo jiraatee, sababa isaa ibsi?	1.Baasaa - - - - 2. Qufaa - - - - 3. ho'ina fi qorrisiisa - - - - 4.Balaa - - - - - 5.Sababa biraa- - - - - - - - - -	
63	Hojii dabalataa manaan alatti ni hojjattaa?	1.Eyeen 2.mitii	
64	Nyaata bilchessuuf yeroo ga`aa ta`e qabdaa?	1. eyyen 2. mitii	
65	Haala akkamitin daa`ima ganna shanii gaditiif nyaata qophesitaaf?	1.Nyaata maatii waliin hojjatamaaf 2. Koophaatii hojjatamaaf	
66	Jumaa ni qamaataa?	1.Eeyee 2.lakki	
67	Lakk.eeyee yoo jette, yeroo hammamiin?	1.guyyaa guyyaatti 2.guyyaa sadiitti 3.torbeen	
68	Daaima kee ni qulqulleessitaa?	1.eeyee 2.lakki	

	Lakk.65 eeyee yoo jette guyyaatti yeroo meeqa?	1.1 2.2 3.3+	
69	Bishaan qulqullinaafi dhugaatii daaimaakeef qof aatti gootaafii?	1.Eeyee 2.lakki	

#### Section 4: naannoorratti kan xiyyeef fatu

s.n o	Gaaaffii	Deebii	Yaada
70	Qulqullina mana keessanii ni eeggattuu?	1.eeyee 2.lakki	
71	Lakk.67 eeyee yoo jette guyyaatti yeroo meeqa?	1.1 2.2 3.≥3	
72	Mana fincaanii ni qabdu?	1.eeyee 2.lakki	
73	Lakk. 69 Eeyee yoo jette gosa akkamiiti	1. Flush toilet 2. Pit latrine, private 3. Pit latrine, shared 4. No facility / Bush / Field	



74	Bishaan harka dhiqannaaf oolu ni jiraa naannoo mana fincaanii keessanii?		
75	Maddi bishaan dhugaatii keessani maalinni?	1. Bishaan boonbaa 2. Bishaan qulqullu(Well water) 3. Bishaan lafaa (laga, haroo) 4. kan biraa- - - - -	
76	Bishaan waraabame maaliin kuusta?	1. jaarikaanii 2. okkotee 3. waantoota sibiila ta'an keessa 4. kan biroo- - - - -	
77	Yeroo hundaa harkakee dhiqattu saamunaa ykn daaraa ni fayyadamtaa?	1. eeyee 2. lakki	
78	Meeshaa itti nyaati itti qophaa'uu ni qulqulleessituu4?	1. eeyee 2. lakki	
79	Bishaan dhugaatiif oolu eessaa waraabdu?	1. boonoo 2. bishaan boollaa 3. bishaan ciisaa 4. kan biroo- - - - -	

80	Bishaan waraabame ni yaaltaa?	1.eeyee 2.lakki	
81	Bishaan waraabamee yaalame maal keessa kuusta?	1.j arkaanii 2.okkotee 3.meeshaa sibiila irra hojjetame keessa	
82	Maaliin bishaan kuusaa bishaanii keessaa namaaf dhiyeessita?	1.jaarikaanii gadi qabuudhaan 2.kuusaa keessaa meeshaa biraan 3.kan biroo - - - - -	