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Determinants of Malnutrition among Children under five years in SOS Hospital, Mogadishu

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ABSTRACT

Malnutrition is defined as a lack of proper nutrition. The vast majority of the world's hungry people live in developing countries, where 12.9 percent of the population are undernourished. It is prevalent in children particularly those in developing countries where one person out every four there is undernourished (FAO, 2015). Mortality is related to the severity of the malnutrition (WHO, 2008). In Somalia, child malnutrition remains a major health problem where the proportion of under-five children who were underweight in 2013 was 40% and 21% in rural and urban areas respectively (UNICEF, 2014). The purpose of this study was to investigate determinants of malnutrition among children under five years in SOS Hospital in Mogadishu, Somalia. The study comprised of a cross-sectional hospital survey. The study population constituted children who were diagnosed as malnutrition cases at SOS Hospital in Mogadishu. The probability systematic random sampling technique was used and the sample size was constitute 384 malnutrition patients. A semi structured questionnaire was used to collect data. Data collected was analyzed using SPSS software to describe and identify significant associations between different variables. Descriptive summary statistics and graphical summaries in tables and charts were used to present the study findings.

Introduction

There is 43.0% underweight, 52.6% marasmus, 1.0% Kwashiorkor, 1.6% Marasmic – kwashiorkor and 1.8% unclassified among children admitted to SOS Hospital. Key study findings revealed are: poor household income (P-value = 0.000); large household size (P-value = 0.002); counselling of the caregiver/mother on healthy eating (P-value = 0.004); age of child (P-value = 0.001); vitamin A supplementation (P-value = 0.048); age up-to when the child was breastfed (P-value = 0.001); type of the milk the baby is fed on particularly Cows milk (P-value = 0.012) with most prevalent comorbidities among the malnourished children admitted to SOS hospital were bronchopneumonia, diarrhea, malaria and measles with a proportions of 62.2%, 55.5%, 33.1% and 24.2% respectively and based on the above findings, the following recommendations were made: promotion of parental education especially mothers as this can improve nutritional education and household income; caregivers 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; use of protected water source for drinking to prevent diarrheal diseases; for prevention of malnutrition, community-based counselling of the mother/caregiver on healthy eating and food fortification should be established and implemented at all community levels and there should be well-trained personnel; strengthen routine expanded program of vaccination at community level; strengthen and expending therapeutic malnutrition program by ministry of Health; food aid programs for malnourished children, including macronutrients and micronutrients, should be implemented to prevent food shortage; management of infections like bronchopneumonia and diarrheal disease to prevent undernutrion; screening of malnutrition should routinely be performed for under five children to identify early malnutrition cases for proper intervention and management of the cases to reduce morbidity and mortality associated with malnutrition.

The term malnutrition generally refers both to undernutrition and overnutrition (WHO, 2005a), but in this study the term was used to refer soley to a deficiency of nutrition. The vast majority of the world's hungry people live in developing countries, where 12.9 percent of the population are undernourished. Malnutrition or lack of proper nutrients prevalent in children particularly those in Sub-Saharan countries, where one person in four there is undernourished (FAO, 2015). Somalia is one of countries with highest malnutrition prevalence due to poverty, instability, food insecurity and many other factors.

Malnutrition is associated with many health problems from birth to later in life. It is one of the leading cause of child mortality and morbidity in developing countries.Taking into account all underlying causes of death, studies suggest that malnutrition was an associated cause in about one half of all child deaths in developing countries (WHO, 2005a).

Malnutrition in children, whatever the cause, affects negatively growth and development patterns where it can cause physical, cognitive and psychological impairment and consequently long-term disabilities including learning disabilities. Malnourished children have lowered resistance to infection; they are more likely to die from common childhood ailments like diarrheal diseases and respiratory infections; and

reduction in malnutrition would lead to a reduction in child mortality (WHO, 2005a).

Factors contributing to malnutrition

Factories that can cause malnutrition are broad and different. The main causes of malnutrition can be understood and addressed with the aid of the UNICEF conceptual framework. The framework, which the nutrition community has been using for programming for the past 25 years, identified three levels of causes of undernutrition: immediate causes operating at the individual level, underlying causes influencing households and communities and basic causes around the structure and processes of societies (UNICEF, 1997., Lancet, 2008).

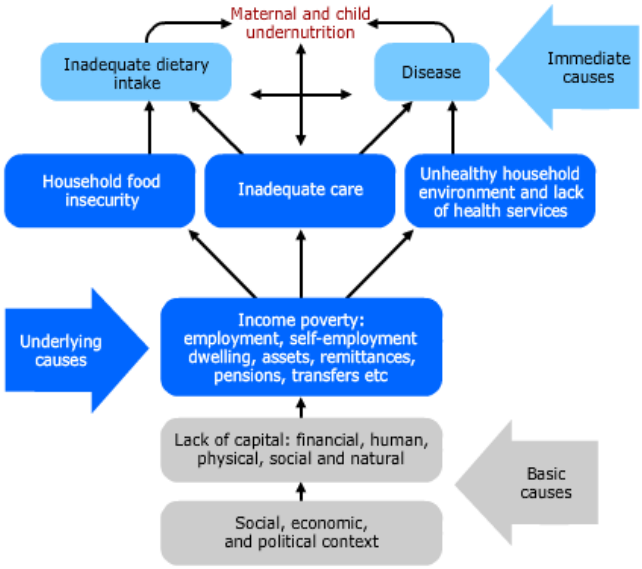

Figure 1.1. UNICEF Conceptual framework for causes of malnutrition. Adopted from (UNICEF, 1997., Lancet, 2008).

Immediate factors contributing to malnutrition

The immediate causes of child undernutrition are inadequate dietary intake and disease.

Inadequate diet

Dietary sufficiency in terms of energy and essential nutrients is critical for the normal growth and development of infants and young children. Undernutrition does not only refer to a child's lack of protein and energy, also micronutrients play a major role. It is found that especially lack of zinc is associated with increased morbidity and mortality from infectious disease including diarrhea. A lack of vitamin A is associated with increased morbidity and mortality from diarrhea too (Black *et al.*, 2008). Iron deficiencies can cause anemia which when very severe increases the risk of childhood mortality. Furthermore chronic iron deficiencies are shown to cause irreversible cognitive impairment (Lozoff *et al*., 2006). Not all children suffering from undernutrition will die of the condition, although undernutrition is estimated to contribute to 1/3 of child deaths globally (UNICEF, 2009).

Disease

Infection has the effect of increasing the body's requirements for nutrients, reducing appetite and reducing the absorption of nutrients from the intestine. Undernutrition and infection often occur at the same time. Undernutrition can increase the risk of infection while infection can cause undernutrition leading to a vicious cycle of undernutrition and infection (Tomkins & Watson, 1989).

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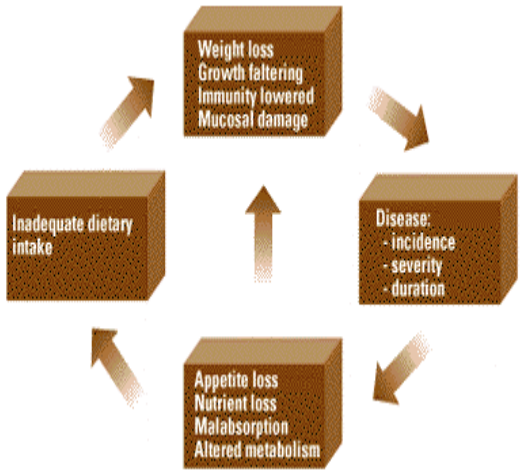

Figure 1.2. The Cycle of Undernutrition and Infection. Adopted frrom Tomkins and Watson (1989).

Eventually, as a result of infection and disease, a child often experiences weight loss and growth altering, or in other words - undernutrition. Whether one or the other starts the vicious circle is unknown and likely it differs from child to child (Scrimshaw *et al*., 1968). Diarrhea, malaria, measles and Acute Respiratory tract Infections (ARI) were the four infectious diseases killing most children in Africa in 2008 (Black *et al.*, 2010). Undernutrition is shown to put children in increased risk of developing diarrhea, have more severe episodes and persistent diarrhea, which increase the risk of mortality. Diarrhoeal disease also affects nutritional status by reducing absorption and child's appetite. In the case of malaria it is shown that undernutrition exacerbate malaria and considerably increases the likelihood of mortality. Malaria affects nutritional status by reducing appetite; increasing metabolic rate; destroying red blood corpuscles leading to anaemia and impairing foetal development leading to low birth weight. Undernutrition exacerbate measles by increasing duration of the disease; increasing its severity, especially if deficient in vitamin A, and consequently increases risk of death. On the other hand, measles reduces appetite, decreases levels of plasma vitamin A and prolonging immune suppression resulting in increased risk of ARI and diarrhoea.Undernourished children have an increased incidence of ARI and the nutritional status increases the severity of the ARI and the risk of dying (Semba & Bloem, 2008).

In Somalia, these diseases are prevalent and common causes of morbidity and mortality are diarrhoeal diseases, including cholera; respiratory infections particularly Tuberculosis; malaria, which affects mainly pregnant women and children under five; and measles (WHO, 2005b).

Underlying factors contributing to malnutrition

House hold food security

The household food security is comprised of four factors: availability, access, stability and utilization. A household should at all times have enough food immediately available, have the sufficient resources to acquire it and be able to consume it, in order to have an active and healthy life (Smith *et al*., 2000). It is important that the household is food secure, and therefore it does not help us much to look at the national average, other than if it determines a de facto deficit (Sen, 1999).

The size and composition of the family, gender equity, rules of food distribution within the household, income, availability and access to food (James *et al*., 1999; Vorster & Hautvast, 2002) and poverty (Mason *et al.*, 2005) can all

contribute to food insecurity. Food insecurity can also occur due to poor agriculture production, destruction of infrastructure and markets and therefore loss of income, loss of livestock and insufficient land for food production. Families will also increase their credit to try and survive. These factors influence the quantity and quality of food available (FAO, 1996).

A Survey about household food security in Central Somalia (WFP, 2014) have showed that: In August, an upward trend in the share of respondents with poor or borderline food consumption from 12.9% in May (3.7% poor and 9.2% borderline) to 21.9% in August (9.4% poor and 12.5% moderated) as shown in the figure 1.3 below.

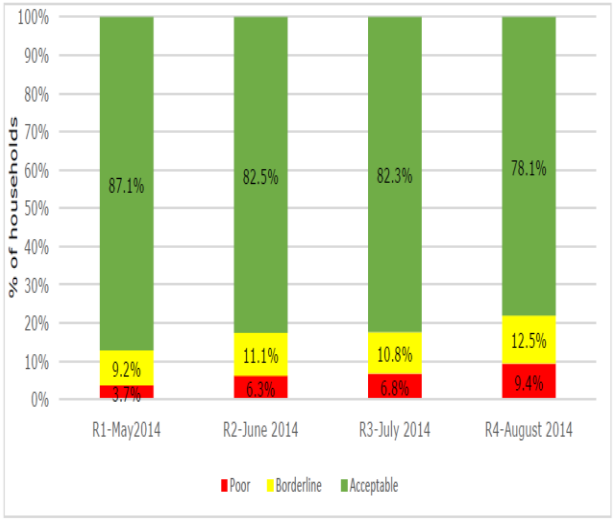

Figure 1.3. Food Consumption Score. Source: WFP phone surveys, 2014.

Inadequate maternal and child care

Inadequate care is often an underlying cause of child undernutrition. Care for children is defined as: "The practices of caregivers that affect nutrient intake, health and cognitive and psychosocial development of the child" (Engle *et al*., 1999).

Mothers should be protected against malnutrition, seeing as healthy mothers are needed for raising healthy children. Care includes breastfeeding, diagnosing illnesses, and introduction of solids, stimulating language and other cognitive capabilities and emotional support. Care affects the child's nutritional status through better infant feeding practices and breastfeeding, preparation of healthy food, hygiene and through support of the mother so that she has sufficient time to care for the child (FAO, 1996).

In a study in Eldoret, Kenya, the social risk factors for PEM included being a single mother and a young mother aged 15- 25 years (Ayaya *et al*., 2004). In Somalia there is a poor access, availability and quality of maternal, neonatal and child care. The child and maternal mortality rates for Somalia are amongst the highest in the world; one out of every ten Somali children dies before seeing their first birthday. One out of every 12 women dies due to pregnancy related causes. Access to maternal services is low with only 9% of births being attended by a skilled birth attendants. Modern contraceptive rate is around 1% only. The high fertility rate in Somalia puts the women at a high risk of mortality and morbidities around child birth especially with the low access to basic health services including family planning (UNICEF, 2012).

Unhealthy household environment and lack of health services (poor public health)

Sanitation and hygiene are also important factors to address when bearing in mind that this is the primary way to reduce the spread and control the severity of infections within the household and community (Cairncross *et al.*,2010). The direct correlation between personal hygiene, sanitation, clean water and malnutrition is well documented especially in young children (Golden *et al.*,2000; Checkley *et al*., 2004; Fewtrell *et al*., 2005). Therefore, unhealthy environments, overcrowding, lack of water and unclean water and poor sanitation, directly lead to malnutrition through infections (FAO, 1996). SAM occurs mainly in families living in unhygienic conditions and with limited access to food. The above mentioned conditions increase the risk of repeated infections (WHO, 2007).

Most foodborne illnesses originate from unsafe food-handling practices in the home. The most frequently reported unsafe practices include eating raw cookie dough, tasting foods during preparation, licking fingers while eating, drinking beverages left by family members, and eating food left by family members (Barclay *et al*., 2001). Poor household hygiene practices are critical in preventing infectious diseases. Child waste inside the house, prolonged storage of cooked food, feeding with unwashed hands and storage of food and water in uncovered containers can cause diarrhoea among malnourished children. These poor hygiene practices lead to contaminated food and fluids (Abate *et al*., 2001).

Malnutrition rates in the developing world are still high because of the lack of access to health services (Oyelami & Ogunlesi, 2007). Even though patients have little or no access to formal health services, there is still the problem that patients do not make use of the services available (Müller & Krawinkel, 2005). There is a need for improved public health services and improved immunization and growth monitoring programmes (James *et al.*,1999). For example, incomplete immunizations is a risk factor for the development of malnutrition (Ayaya *et al.,* 2004) and incomplete Bacille Calmette-Guerin (BCG) vaccination against TB increased the risk for the development of severe PEM in Bangladesh (Iqbal Hossain *et al.*,1999). The education and promotion of important vaccinations can reduce the occurrence of PEM (Iqbal Hossain *et al.*,1999).

When it comes to child undernutrition caused by lack of health services, it is the primary health service level that functions insufficiently (UNICEF, 2009). The job of the primary health service is to deliver treatment to all children for simple infections as pneumonia, malaria and diarrhea, as well as deliver advice and education to caretakers about care practices. Thereby they could prevent and treat disease and secure sound child development and avoid the development of child undernutrition. The services should be available to all people, also rural inhabitants living in remote areas, and when considering developing countries, it should be free of cost, in order for the people to be able to seek help at any relevant occasion. This is critical in order to reach every child with needed public health interventions such as immunization, vitamin A supplementation and in the case of undernutrition, supplementary food and information for caretakers (UNICEF, 1998).

Income poverty

The problem of income poverty and hunger is directly correlated. Income poverty and unemployment are also very closely linked, and by default unemployment and hunger are correlated. In countries with a high unemployment rate, often results in a large part of the population being dependent on subsistence farming. Little extra income is generated and the rural population can become increasingly food insecure and it can thereby affect dietary intake, as well as the access to health facilities. Therefore an employment is a good way to

relieve the household of the vulnerability of lacking availability (Sen, 1999).

Basic factors contributing to malnutrition

The third level, the basic causes of undernutrition, are a broad set of factors that operate at the sub-national, national and international levels and range from structural and natural resources, social and economic environments to political and cultural contexts. Basic causes, also called national or root causes, of malnutrition include poor availability and control of resources (political, social, ideological and economic), environmental degradation, poor agriculture, war, political instability, urbanization, population growth and size, distribution, conflicts, trade agreements and natural disasters, religious and cultural factors (Torún & Chew, 1994; Vorster & Hautvast, 2002; UNICEF, 2004; Torún, 2006). Other basic causes include market failures due to economic decline, conflict and political upheavals that can lead to a reduction in food yields and price increases (Mason *et al.,* 2005). Loss of food after a harvest can also occur when storage conditions are poor and food is inadequately distributed (Torún & Chew, 1994; Torún, 2006). If issues related to the economic position of the family are affected negatively, it can influence the chances of a child being stunted and underweight (Grantham-McGregor, 1984; Zere & McIntyre, 2003; UNICEF, 2004).

Classification of malnutrition

Table 1.1. Classification of malnutrition (Firman, 2010).

Classification	Definition	Grading	
Gomez	Weight below % median WFA	Mild(grade1) Moderate(grade2) Severe (grade 3	75%–90%WFA 60%–74%WFA <60% WFA
Waterlow	z-scores(SD) below median WFH	Mild Moderate Severe	80%–90%WFH 70%–80%WFH <70% WFH
WHO (wasting)	z-scores (SD) below median WFH	Moderate Severe	-3%</= z-score <-2z-score < -3
WHO (stunting)	z-scores (SD) below median HFA	Moderate Severe	-3%</= z-score <-2z-score < -3
Kanawati	MUAC divided by occipitofrontal head circumference	Mild Moderate Severe	<0.31 <0.28 <0.25
Cole	z-scores of BMI for age	Grade1 Grade2 Grade3	BMI for age z-score<-1 BMI for age z-score<-2 BMI for age z-score < -3

Malnutrition can be classified in six different ways: Gomez, Water-low, WHO (Wasting), WHO (Stunting), Kanawati and Cole as in Table 1.1 (Firman, 2010). Modified Wellcome Classification uses weight for age (Gomez classification system) and the presence or absence of oedema to classify PEM. This classified PEM into kwashiorkor, underweight; marasmus, marasmic kwashiorkor as in Table 1.2 (Firman, 2010). Marasmus and the various forms of kwashiorkor are part of the recently defined Severe Acute Malnutrition (SAM) by the World Health Organization (WHO). The WHO defined SAM by a very low weight for height (below -3z scores of the median WHO growth standards), visible severe wasting or the presence of nutritional oedema (WHO, 2015).

Table 1.2. Modified Wellcome Classification (Firman, 2010).

Weight for Age (Gomez)	With Edema	Without Edema
60-80%	Kwashiorkor	Underweight
< 60%	Marasmic-kwashiorkor	Marasmus

Assessment of nutritional status

The nutritional status of a child can be evaluated using specific measures called anthropometric measures (weight for age, weight for height, mid-upper arm circumference, etc.) in addition to dietary history, physical and biochemical signs for malnutrition (WHO, 1999).

Anthropometric measures

Anthropometric measurements that can be used for nutritional assessment are indicated in Table 1.3 (Bates *et al*., 2005). Assessment of nutritional status according to weight-for-height (or length), height (or length)-for-age and oedema is summarized in Tables 1.4. (Torún, 2006), while assessment according to mid-upper arm circumference (MUAC) is found in Table 1.5 (Golden & Golden, 2000).

Table 1.3. Anthropometric measurements for nutritional assessment (Bates et al., 2005).

Age (years)	Practical field Observations	More detailed observations
0 – 1	Weight Length	Head and arm circumference Triceps and subscapular skinfolds
1 – 5	Weight Length / Height Arm circumference	Triceps and subscapular skinfolds
5 – 20	Weight Height Arm circumference	Triceps, subscapular and medial calf skinfolds Calf circumference
> 20	Weight Height	Arm and calf circumference Triceps, subscapular and medial calf skinfolds Waist and hip circumference (overnutrition only) Demispan (elderly subjects)

Table 1.4. Classification of severity of current ("wasting") and past or chronic ("stunting") PEM in infants and children, based on the weight for height and height for age

	Normal	Mild	Moderate	Severe
Weight for height (deficit = wasting)	90-110 (+ 1 Z-score)	80-89 (-1.1 to – 2 Z score)	75-79 (-2.1 to –3 Z-score)	< 75, or with oedema (< -3 Z-score)
Height for age (deficit = stunting)	95-105 (+ 1 Z-score)	90-94 (-1.1 to –2 Z-score)	85-89 (-2.1 to –3 Z-score)	<85 (< -3 Z-score)

and oedema (Torún, 2006).

Table 1.5. Classification of malnutrition in children aged 1-5 years by mid upper arm circumference (Golden & Golden, 2000).

Circumference (cm)	Level of nutrition
> 14	Normal
12.5 – 14.0	Mild / moderate malnutrition
< 12.5	Severe malnutrition

History and physical examination

A checklist for taking the child's medical history and conducting the physical examination is given in appendix iv (WHO, 1999).

An infant with marasmus is extremely underweight with loss of subcutaneous fat. The body has a "skin and bones" appearance, and the child is profoundly weak and highly susceptible to infections. The cause is a diet very low in calories from all sources (including protein), often from early weaning to a bottled formula prepared with unsafe water and diluted because of poverty. Poor hygiene and continued depletion lead to a vicious cycle of gastroenteritis and deterioration of the lining of the gastrointestinal tract, which interferes with absorption of nutrients from the little food

available and further reduces resistance to infection. If untreated, marasmus may result in death due to starvation or heart failure (Encyclopedia Britannica, 2015).

Kwashiorkor, a Ghanaian word meaning the disease that the first child gets when the new child comes, is typically seen when a child is weaned from high-protein breast milk onto a carbohydrate food source with insufficient protein. Children with this disease, which is characterized by a swollen belly due to edema (fluid retention), are weak, grow poorly, and are more susceptible to infectious diseases, which may result in fatal diarrhea. Other symptoms of kwashiorkor include apathy, hair discoloration, and dry, peeling skin with sores that fail to heal. Weight loss may be disguised because of the presence of edema, enlarged fatty liver, and intestinal parasites; moreover, there may be little wasting of muscle and body fat (Encyclopedia Britannica, 2015).

Malnourished child is susceptible for selected nutrient-deficiency diseases such as xerophthalmia (vitamin A deficiency), rickets (vitamin D deficiency), beriberi (thiamine deficiency), pellagra (niacin deficiency), scurvy (vitamin C deficiency) and iron-deficiency anemia (iron deficiency). Therefore, the child should be evaluated for symptoms and signs associated with above nutrient deficiencies.

Laboratory tests

Where facilities permit, the laboratory tests (given in appendix iii) may help to diagnose specific problems. They are not needed, however, to guide or monitor treatment. The interpretation of test results is frequently altered by malnutrition. For this reason, laboratory tests may misguide inexperienced workers (WHO, 1999).

Investigations for associated comorbidities such as HIV/AIDS and those for selected nutrient deficiencies, if appropriate, may be ordered depending on the availability of the test at the facility.

Management of Severe Malnutrition

Management in severe malnourished children includes stabilization and rehabilitation phases (Appendix vi).

In stabilization phase, initial treatment begins with admission to hospital and lasts until the child's condition is stable and his or her appetite has returned, which is usually after 2–7 days. If the initial phase takes longer than 10 days, the child is failing to respond and additional measures are required. The principal tasks during initial treatment are to treat or prevent hypoglycaemia (blood glucose <54 mg/dl or <3 mmol/l) and hypothermia (rectal temperature is below 35.5 °C (95.9 °F) or the underarm temperature is below 35.0 °C (95.0 °F)); to treat or prevent dehydration and restore electrolyte balance; to treat incipient or developed septic shock, if present; to start to feed the child; to treat infection; to identify and treat any other problems, including vitamin deficiency, severe anaemia and heart failure(WHO, 1999). If hypothermia is present, the child should be warmed by using a warming blanket or by close contact with the mother's body. Diarrhea can cause death due to either dehydration or electrolyte imbalance (Mitra *et al*., 2000).Whenever possible, a dehydrated child with severe malnutrition should be rehydrated orally with oral rehydration (rehydration solution for malnutrition or ReSoMal) that contains high potassium concentration and low sodium concentration. IV infusion easily causes overhydration and heart failure and should be used only when there are definite signs of shock. If intravenous hydration is necessary, as in case of septic shock, Half-strength Darrow's solution with 5 percent glucose is preferred (WHO, 1999) and observe the child carefully (every 5–10 minutes) for signs of overhydration and congestive heart failure. If infection is present, oral antibiotics like amoxycillin 50mg/kg in 3 divided doses or trimethoprim-sulfamethoxazole 'TMP-SMX' 5 mg of trimethoprim/kg + 25 mg of sulfamethoxazole orally twice daily for 5 days is recommended for treatment of non-complicated infections like UTI. Children with complications (septic shock, hypoglycaemia, hypothermia, skin infections, respiratory or urinary tract infections, or who appear lethargic or sickly) should be treated with intravenous broad spectrum of antibiotics: ampicillin, 50mg/kg IM or IV every 6 hours for 2 days, followed by amoxicillin, 15mg/kg orally every 8 hours for 5 days (if amoxicillin is unavailable, give ampicillin, 25mg/kg orally every 6 hours) and gentamicin, 7.5 mg/kg IM or IV once daily for 7 days (WHO, 2013b). Children who do not require other emergency treatment, especially for hypothermia, dehydration or septic shock, should immediately be given a formula diet. They should also continue to be breastfed. Feeding should be initiated using a formula containing 75-kcal/100mls (known as F-75 formula) soon after the child reaches the hospital. Infants are fed orally using a cup, spoon or syringe and nasogastric tube if there is impaired consciousness or there is vomiting, tachypnea, or painful stomatitis. If the child's appetite improves, treatment has been successful.

The initial phase of treatment ends when the child becomes hungry (Ashworth *et al*., 2003). This indicates that infections are coming under control, the liver is able to metabolize the diet, and other metabolic abnormalities are improving. The child is now ready to begin the rehabilitation phase. This usually occurs after 2–7 days. Some children with complications may take longer, whereas others are hungry from the start and can be transferred quickly to F-100. Nevertheless, the transition should be gradual to avoid the risk of heart failure which can occur if children suddenly consume large amounts of feed (WHO, 1999). Replace the F-75 diet with an equal amount of F-100 for 2 days before increasing the volume offered at each feed. Mineral supplements are also recommended in the rehabilitation phase. Folic acid, vitamin A and zinc are recommended during admission while Iron is given only in the rehabilitation phase. Emotional and physical stimulation through play programmes that start during rehabilitation and continue after discharge can substantially reduce the risk of permanent mental retardation and emotional impairment. A child may be considered to have recovered and be ready for discharge when the child's weight-for-height Z-score is >–1 SD. has reached -1 SD (WHO, 2013b). Training of the mother should focus on areas that need to be strengthened, especially feeding practices, mental and physical stimulation of the child. Follow up of the child is done for about six months at a special clinic (WHO, 1999).

Malnutrition is a major cause of child death globally. Malnutrition is a major determinant of morbidity and mortality in infancy and childhood. It has long term impacts on health outcome of the child. Malnutrition is a public health problem especially in developing countries. Mortality is related to the severity of the malnutrition.

Some 805 million people in the world do not have enough food to lead a healthy active life that's one in nine people in the earth (FAO, 2015). Worldwide, 99 million children under age 5 were underweight in 2013 ((UNICEF *et al*., 2014). Recent data in 2013 have showed that the percentage of underweight in under-five children in rural Latin America was at 8% , in rural Sub-Saharan Africa 26% and in Somalia 40% and 21% in rural and urban areas respectively (UNICEF, 2014). In Somalia, some 236,000 children under the age of

five are malnourished, more than two thirds of them in the south (IFAD, 2013). In 2014, Over 160,000 severely malnourished children reached through UNICEF supported programmes (UNICEF, 2015). The percentage of mortality due to malnutrition in Somalia is not known.

Even though the causes of malnutrition can be broadly categorized into immediate, underlying and basic causes, they differ from area to area (UNICEF, 2014). In Somalia, the causes of child malnutrition are multifactorial with major concern on dietary intake and food insecurity, health and care. In this research, the study aimed at finding out the determinants of malnutrition among children under five years in SOS Hospital in Mogadishu, Somalia.

Study Objective

The broad objective of the study was to investigate determinants of malnutrition among children under five years in SOS Hospital in Mogadishu.

Scope of the study

The study focused on the geographical area of Benadir region and the target group was under 5 years malnourished children attending at SOS Hospital in Mogadishu Somalia. The study was conducted at SOS Hospital which is one of the referral hospitals, located in the North part of Mogadishu in Heliwa District and provided specialty care in paediatrics and obstetrics & gynaecology. Most of patients in this facility come from Benadir region. It has a bed capacity of 124. The Paediatric wards have 82 bed capacities with 4 subunits namely, out-patient department (OPD) unit, pediatric emergency and semi-intensive care unit, general pediatric ward (including a unit for malnutrition), premature and neonatal intensive care unit (NICU). The malnutrition unit is subdivided into 4 core units: Supplementary Feeding Program(SFP) unit, Out-Patient Therapeutic Program (OTP) unit, Stabilization Center (SC) unit and community mobilization unit. All children diagnosed as severe acute malnutrition (SAM) with complications are admitted for care and follow up in the malnutrition SC unit which has 24 beds. On average, about three children are admitted per day with severe acute malnutrition. Nurses and doctors supervise daily the malnutrition unit for care and feeding.

Related Literature

Theoretical review

Many factors will have an impact on development of malnutrition in children. The child's birth-weight, breastfeeding status and duration, maternal nutritional knowledge, frequency of food intake particularly protein-energy rich foods will influence the nutrition (UNICEF, 2013). Mortality of malnourished patients are influenced by parental education, child factors as residence location (urban or rural), age, and gender, relationship between patient and providers and system of care (Oyelami *et al*., 2007). Treatment course interruption have also impact on mortality as child care givers may drop out from malnutrition centers with clinical improvement of the child's condition without meeting discharge criteria. Geographic proximity to treatment centers, cost of transportation, substance abuse of care givers may also contribute to the discontinuation of treatment.The interaction between undernutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status (UNICEF, 2013).

The strongest and most consistent relation between malnutrition and an increased risk of death was observed for diarrhoea and acute respiratory infection. The evidence, although limited, also suggests a potentially increased risk for death from malaria. A less consistent association was observed between nutritional status and death from measles. Although some hospital-based studies and case–control studies reported an increased risk of mortality from measles, few community-based studies reported any association (Rice *et al*., 2000).

On September 2014, UNICEF, WHO and the World Bank (WB) updated their joint database on child malnutrition and released new global and regional estimates for 2013. Globally, 161 million under-five year olds were stunted in 2013. The global trend in stunting prevalence and numbers affected is decreasing. Between 2000 and 2013, stunting prevalence declined from 33% to 25% and numbers declined from 199 million to 161 million. In 2013, about half of all stunted children lived in Asia and over one third in Africa (UNICEF *et al*., 2014).

Globally, 51 million under-five year olds were wasted and 17 million were severely wasted in 2013. Globally, wasting prevalence in 2013 was estimated at almost 8% and nearly a third of that was for severe wasting, totaling 3%. In 2013, approximately two thirds of all wasted children lived in Asia and almost one third in Africa, with similar proportions for severely wasted children (UNICEF *et al*., 2014).

Globally, 99 million under-five year olds were underweight in 2013, two thirds of which lived in Asia and about one third in Africa. The global trend in underweight prevalence continues to decrease; going from 25 per cent to 15 per cent between 1990 and 2013. Africa has experience the smallest relative decrease, with underweight prevalence of 17% in 2013 down from 23% in 1990, while in Asia for same period it reduced from 32% to 18% and in Latin America and the Caribbean from 8% to 3%. This means Asia and Latin America and the Caribbean are likely to meet the MDG while Africa is likely to fall short, reaching about only half of the targeted reduction (UNICEF *et al*., 2014). The percentage of underweight in under-five children in rural area of Somalia is 40% and in urban area is 21% (UNICEF, 2014).

Recent estimates suggest that malnutrition (measured as poor anthropometric status) is associated with about 50% of all deaths among children. Although the association between malnutrition and all-cause mortality is well documented, the malnutrition-related risk of death associated with specific diseases is less well described. There is a relation between malnutrition and child mortality from diarrhoea, acute respiratory illness, malaria and measles, conditions that account for over 50% of deaths in children worldwide (Rice *et al*., 2000).

Child stunting, wasting, and underweight have been individually associated with increased mortality. It is unclear how multiple anthropometric deficits amplify the risk of mortality and which combination is associated with the greatest risk. However, children with multiple deficits are at a heightened risk of mortality and may benefit most from nutrition and other child survival interventions (McDonald *et al*., 2013).

The severity of malnutrition depends on the timing and duration of the nutritional stress. Malnutrition increases a child's susceptibility to illnesses, such as infections, which doesn't necessarily lead to death, but it can contribute to mortality due to the other illnesses (Duggan & Golden, 2005). The life-threatening complications that accompany severe malnutrition include jaundice, severe anaemia, respiratory distress, neurological and consciousness alterations and hypothermia (Torún & Chew, 1994; Torún, 2006).

Child mortality rather than infant mortality can give a better idea of the association between malnutrition and death. The nutritional status of the child affects the risk of death due

to diarrhoea, respiratory infection and malaria (Duggan & Golden, 2005). Marasmus is associated with a lower mortality than kwashiorkor (Shetty, 2002). The difference between the long-term effects of severe malnutrition and persistent socio-economic deprivation are difficult to separate (Duggan & Golden, 2005). There is no clear evidence to show that the damage done by malnutrition and poor living environment cannot be corrected in a good, stimulating environment (Torún & Chew, 1994; Torún, 2006).

Mortality rates are also associated with the quality of treatment. With adequate treatment a mortality rate of 5% or less can be achieved. Severe anthropometric deficiencies are associated with a higher mortality rate. Mortality rates can be as high as 40% but with adequate treatment it can be reduced to less than 10% (Torún & Chew, 1994; Torún, 2006).

Conceptual Framework (Relationship between variables)

The conceptual framework consists of both independent and dependent variables. The independent variables are socio-demographic factors, maternal & child factors and comorbidities while the dependent variable is malnutrition among children under five years.

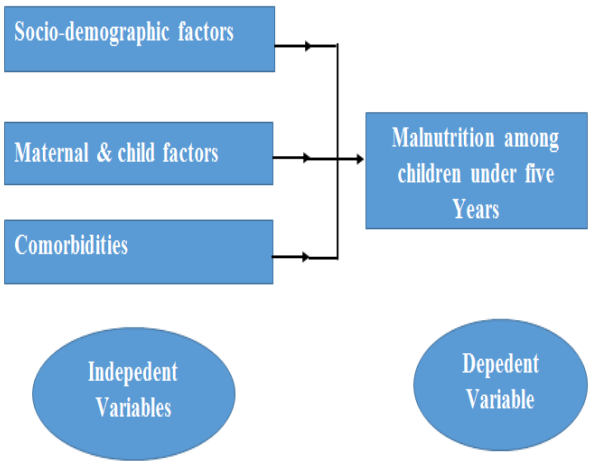

Figure 2.1. Study Conceptual Framework.

The Socio-demographic factors

Income poverty

Income poverty (due to unemployment, low wages, or lack of education) can lead to household food insecurity, inadequate care, "unhealthy household environment, and lack of health services." People of low socioeconomic status are most vulnerable to food insecurity since purchasing power serves as a main determinant of the ability-to-afford nutritional food sources. Households that cannot attain nutritious foods due to income poverty are most associated with the inadequate diet and disease that leads to malnutrition (Horton *et al.*, 2008).

Somalia is among the five least developed countries of 170 countries listed in the 2012 Human Development Index. It faces several obstacles, including long-term civil conflict, the lack of a fully functioning government, and natural disasters. More than 70 per cent of the population is under the age of 30. Almost 20 per cent of children do not survive past their fifth birthday. About 40 per cent of the population lives in extreme poverty, in rural areas this figure exceeds 50 per cent. In 2012, 62 per cent of the population was rural. Overall, where there is less instability – such as in the northern regions of Somaliland and Puntland – the rural poverty and food security situation is less critical. In much of the country, insecurity and lack of functional infrastructure have exacerbated already low crop yields. Poor access to irrigation is another contributing factor. In central and southern Somalia, irrigation is restricted to the relatively fertile areas around the Shabelle River, where the main crops are maize, rice, sesame, cowpeas, bananas, papayas, lemons, grapefruit and mangoes. Currently, only 20 to 30 per cent of land that was irrigable prior to the civil war can be irrigated. Livestock is essential to the economy and is the chief source of food and foreign exchange income. Over 60 per cent of the population depends on livestock for food and income. The 2011 drought led to the worst famine in 60 years. Worst affected were the Shabelle, Bay and Bakool regions. Despite the official end of the famine, 2.1 million people remain food-insecure and 236,000 children malnourished, 70 per cent of them in southern Somalia (IFAD, 2013).

Parental education

The role of parental education in determining children's health and nutritional status is two-fold. First, ignorance is directly associated with poor infant and child rearing practices, misconceptions about food, inadequate feeding during illness (especially infectious diseases and diarrhea), improper food distribution among family members (Torún, 2006), poor maternal care (James *et al*., 1999) and high birth rates.

Second, better education should translate into higher incomes. In studies where income is not included as a separate variable, then this effect should exert a positive effect on the coefficient of parental education variables. Even when income is included in the estimated equation, schooling that is more parental could be beneficial for child health and nutrition. Better educated parents are likely be able to make better use of available information about child nutrition and health, partly as being educated themselves may increase their preference for child quality over quantity (a decision which can also reflect the increased opportunity cost of the mother's time). Most likely, successful completion of primary schooling or functional literacy is sufficient in this context, and post-primary school education might only add limited benefits, though this depends on the quality of schooling. Furthermore, education might be a signal for parents' innate intellectual abilities, leading to a positive coefficient even if education itself possesses no value. Of particular interest in the analysis of education is the differential impact maternal and paternal schooling might have. Since it is mainly mothers who care for children, while men are presumably working outside of the household, mothers' ability to access information and make use of existing health care facilities is likely to be more important. Female education should thus be directly relevant, whereas paternal education should affect child health and nutritional status mainly through its income generating properties (World Bank, 2004).

Household size and composition

Household size and composition can have different effects. What usually matters is the dependency ratio that is the ratio of non-working to working (or total) household members. If a household is large because it comprises a large number of able-bodied people of working age then, partly by virtue of economies of scale in consumption, the welfare of household members should, ceteris paribus, be higher and so child health and nutrition status better. However, if there are many young children they compete for resources, children of higher birth order being particularly vulnerable. Anthropologists writing of different continents have documented how parents reluctantly practice triage, neglecting the care of certain children who die as a result (Turnbull, 1973; Scheper-Hughes, 1992), or even actively intervene to

bring about death usually of daughters (Croll, E. 2000; Venkatramani, 1992).

Sanitation and drinking water

The provision of sanitation and drinking water is seen as an essential complement to the availability of food in preventing child malnutrition. Even if the food supply for children is sufficient, diarrhea hampers the intake of calories and micronutrients and thereby prevents adequate nutritional outcomes and increase the likelihood of mortality. By reducing the risk of bacterial infections and diarrheal diseases, sanitation and clean water will indirectly contribute to a child's nutrition. The reduction in infections from contaminated water and the lack of hygiene may also have spill-over effects to other households in the neighborhood as the probability cross-infections will fall. The rise in the availability of these services may thus even affect households that do not have direct access to them. Sharing of piped water, and probably to a much lesser extent toilet facilities, may also contribute to this (World Bank, 2004).

Maternal and child factors

Maternal nutrition

Poorly nourished mothers give birth to babies with low birth weight and those babies who were born underweight are more likely to be growth retarded in childhood. Further, children of malnourished mothers were more likely to be malnourished in their childhood. Hence, finding determinants of maternal malnutrition is of vital importance to ensure that malnutrition does not become an intergenerational problem. Many interrelated factors influence a mother's nutritional status, ranging from her physiological utilization of food and nutrients during pregnancy and lactation, through to the socioeconomic influences on food availability (World Bank, 2004).

In this context, it is important to understand that malnourished mothers can still breastfeed. Moderate malnutrition has little or no effect on milk production. However mothers should be provided with extra food and fluids to rebuild their own nutrient stores, and may need micronutrient supplements. Severely malnourished mothers need therapeutic care and skilled support to continue breastfeeding (UNICEF, 2015a).

Breast-feeding

Early and exclusive breastfeeding helps children survive, but it also supports healthy brain development, improves cognitive performance and is associated with better educational achievement at age of 5 years. Breastfeeding is the foundation of good nutrition and protects children against disease. In this way, breastfeeding allows all children to thrive and develop to their full potential. Yet, less than half of the world's newborns benefit from early breastfeeding and even fewer are exclusively breastfed for the first six months (UNICEF, 2015c).

Optimal breastfeeding of infants under two years of age has the greatest potential impact on child survival of all preventive interventions, with the potential to prevent over 800,000 deaths (13 per cent of all deaths) in children under five in the developing world (Lancet, 2013).

Breastfed children have at least six times greater chance of survival in the early months than non-breastfed children. An exclusively breastfed child is 14 times less likely to die in the first six months than a non-breastfed child, and breastfeeding drastically reduces deaths from acute respiratory infection and diarrhoea, two major child killers (Lancet, 2008).

Infants are particularly vulnerable during the transition period when complementary feeding begins. Ensuring that their nutritional needs are met thus requires that complementary foods be timely, adequate, safe and properly fed. Appropriate complementary feeding depends on accurate information and skilled support from the family, community and health care system (WHO & UNICEF, 2003).

Childcare practice

Childcare practices also include protecting the children's food and drinks from contamination to reduce the risk of infections. A caregiver's unwashed hands can cause infections such as diarrhea (Abate *et al.,* 2001). When the household income decreases, usually the women try earning extra wages. This causes the mother to have less time for childcare and ensuring the children eat healthy food. If the female children are also sent out to look for work, this results in poor school attendance, which influences education, leading to poor knowledge and caring practices for her own family (UNICEF, 2009b).

Sex of child

Mortality is found to be higher among male infants compared to female infants, a result that seems particularly striking in East Asia. However, male children are less likely to die than female children are, and in no studies of child, mortality does being male have a positive effect. Nearly half the nutrition studies find that male children are less well nourished than females –this is true of almost all of the studies in East and Southern Africa. This means that roughly half of the authors do not find a significant gender effect. Sex of child is always an insignificant determinant of nutrition in the Latin American studies reviewed. In Asia, the experience is mixed and no strong conclusions can be drawn, even for individual countries (World Bank, 2004).

Age of child

Age of child is an important determinant of malnutrition; a study done in Kenya, the mean age was 29.5 months in 1993, 28.3 months in 1998 months, 27.8 months in 2003, and 28.7 months in 2008-09. (Masibo, 2013). In a systemic review on timing of mortality in malnutrition children, majority occur before the age of two years because during this period, the child has increased nutritional needs to support rapid growth and development, is more susceptible to infections, and is totally dependent on others for nutrition (UNICEF, 2013). A study conducted in Nigeria showed that the most common age groups with PEM were 6 to 12 months (55.7%) followed by 13 to 24 months (36.8%) and the lower household socio-economic class was found to be significantly associated with mortality of child malnutrition (Ubesie *et al*., 2012).

Child vaccination

More than 30 million children are unimmunized either because vaccines are unavailable, because health services are poorly provided or inaccessible, or because families are uninformed or misinformed about when and why to bring their children for immunization. Pneumonia, diarrhoea, malaria, measles, HIV/AIDS and malnutrition are the primary killers of children in the developing world. These children die because they are poor, they do not have access to routine immunization or health services, their diets lack sufficient vitamin A and other essential micronutrients, and they live in circumstances that allow pathogens (disease-causing organisms) to thrive (UNICEF, 2015b).

Comorbidities in malnutrition

Diarrhea

Diarrheal disease is the second leading cause of death in children under five years old, and is responsible for killing

around 760 000 children every year. Diarrhea can last several days, and can leave the body without the water and salts that are necessary for survival. Most people who die from diarrhea actually die from severe dehydration and fluid loss. Children who are malnourished, or have impaired immunity as well as people living with HIV are most at risk of life-threatening diarrhea. Children who die from diarrhea often suffer from underlying malnutrition, which makes them more vulnerable to diarrhea. Each diarrheal episode, in turn, makes their malnutrition even worse. Diarrhea is a leading cause of malnutrition in children under five years old (WHO, 2013a).

Measles

Measles, a viral respiratory infection, killed over 500,000 children in 2003, more than any other vaccine-preventable disease. The measles death children in Africa is so high – every minute one child dies – that many mothers don't give children real names until they have survived the disease. Measles weakens the immune system and renders children very susceptible to fatal complications from diarrhea, pneumonia and malnutrition. Those that survive may suffer blindness, deafness or brain damage (UNICEF, 2015).

The WHO Integrated Management of Childhood Illness initiative is based on the premise that combining efforts to promote the appropriate case management of serious infectious diseases with nutritional interventions, immunization programmes, and other disease prevention and health promotion activities. This will be more effective in decreasing child mortality than implementing any one of the components alone (Lambrechts *et al*., 1999; Tulloch, 1999).

Acute respiratory illness

The synergistic relation between malnutrition and infection is well known, and nutritional interventions have been recognized as an important approach for reducing mortality from acute respiratory illness and diarrhoea (Jamison *et al*., 2006). Malnutrition is an important risk factor for acute respiratory infection (ARI), which is a leading cause of mortality and morbidity among children aged < 5 years.

Malaria

The relation between malnutrition and malaria is controversial. On the one hand, malaria may cause malnutrition, whereas on the other hand, malnutrition itself may modulate susceptibility to the disease. A study done in Kenya on malaria and nutritional status in children living on the coast of Kenya concluded that the effect of malaria on nutritional status appears to be greatest during the first 2 y of life (Nyakeriga *et al*., 2004).

HIV/AIDS

Undernutrition is common among people living with HIV/AIDS. The HIV/AIDS pandemic combined with drought, floods, soaring food prices, decades of conflict, economic decline and cuts in social services, have overwhelmed families in many parts of sub-Saharan Africa, leaving them with few coping mechanisms. Weight loss and low micronutrient levels are associated with increased progression to AIDS in adults living with HIV. This crisis in Africa has underscored the dire nutritional needs of all children who are HIV positive or affected by HIV/AIDS, such as orphans and those living in households with infected family members. Many are left to fend for themselves, while others live with HIV-infected parents who can no longer provide food for their families. Undernutrition rates are increasing and orphans are hardest hit. Without treatment, almost 50 per cent of infected infants will die before age two. In 2012, 646,852 children 0-14 aged were receiving antiretroviral therapy in low and middle-income countries. Many HIV-infected children also suffer from undernutrition (UNICEF, 2014).

In asymptomatic adults with HIV infection, loss of lean body mass is not a common finding. However, in infants and young children with HIV infection, including those without secondary/opportunistic infections, growth failure secondary to low rates of lean tissue synthesis is common along with inability to down-regulate protein catabolism (Enwonwu, 2006).

Methodology

Research design

The study comprised of a cross-sectional hospital survey.

Target population

The study focused on under five children who were diagnosed as malnutrition at SOS Hospital. The choice of this hospital was because of easy accessibility and the convenience of getting the data by the researcher.

Inclusion criteria

Malnourished children under 5 years, admitted to paediatric units at SOS Hospital, whose mother/caregiver were willing to participate in the study by signing the informed consent were included in the study.

Exclusion criteria

Malnourished children above five years and malnourished children out of SOS Hospital.

Operational definitions

Socio-demographic status of mother/caregiver

Socio-demographic status of the mother/caregiver included the age; gender; marital status; education; occupation; income; household size; head of the household; location of residence of the family; type of house and number of rooms; source of drinking water and hand-washing practice.

Maternal & child factors

Maternal/caregiver factors included mother/caregiver nutritional status; if the mother still alive & with whom the child lives; mother/caregiver heath education & counselling on certain topics like breastfeeding,complementary feeding & hygiene; mother/caregiver TB or medical treatment; maternal antenatal care; maternal drugs, alcohol or smoking during pregnancy; place of delivery; regular visits to hospital after birth for child check up; number of live births to the child's mother including this child (birth rate) and birth order of the child.

Child factors included the child's age & sex; child's birth weight & whether the child was born prematurely; child's vaccination & vitamin A supplementation; whether the child is breastfed or not; at what age solid foods introduced; twenty-four hours dietary recall; number of meals per day; child's history of current illness, child's history of known chronic diseases & past hospitalization; child's anthropometric measures to assess child's nutritional statu and child's nutritional diagnosis.

Comorbidities

For the purpose of this study, comorbidities included; urinary tract infection, chronic suppurative otitis media, bronchopneumonia, sepsis, TB, measles, malaria, diarrhea, severe anaemia and HIV. Whether the child received treatment for the comorbidity or not was also asked.

Urinary Tract Infection (UTI) were diagnosed using a urine test, which can detect bacteria and blood in the urine. Diagnosis of chronic suppurative otitis media was suspected clinically and confirmed by culture of ear swab. Diagnosis of bronchopneumonia was confirmed using chest X-ray anterior posterior view and reading was done by experienced radiologist. Sepsis was defined as clinical features of systemic

inflammatory response (fever, tachycardia, tachypnea, leukocytosis or leukopenia) associated with infection. Diagnosis of tuberculosis was made in the presence of chronic cough that have lasted for more than three weeks supported by varied combination of the following: positive family history of tuberculosis, positive mantoux, suggestive chest X-ray and elevated erythrocyte sedimentation rate. Diagnosis of measles was based on presence of a maculopapular skin rash and checking for symptoms that are characteristic of the disease, such as white spots in the mouth, fever, cough, and sore throat. Diagnosis of malaria was confirmed using blood film. Diarrhea was defined as passage of watery or loose stools or an increase in frequency above normal for a child. Severe anaemia was defined using a packed cell volume of less than 15% or haemoglobin of less than 5g/dl. Diagnosis of HIV was made using determine and unigold.

Anthropometric measures

For the purpose of this study anthropometric measurements included weight, length/height and MUAC in children. Measurements taken of the mothers / caregivers included weight and height to determine BMI.

Weight was measured with minimal clothing using a digital electronic scale, accurate to the nearest 0.1kg for mother/caregiver while children below 2 years were weighed with an infant scale with minimal clothing. The scales were adjusted to zero before each measurement. If an infant scale is not available, the mother/caregiver and child were weighed together. The weight of the child was then subtracted from the mother/caregiver's weight to get the weight of the child.

For children less than two years, length was measured using a length board in the recumbent position by two examiners. For those above two years and mother/caregiver, height was measured while standing using a height meter. Weight for height/length Z score of less than -1 was indicated as mild, -2 was indicated as moderate and -3 was indicated as severe wasting. The researcher used a non- stretch measuring tape at midpoint between acromion and olecranon process of the left arm to the nearest 1 mm to measure MUAC. Children with MUAC of 12.5-13.5cm were mild, 11.0 to 12.5cm were moderate and less than 11cm were considered as severe malnourished.

For mothers / caregivers, body mass index (BMI) refers to the current weight (kg) divided by the height(m)^2. For the purpose of this study, mothers/caregivers with BMI of less than 18.5 kg/ m^2 were classified underweight,18.5 to 24.9 kg/m^2 were classified normal or healthy weight, 25- 29.9 kg/m^2 were classified overweight, 30-34.9 kg/m^2 were classified under class I obesity 35-39.9 kg/m^2 were classified under class II obesity and above 40 kg/m^2 were classified under class III obesity.

Diagnosis of malnutrition

Diagnosis of malnutrition was based on the Modified Wellcome Classification because it was the method that was used for clinical diagnosis by the clinicians in SOS Hospital. This classified PEM into underweight, marasmus, kwashiorkor, marasmic-kwashiorkor and there was also provision for unclassified PEM.

Ethical considerations

Permission to proceed was observed by obtaining a notice from Jomo Kenyatta University of Agriculture and Technology research committee and permission to proceed in carrying out the research from SOS Hospital and Benadir Hospital where the study was carried out for the validity and reliability of the data. Ethical issues like voluntary participation, informed consent, anonymity and confidentiality, risk of harm, benefits and being in a position to withdraw without being victimised were observed.

Findings

Socio-demographic factors associated with malnourished children

The study examined the socio-demographic factors of the children's caregivers and the findings were as follows.

Majority of the children's caregivers, 97.1% were females while male caregivers accounted for only 2.9% of all the caregivers, see Figure 4.1 below.

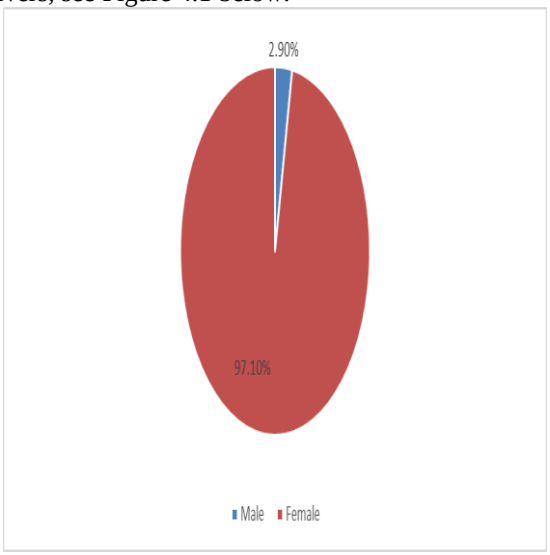

Figure 4.1. Gender of the caregiver.

The caregivers were of different age groups with majority of them within the age groups 26 – 34years (43.5%) and 19 – 25years (43.0%). This means that majority of the children caregivers(86.5%) were below the age of 35years and only 13.5% of the caregivers were 35 years and above. This result, is further displayed in the following Figure 4.2.

Table 4.1. Socio-demographic factors for the patients.

Variable	Category	Number	Percentage
Gender of the caregiver	Male	11	2.9%
	Female	373	97.1%
Age of the caregiver	19 – 25	165	43%
	26 – 34	167	43.5%
	35 – 44	42	10.9%
	Above 44	10	2.6%
Mother/caregiver Marital status	Single	7	1.8%
	Married	305	79.4%
	Divorced	60	15.6%
	Widowed	11	2.9%
	Others	1	0.3%
Mother literacy status	Cannot read and write	299	77.9%
	Can read and write	85	22.1%
Father literacy status	Cannot read and write	242	63.1%
	Can read and write	142	36.9%
Mother's Occupation	Housewife	345	89.8%
	Merchant	31	8.1%
	Employed	8	2.1%
Source of family income	Salary/wage	264	68.8%
	Old age pension	7	1.8%
	Disability Grant	13	3.4%
	Child support Grant	32	8.3%
	Other sources	68	17.7%
Level of daily income	0 - $5	342	89.1%
	$6 - $10	41	10.7%
	Above $10	1	0.3%
Household size	Up to three persons	72	18.7%
	More than three persons	312	81.3%
Head of household	Male	309	80.5%
	Female	75	19.5%

Household Location	IDPs	67	17.4%
	Near major towns	170	44.3%
	Far major towns	147	38.3%
Type of house	Ticuna	86	22.4%
	Corrugated iron sheet	277	72.1%
	Other	21	5.5%
Number of rooms used for sleeping	1 – 2	255	66.4%
	3 – 4	98	25.5%
	More than 4	31	8.1%
Source of drinking water	Unprotected water source	352	91.7%
	Protected water source	32	8.3%
Hand washing practice (n=384)	After latrine use	330	86.0%
	Before food preparation	332	86.5%
	After cleaning child	304	79.2%
	Mostly after lunch	285	74.2%
	After all the above	261	68.0%
How the caregiver wash hands?	Only with water	103	26.8
	Sometimes with soap	191	49.7
	Always with soap	90	23.4

As regards the marital status of the caregivers, 79.4% of the caregivers were married, 15.6% of the caregivers had divorced while only 2.9%, 1.8% and 0.3% of the caregivers were widowed, single and others respectively. This reveals that in this study majority of the malnutrition patients were under care of the married caregivers. The study findings also revealed that the illiteracy status (inability to read and write) of the parents of the child was high among the mothers (77.9%) as compared to fathers (63.1%). Only 36.9% and 22.1% of the child fathers and mothers respectively could read and write.

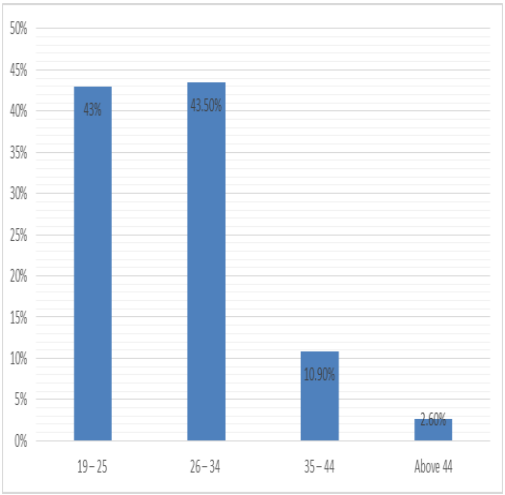

Figure 4.2. Percentage Age Composition of the mother/caregiver.

In relation to the child's mother occupation, majority of the mothers (89.8%) were housewives while only 2.1% and 8.1% of the mothers were salaried employees and Merchants, respectively. As far as the source of child's family income was concerned, 68.8% of the families obtained their income from wages and salaries, 8.3%, 3.4% and 1.8% of the families had their income source as child support grant, disability grant and old pension grant, respectively while 17.7% of the families depended on other undefined sources of income. Majority of the families (89.1%) with the malnourished children who participated in this study had a daily income of not more than $5 while only 10.7% and 0.3% of the families had a daily income of $6 - $10 and above $10 respectively. This finding is as portrayed in Figure 4.3 below.

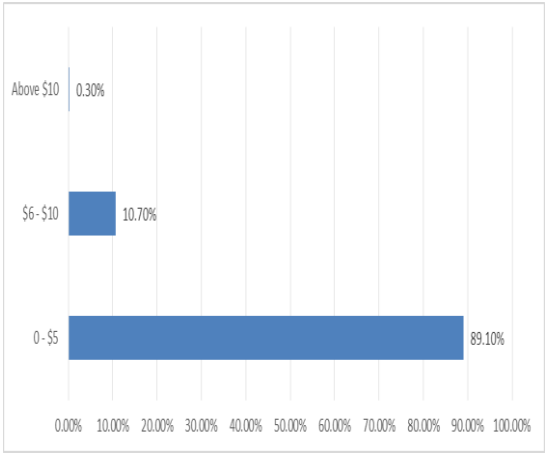

Figure 4.3. Level of Household daily income.

As regards the household size, only 18.7% of the households had three persons while the majority (81.3%) households had more than three persons. This means that most of the malnutrition cases came from large households as portrayed on the chart below.

The study results also revealed that 80.5% of the households were headed by males while only 19.5% of the households were headed by females. As far as location was concerned, nearly half 44.3% of the households were located in the near major towns, 38.3% were from far major towns while 17.4% were from IDP camps. Findings also show that most of the houses were of Corrugated iron sheets (72.1%), the *Ticuna* type accounted for only 22.4% while 5.5% of the houses were of other types other than Ticuna and Corrugated iron sheets. The findings further reveal that about two-thirds (66.4%) of the families with malnourished children had house with utmost 2rooms used for sleeping. Only 25.5% and 8.1% of the families had houses with 3 – 4 and more than 4 rooms used for sleeping. This is as portrayed on the following graph.

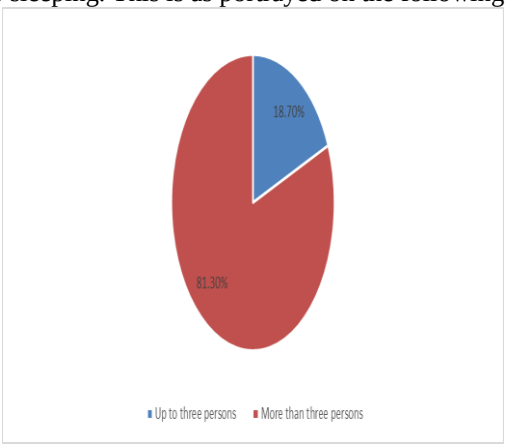

Figure 4.4. Household size.

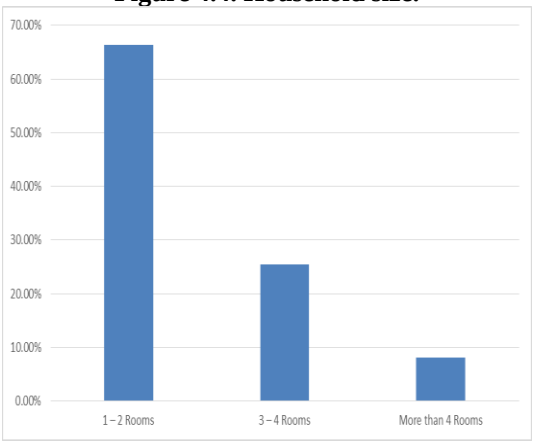

Figure 4.5. Number of rooms used for sleeping.

As regards the source of drinking water the findings reveal that only 8.3% of the households use drinking water from protected sources while a large proportion 91.7% of the families with malnourished children drink water from unprotected sources. This finding is as displayed on the chart below;

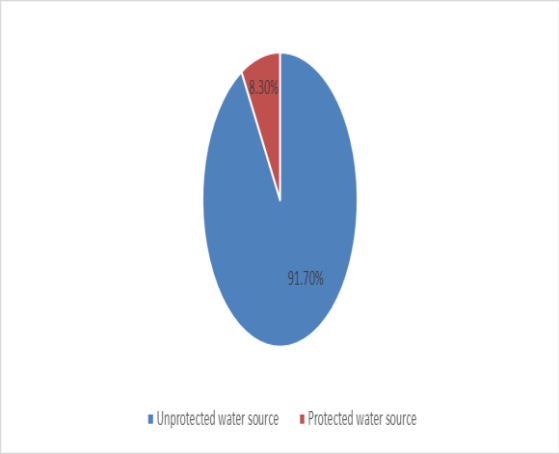

Figure 4.6. Source of drinking water.

As far as the hand washing practice is concerned, the study results indicate that a significantly high number of the caregivers wash their hands after latrine use(86%), before food preparation(86.5%), after cleaning the child(79.2%), mostly after lunch(74.2%) and 68.0% were found to wash their hands after all the four activities. This shows that over two-thirds of the caregivers washed their hands. However, as regards the way caregivers wash their hands, the results indicate that only 23.4% always wash their hands with soap, 26.8% wash their hands with only water while 49.7% of the caregivers use soap sometimes to wash their hands.

4.3 Maternal factors associated with malnutrition children

Results in Table 4.2 below, relates to the maternal/caregiver factors and includes among others mother/caregiver nutritional status;

Table 4.2. Maternal factors associated with malnourished children admitted to SOS hospital.

Variable	Category	Number	Percentage
Is mother still alive?	Yes No	376 8	97.9% 2.1%
With whom the child is staying most of the time?	Parent(s) Grandparent(s) Aunt/Uncle Other family members	346 18 8 12	90.1% 4.7% 2.1% 3.1%
Has the mother/ caregiver received counselling on the following topics?	Diarrhea Healthy eating Breastfeeding Complementary feeding Food fortification Growth Chart Hygiene Other topics	216 201 231 111 59 53 188 51	56.3% 52.3% 60.2% 28.9% 15.4% 13.8% 49.0% 13.3%
Does the mother/ caregiver or any other person in the household has TB?	Yes No	45 339	11.7% 88.3%
Is / was the mother / caregiver on any of the following treatment? (n=384)	Anti TB therapy Antimalarial therapy None Other (specify)	43 96 241 15	11.2% 25.0% 62.8% 3.9%
Did the mother attend the Ante- Natal Clinic when she was pregnant with this child?	Yes No Don't Know	200 155 29	52.1% 40.4% 7.6%
Did the mother consume any of the following during pregnancy? (n=384)	Alcohol Cigarette Khat Others Don't know None	4 23 73 52 29 203	1.0% 6.0% 19.0% 13.5% 7.6% 52.9%
Where was the child born?	Healthy Facility Home Other	155 207 22	40.4% 53.9% 5.7%
How regularly is the child taken to the hospital after birth?	Weekly Monthly None Others	13 76 225 70	3.4% 19.8% 58.6% 18.2%
Number of live births to the child's mother including this child.	1 – 3 4 – 6 7 – 9 More than 9	125 174 71 14	32.6% 45.3% 18.5% 3.7%
Order of child's birth	1st child 2nd child 3rd child 4th child Other	36 45 55 90 158	9.4% 11.7% 14.3% 23.4% 41.1%

if the mother still alive & with whom the child lives most of the time; mother/caregiver heath education & counselling on certain topics like breastfeeding,complementary feeding & hygiene; mother/caregiver TB or medical treatment; maternal antenatal care; maternal drugs, alcohol or smoking during pregnancy; place of delivery; regular visits to hospital after birth for child check up; number of live births to the child's mother including this child (birth rate) and birth order of the child.

From the above table, results show that out of the total children, 97.9% had their mothers still alive while only 2.1% had lost their mothers. However, the results indicate that only 90.1% of the children stayed with their mothers most of the time while 4.7%, 3.1% and 2.1% of the children stayed with grandparents, other family members and aunt/uncle respectively. As regards on whether the child's mother/caregiver received counselling on health topics such as; diarrhea, healthy eating, breast feeding, complementary feeding, food fortification, growth chart monitoring, hygiene and other topics, the study results indicate that majority of mothers/caregivers 60.2% received breastfeeding counselling. This was followed by 56.3% of the mothers/caregivers who received counselling on diarrhea, 52.3% of the mothers/caregivers received counselling on healthy eating and nearly a half (49.0%) of the mothers/caregivers received counselling on hygiene. However, the results further indicate that only 28.9%, 15.4% and 13.8% of the mothers/caregivers received counselling on complementary feeding, food fortification, and growth chart monitoring while only 13.3% received counselling on other health related topics. The following figure portrays the information regarding the topics on which the caregiver/mother of the malnourished children received counselling/training, see Figure 4.7 below.

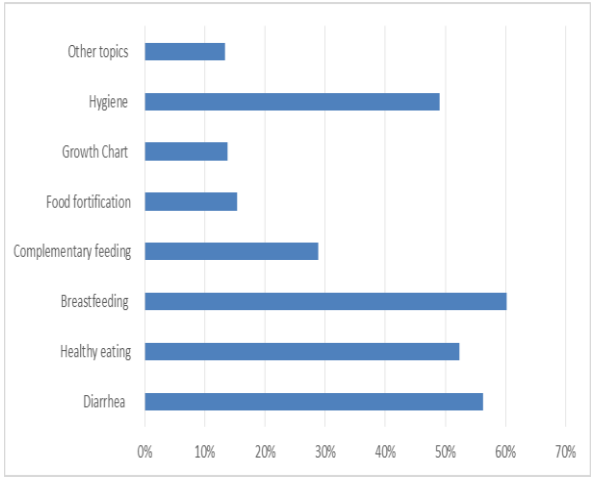

Figure 4.7. Topics on which the mother/caregiver ever received counselling.

As regards the mother/caregiver TB status, the results show that only 11.7% of the caregivers/mothers or any member of the households had TB while 88.3% had no TB. It was also revealed that majority of the mothers/caregivers (62.8%) were not on any treatment, 25.0% and only 11.2% were on antimalarial and anti TB therapy while 3.9% were on other treatments.

The study also sought information on whether the child mother attended antenatal clinic when she was pregnant with the child under consideration and the study results indicate that only 52.1% of the mothers attended antenatal clinics while pregnant. 40.4% of the mothers did not attend antenatal clinics while 7.6% did not know whether the child mothers attended antenatal clinics during pregnancy. This finding is as displayed on the following chart.

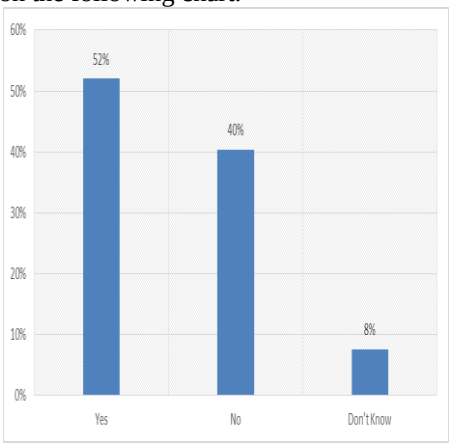

Figure 4.8. Whether the mother attend the Ante- Natal Clinic when she was pregnant.

As regards on whether the mother used drugs during pregnancy, the findings revealed that 52.9% of the respondents did not use any drug/alcohol during pregnancy of the malnourished child. 19%, 6.0%, and 13.5% of the mothers used khat, cigarette, and other drugs while only 1% and 7.6% of the mothers used alcohol and did not know whether the mothers used any drug respectively.

As far as the place where the child was born, the study findings reveals that majority of the children 53.9% were born at home while only 40.4% were born in a healthy facility(Hospital, Clinics or community health centres) while 5.7% were born from other places other than health facilities and homes. This finding is as displayed on the chart below.

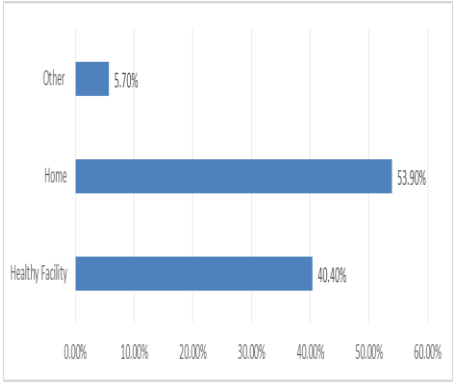

Figure 4.9. Place of Birth of the Child.

As regards hospital visits after birth, it was revealed that majority of the mothers (58.6%) do not regularly take their children to hospital after birth for checkup while only 3.4% and 19.8% regularly take their children to health facility for checkup weekly and monthly. 18.2% of the mothers followed other patterns other than those mentioned. This is as displayed on the chart below.

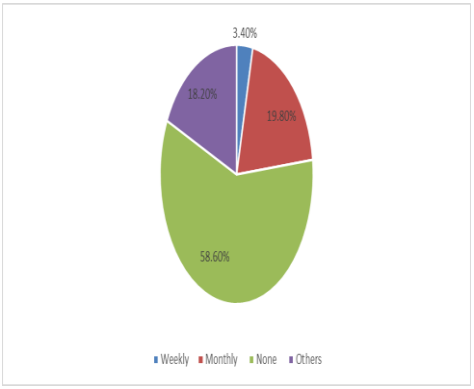

Figure 4.10. Frequency the child was taken to the hospital after birth.

As regards the number of live births to the child's mother, 45.3% of the child's mothers had 4 – 6 live births, 32.6% had 1 – 3 live births while 18.5% and 3.7% child mothers had 7 – 9 live births and more than 9 live births respectively. This means that over 67.4% of the child's mothers had more than 4 live births. As far as the child's birth order was concerned, the study findings reveal that only 9.4% and 11.7% of the malnourished children were the first and second child, respectively. 14.3% and 23.4% were of the third and fourth order, respectively while 41.1% of the malnourished children were of other birth orders. This means that the child's malnutrition chances increased as the child's birth order increased.

Child factors

Child factors associated with malnutrition children

The study sought to assess the child factors associated with malnourished children and the results are as presented in Table 4.3 below

Table 4.3. Child factors associated with malnourished children admitted to SOS hospital.

Age of the child (months)	0 – 6 months 6 – 12 months 13 – 24 months 25 – 59 months	44 255 69 16	11.5% 66.4% 18.0% 4.1%
Gender of the child	Male Female	170 214	44.3% 55.7%
Birth weight of the child(grams)	Very low birth weight(< 1500) Low birth weight(1500 – 2500)	29 90 265	7.6% 23.4% 69.0%

	Normal birth weight (2500 – 4000)		
Was the child born prematurely?	Yes No Don't Know	66 315 3	17.2% 82.0% 0.8%
Has the child been immunized up to date?	Yes no	270 114	70.3% 29.7%
Is the child's Vitamin A supplementation up to date?	Yes No	257 127	66.9% 33.1%
Has the child been breastfed?	Yes No	218 166	56.8% 43.2%
Duration of exclusive breastfeeding (months) (n=219)	1 – 2 months 3 – 4 months 5 – 6 months	50 79 90	22.8% 36.1% 41.1%
Duration the child partially breastfed (n=219)	1 – 6 months 7 – 12 months 13 – 24 months	62 145 12	28.3% 66.2% 5.5%
Type of milk if the child is not breastfed (n=169)	Formula milk Cow's milk Others	94 60 15	55.6% 35.5% 8.9%
How was the milk fed to the baby(n=167)	Bottle Cup	67 100	40.1% 59.9%
At what age was solid food introduced?(n=219)	1 – 6 months 7 – 12 months 13 – 24 months	65 130 24	29.7% 59.3% 11.0%
Number of meals per day	Less than three Three More than three	102 181 101	26.6% 47.1% 26.3%

Findings in the above table show that more than a half (55.7%) of the malnourished children were females while the males/boys accounted for only 44.3% (See chart below).

The findings also show that majority of children (66.4%) by time of interview were aged between 6 – 12months. This group was followed by those aged between 13 and 24 months while 11.5% and 4.1% of the children were aged between 0 – 6months and 25 – 59months respectively. This means that in Mogadishu, malnutrition is more prevalent among the children between 6 months and 24months of age. This finding is further portrayed on the following chart.

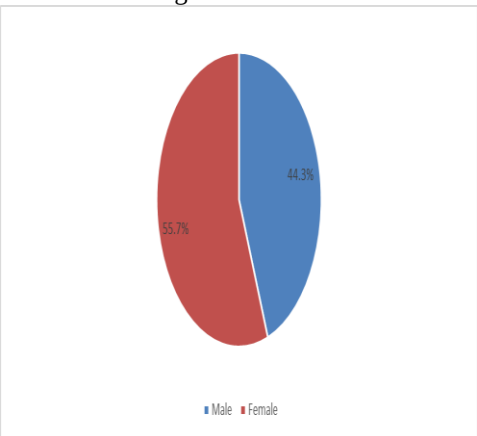

Figure 4.11. Gender of the child.

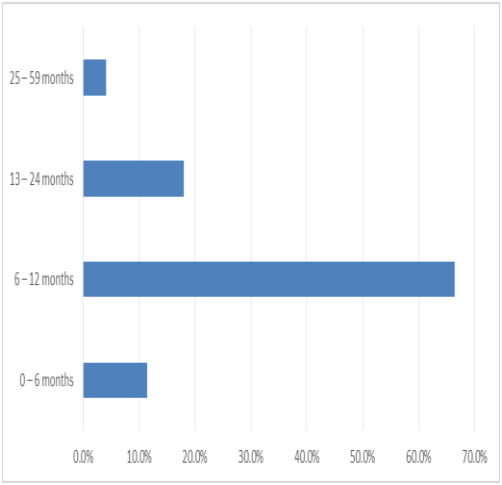

Figure 4.12. Percentage Age composition of the malnourished children (months).

As regards the birth weight of the child, 69.0% of the malnourished children studied had normal birth weight that is between 2500gm – 4000gm, 23.4% had low birth weight between 1500gm – 2500gm while only 7.6% of the children had very low birth weight that is under 1500gm.

The study findings further indicate that majority of the malnourished children 82.0% of all the children were not premature and only 17.2% were premature while only 0.8% of the children's birth status was not known. This finding is as displayed in the following figure.

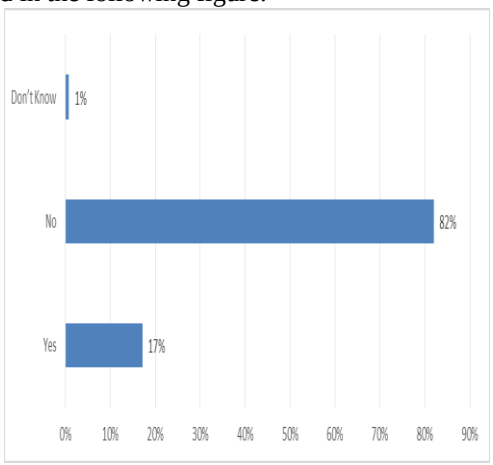

Figure 4.13. Whether the child born prematurely.

Results in Table 4.3 also reveals that 70.3% of the children under study were immunized up to-date and only 29.7% had their immunization schedules not up to-date. This shows that over two-thirds of the children admitted to the nutrition ward of SOS hospital were immunized. It is further revealed that 66.9% of the malnourished children had their vitamin A supplementation up to-date with only 33.1% who had their vitamin A supplementation not up to-date at the time of interview. As regards the child's breastfeeding status, results show that a proportion slightly above average (56.8%) of the total children had been breastfed while 43.2% were not breast fed. This shows that a child being malnourished, may be attributed to low /lack of breast feeding. This finding is as portrayed on the following chart.

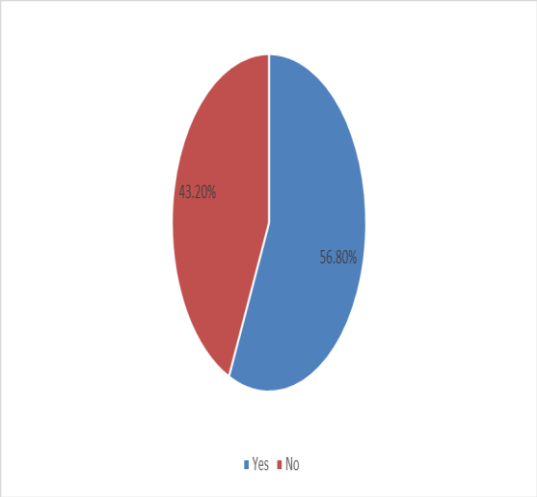

Figure 4.14. Whether the child had been breastfed.

As regards the duration at which the child were exclusively breastfed, results show that 41.1% of the children were exclusively breastfed up to the 5th and 6th month of the child's age, 36.1% were exclusively breastfed to the age of between 3 and 4 months while only 28.3% were exclusively breastfed for a duration between 1 and two months. With respect to the duration the child was partially breastfed, the results show that 66.2% of the children were partially breastfed between the age of 7 and 12 months, 28.3% were breastfed between the age of 1 and 6 months while only 5.5% were partially breastfed between the age of 13 and 24 months. Of the total children that were partially breastfed on milk, the study thought to establish the type of milk upon which the child was fed and the results in Table 4.3 indicate that majority of the children(55.6%) were fed on formula milk. 35.5% of the children were fed on cow's milk while the remaining 8.9% were fed on other milk types other than formula and cow's milk. As far as the method by which the milk was fed to the child, results indicate that majority of the children (59.9%) were fed using a cup while only 40.1% were fed using a feeding bottle.

As far as the age at which solid foods were introduced, results shows that 59.3% of the malnourished children breastfed(n=219), were introduced to solid foods at the age between 7 and 12 months. 29.7% of the breastfed malnourished children were introduce to solid foods before the age of 6 months while only 11.0% of the children had solid foods introduced at the age between 13 and 24months.

Among the child factors, the study sought for the number of meals the child had per day and the findings reveal that 47.1% of the children had an average three meals per day, while about the same proportion 26.6% and 26.3% of the children had less than three meals per day and more than three meals per day respectively. See chart below.

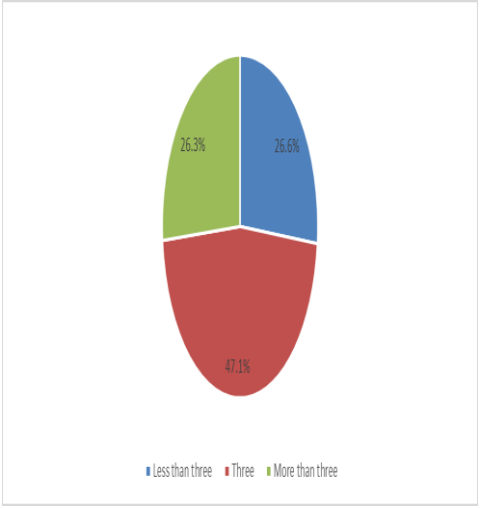

Figure 4.15. Number of meals per day.

This finding shows that, overall, majority of the malnourished children (73.7%) were subjected to not more than three meals per day.

4.4.2 The child's health/medical history

Table 4.4. Medical history of malnourished children admitted to SOS Hospital.

Patient's History of current illness	Fever	275	71.6%
	Cough	245	63.8%
	Diarrhea	172	44.8%
	Failure to gain weight	147	38.3%
	Generalized body swelling	10	2.6%
	Seizures	11	2.9%
	Oral thrush	32	8.3%
	Others	33	8.6%
Patient's History of known chronic diseases(n=384)	PTB	27	7.0%
	Congenital heart disease	29	7.6%
	Others	59	15.4%
	None	269	70.0%
Was this child previously admitted to hospital?	Yes	166	43.5%
	No	218	56.5%
Who referred child to the hospital?	Nurse	37	9.6%
	Doctor	158	41.1%
	Dietitian	12	3.1%
	Other	177	46.2%
Edema in lower limbs	Yes	11	2.9%
	No	373	97.1%
Nutritional diagnosis of the child at the time of admission	Underweight	165	43.0%
	Marasmus	202	52.6%
	Kwashiorkor	4	1.0%
	Marasmic – kwashiorkor	6	1.6%
	Unclassified	7	1.8%

As regards the child's medical/health history of current illness, the findings in Table 4.4 reveal that fever, cough, diarrhea and the child's failure to gain weight were the major illness among the children with proportions of 71.6%, 63.8%, 44.8% and 38.3% respectively. These were followed by oral thrush, seizures and generalized body swelling accounting for 8.3%, 2.9% and 2.6% of the total patient population respectively while 8.6% of the malnourished children were currently suffering from other illnesses other than those mentioned above. The above finding is as displayed on the following bar chart.

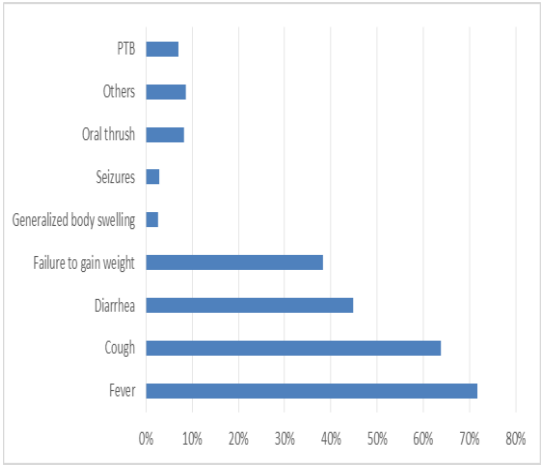

Figure 4.16. Child's History of current illness.

As far as the patient's history of chronic illness was concerned, the study findings revealed that majority of the malnourished children studied had no history of any known chronic disease. Only 7.6% and 7% of the total children studied had history of congenital heart diseases and PTB, respectively while 15.4% of the studied children had history of other chronic diseases other than congenital heart diseases and PTB. The study results also revealed that 43.5% of the total malnourished children studied had been previously admitted to the hospital while 56.5% had not been admitted to the hospital. This is further displayed on the chart below.

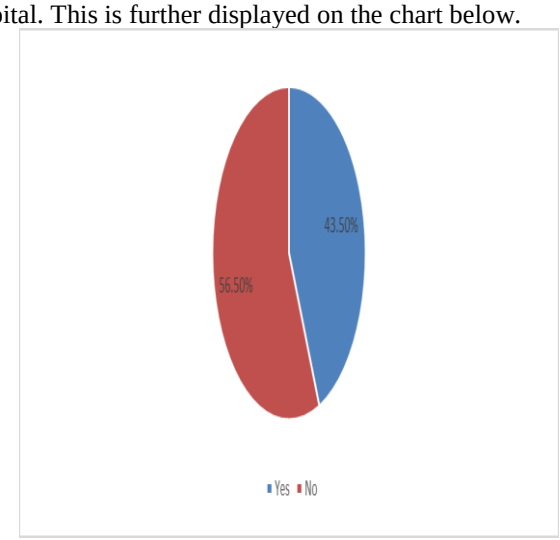

Figure 4.17. Whether the Child was Previously Admitted to the Hospital.

As regards to who referred the child to the hospital, the results indicated that only 53.8% of the total malnourished children admitted to SOS hospital were referred by known medical practitioners of which 41.1%, 9.6% and 3.1% were referred by a doctor, nurse and dietitian respectively. Other people other than the nurse, doctor or dietitian referred the remaining proportion of admissions, 46.2%. This finding is as displayed on the following chart.

As regards the condition of edema in the lower limbs of the child, the results indicate that only 2.9% of the malnourished children had the condition while a greater proportion (97.1%) had no edema in their lower limbs.

The results also reveal that among the malnourished children, 43%, 52.6%, 1%, 1.6% and 1.8% were diagnosed with underweight, marasmus, Marasmic-kwashiorkor, and unclassified respectively. This finding is further displayed in the following figure.

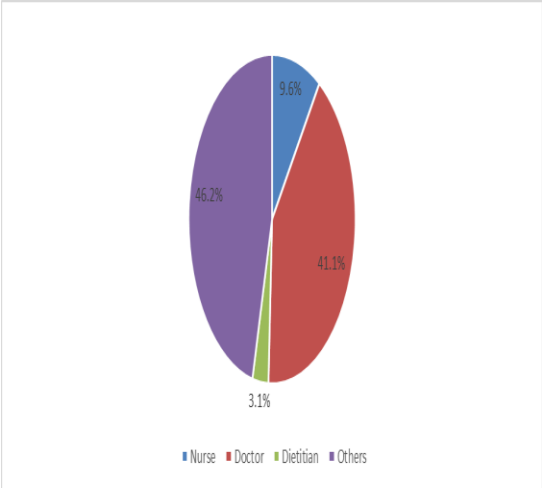

Figure 4.18. Who referred child to the hospital.

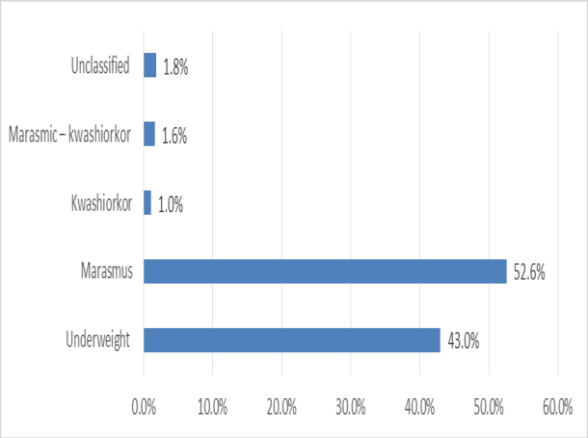

Figure 4.19. Nutritional diagnosis of the child at the time of admission.

This shows that the most prevalent/common malnutrition conditions among the children admitted were marasmus (52.6%) and underweight (43%).

4.5 Anthropometric measurements of the child and mother/caregiver

Table 4.5. Anthropometric information of the child – weight and height/length.

Variable	Range	Median
Birth weight of child/baby(kg) (n=384)	1.2 – 4.0	2.5
Current weight of child/baby(kg) (n=384)	1.6 – 15	6.5
Height/length of child/baby (cm) (n=384)	45 – 114	66

The study findings on weight and height/ length of the children presented in Table 4.5 above show that the birth weight of the malnourished children ranged between 1.2 and 4kg with a median birth weight of 2.5kg. As regards the child's current weight, results shows that the current weight ranged between 1.6 and 15kg with a median current weight of 6.5kg while for height/length, the height of the children ranged between 45 and 114cm with the median height of 66cm.

As regards the MUAC measurement of the malnourished children considered in this study, results (in Table 4.6 above) indicate that majority of the children (61.2%) had an MUAC ranging between 11.0 – 12.5cm meaning that 61.2% of the children had moderate malnutrition. This was followed by 25.8% of the children who were severely malnourished and only 2.9% of the children had mild malnutrition based on the MUAC. However 10.2% had their MUAC not measured and thus unclassified. According to weight for height Z – score measurement, majority of children (40.1%) had mild malnutrition (Z-score between -1.1 to -2), followed by 31.5% and 26.1% for severe and moderate malnutrition respectively.

However only 2.3% of the children had their Z-score not measured and thus unclassified.

Table 4.6. Anthropometric information of the child – MUAC and Z – score.

Variable	Category	Score	Percentage
MUAC of the child(cm)	Classification		
12.5 – 13.5cm	Mild malnutrition	11	2.9%
11.0 – 12.5cm	Moderate malnutrition	235	61.2%
< 11.0cm		99	25.8%
MUAC not measured	Severe malnutrition	39	10.2%
	Unclassified		
Z – score	Classification		
-1.1 to -2	Mild malnutrition	154	40.1%
-2.1 to -3	Moderate malnutrition	100	26.1%
< -3		121	31.5%
Z – score not measured	Severe malnutrition	9	2.3%
	Unclassified		

Table 4.7. Anthropometric information of the mother/caregiver – BMI.

BMI of mother/caregiver	Classification	Score	Percentage
Less than 18.5kg/m^2	Underweight	1	.3%
Between 18.5 and 24.9kg/m^2	Normal weight	8	2.1%
	Overweight	29	7.6%
Between 25 and 29.9kg/m^2	Obese	77	20.1%
Between 30 and 34.9kg/m^2	Morbidly obese	190	49.5%
Between 35 and 39.9kg/m^2		79	20.6
Above 40kg/m^2	Severely obese		

As regards the mother/caregivers' anthropometric measurements, the results in Table 4.7 revealed that only 2.1% of the mothers/caregivers had normal weight while 49.5% of the caregivers/mothers were morbidly obese, 20.6%, 20.1%, 7.6% and 0.3% of the mothers/caregivers were severely obese, obese, overweight and underweight respectively.

4.6 Comorbidities associated with malnourished children

Table 4.8. Comorbidities associated with malnourished children admitted to SOS Hospital.

Does this child has currently the following conditions?	Urinary tract infection	46	12.0%
	Chronic suppurative otitis media	52	13.5%
	Bronchopneumonia	239	62.2%
	Sepsis	17	4.4%
	TB	18	4.7%
	Measles	93	24.2%
	Malaria	127	33.1%
	Diarrhea	213	55.5%
	Severe anaemia	65	16.9%
	HIV	3	0.8%
	Others	47	12.2%
Does the child receive treatment for any comorbidity	Yes	348	90.6%
	No	36	9.4%
What treatment does the child receive for comorbidity?	Antibiotics	322	83.9%
	Anti TB therapy	18	4.7%
	Antimalarial therapy	70	18.2%
	Antiretroviral therapy	4	1.0%
	IVF therapy	1	0.3%
	Blood transfusion	11	3.1%
	Others	91	25.2%

The study sought to establish the comorbidities (urinary tract infection, chronic suppurative otitis media, bronchopneumonia, sepsis, TB, measles, malaria, diarrhea, severe anaemia and HIV) among the malnourished children under five and as to whether or not, the child received treatment for the comorbidity.

The results in Table 4.8 indicate that Bronchopneumonia and Diarrhea was the most prevalent comorbidity among the malnourished children studied with a proportion of 62.2% and 55.5% respectively. This was followed by Malaria, Measles, severe anaemia, Chronic suppurative otitis media, urinary tract infection, TB, Sepsis and HIV with proportions 33.1%, 24.2%, 16.9%, 13.5%, 12%, 4.7%, 4.4% and 0.8% respectively. However, 12.2% of the malnourished children had different conditions other than those mentioned. This means that Bronchopneumonia, Diarrhea and Malaria were the common diseases/conditions among the malnourished children admitted to SOS hospital while TB, Sepsis and HIV were the least prevalent. The proportions of children currently suffering from a given comorbidity is as portrayed in the following figure.

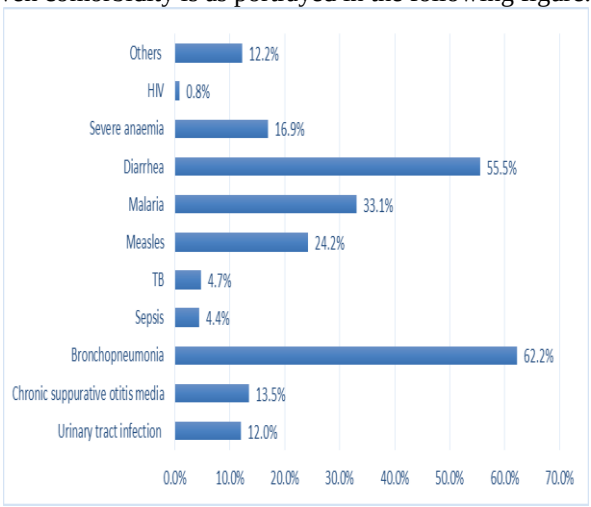

Figure 4.20. Conditions the children were currently suffering.

The study findings also revealed that over 90% (90.6%) of the malnourished children who had comorbidities were on treatment while only 9.4% were not under treatment. This finding is further portrayed on the following chart.

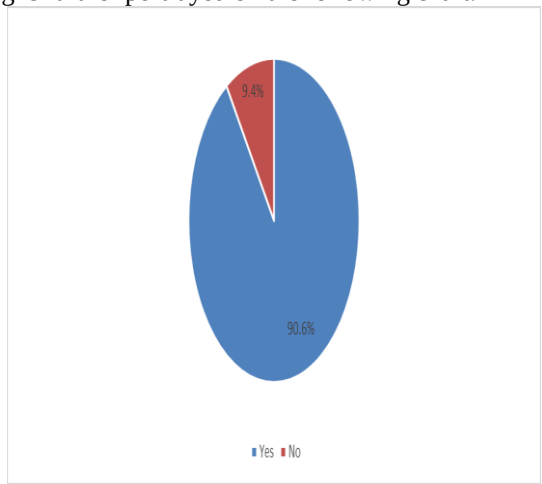

Figure 4.21. Whether the child receive treatment for any comorbidity.

As regards the type of treatment received, results indicate that about 84% of the patients were receiving Antibiotics, followed by 18.2%, 4.7% and 3.1% of the children who were on antimalarial therapy, anti TB therapy and blood transfusion respectively. Only 1% and 0.3% of the patients were on antiretroviral therapy and IVF therapy respectively. However, 25.2% of the patients were on other treatments other than those mentioned.

Associations between variables

The Associations between variables are reported in the following sections

4.7.1 Association between malnutrition diagnosis and Socio-demographic factors

4.7.1.1 Malnutrition diagnosis and Child's mother/caregiver education status

Table 4.9. Association between nutrition diagnosis and Child's mother education status.

Malnutrition diagnosis	Mother/caregiver education status		Total
	Cannot read and write	Literate	
Kwashiorkor	75.0%	25.0%	100.0%
Marasmic-Kwashiorkor	83.3%	16.7%	100.0%
Marasmus	72.8%	27.2%	100.0%
Unclassified	85.7%	14.3%	100.0%
Underweight	83.6%	16.4%	100.0%
Total	77.9%	22.1%	100.0%
Pearson chi2(4) = 6.6017 Pr = 0.158			

The study investigated the association between child's malnutrition diagnosis and socio-demographic factors and results in Table 4.9 above reveals that overall, majority of the malnourished children under five(77.9%) belonged to mothers/caregivers who could not read and write while only 22.1% of the malnourished children were for parents/ caregivers who were literate. Across all the malnutrition diagnosis category, only 16.4%, 27.2%, 25.0%, 16.7% and 14.3% of the children belonging to mothers who could read and write were diagnosed underweight, marasmus, kwashiorkor, marasimic-kwashiorkor and unspecified, respectively. However, the study findings revealed that there is no significant relationship between the malnutrition diagnosis of a child and the education status of the child's mother/caregiver evidenced by the Pr(Chi2) = 0.158.

Malnutrition diagnosis and Household's Daily income level

Table 4.10. Association between malnutrition diagnosis and household's daily income level.

Nutritional Diagnosis	Level of daily income($)			Total
	0 - $5	$6 - $10	More than $10	
Kwashiorkor	25.0%	75.0%		100.0%
Marasmic-Kwashiorkor	100.0%			100.0%
Marasmus	89.6%	10.4%		100.0%
Unclassified	42.9%	57.1%		100.0%
Underweight	91.5%	7.9%	0.6%	100.0%
Total	89.1%	10.7%	0.3%	100.0%
Pearson chi2(8) = 36.5681 Pr = 0.000				

As regards the level of family's daily income, the results in Table 4.10 above shows those families with income between $0 and $5 had 91.5%, 89.6% and 100% of underweight, marasmus and Marasmic-Kwashiorkor respectively. 75%, 57.1%, 10.4% and 7.9% of the malnourished children belonged to families with daily income between $6 and $10. However, while for families with daily income of above $10 only 0.6% of those diagnosed underweight were from this category. Overall, the findings reveals that majority of the malnourished children (89.1%), were from families with daily income of between 0 - $5 while only 10.7% and 0.3% of the malnourished children were from families with daily income of between $6 - $10 and above $10, respectively. The findings further revealed a significant relationship between malnutrition status and daily income level of the families/households – with malnutrition cases being significantly higher in low income families.-, exhibited by the Pr(Chi2) = 0.000

Malnutrition diagnosis and Household's Size

Table 4.11. Association between malnutrition diagnosis and the size of the household.

Malnutrition Diagnosis	Number of people in the household		Total
	Greater than three	Less than three	
Kwashiorkor	25.0%	75.0%	100.0%
Marasmic-Kwashiorkor	83.3%	16.7%	100.0%
Marasmus	80.2%	19.8%	100.0%
Unclassified	42.9%	57.1%	100.0%
Underweight	84.8%	15.2%	100.0%
Total	81.2%	19.0%	100.0%
Pearson chi2(4) = 16.4547 Pr = 0.002			

Results in Table 4.11 above indicates a significant relationship between malnutrition status in children under five admitted to SOS Hospital and the household/family size, (Pr(Chi2) = 0.002). In general, households with more than 3 members constituted 81.2% of the total malnourished children under-five while those families with less than or three members constituted only 18.8% of the total admissions. Among large families (more than 3 people), Underweight, Marasmic-Kwashiorkor, and Marasmus were highly prevalent among the under-five at 84.8%, 83.3% and 80.2%, respectively while Kwashiorkor and Unclassified malnutrition conditions were found to be significantly more prevalent among small sized families/households at 75.0% and 57.1% respectively.

Malnutrition diagnosis and Location of the Household

Table 4.12. Association between malnutrition diagnosis and the location of the household.

Malnutrition Diagnosis	Location/residency			Total
	Far major towns	IDPs	Near major towns	
Kwashiorkor	25.0%	25.0%	50.0%	100.0%
Marasmic-Kwashiorkor	66.7%		33.3%	100.0%
Marasmus	39.6%	13.9%	46.5%	100.0%
Unclassified	14.3%	14.3%	71.4%	100.0%
Underweight	37.0%	22.4%	40.6%	100.0%
Total	38.3%	17.4%	44.3%	100.0%
Pearson chi2(8) = 9.8077 Pr = 0.279				

As regards location of the residence, study results indicate that children from families in IDPs camps had a small proportion (17.4%) of the total malnourished children admitted to Mogadishu hospital while those from major towns near Mogadishu had formed the highest proportion(44.3%) followed by those from major towns far from Mogadishu forming 38.3% of the total admissions. However, location of residency was not found to be significantly associated with malnutrition in Mogadishu – Somalia since the Pr(chi2) = 0.279 > 0.05.

Malnutrition diagnosis and Number of rooms used for Sleeping

Table 4.13. Association between malnutrition diagnosis and Number of rooms used for Sleeping.

Malnutrition Diagnosis	Number of rooms used for sleeping			Total
	1 – 2	3 – 4	More than 4	
Kwashiorkor	25.0%	75.0%		100.0%
Marasmic-Kwashiorkor	66.7%	33.3%		100.0%
Marasmus	65.3%	24.3%	10.4%	100.0%
Unclassified	57.1%	14.3%	28.6%	100.0%
Underweight	69.1%	26.1%	4.8%	100.0%
Total	66.4%	25.5%	8.1%	100.0%
Pearson chi2(8) = 13.7347 Pr = 0.089				

As regards the number of rooms in the house used for sleeping, the study findings revealed that malnutrition

conditions of underweight, marasmus, Marasimic-kwashiorkor and un-classified cases were high among children whose families had houses with 1 – 2 rooms used for sleeping, that is 69.1%, 65.3%, 66.7% and 57.1% respectively, while 75% of the children diagnosed with kwashiorkor were from homes with rooms used for sleeping between 3 and 4 rooms. However, the findings indicates no significant association/relationship between malnutrition diagnosis of a child and number of rooms used for sleeping in a house (Pr(chi2) = 0.089 > 0.05).

Malnutrition diagnosis and source of drinking water and hand washing

Table 4.14. Association between malnutrition diagnosis and source of drinking water.

Malnutrition Diagnosis	Source of drinking water		Total
	Protected	Unprotected	
Kwashiorkor		100.0%	100.0%
Marasmic-Kwashiorkor		100.0%	100.0%
Marasmus	9.9%	90.1%	100.0%
Unclassified	14.3%	85.7%	100.0%
Underweight	6.7%	93.3%	100.0%
Total	8.3%	91.7%	100.0%
Pearson chi2(4) = 2.4836 Pr = 0.648			

The study also sought information regarding the source of drinking water used by the malnourished children's families. Is was established that almost all children; 91.7%, diagnosed with malnutrition conditions used drinking water from unprotected sources, while only 8.3% of the malnourished children under five, admitted to Mogadishu hospital, drink water from protected sources. However, the source of drinking water was not found to be significantly associated with malnutrition among the admitted patients. This is because of the probability of the Chi-square value was found to be way above the level of significance, (Pr(Chi2) = 0.648 > 0.05), as presented in Table 4.14 above.

Table 4.15. Association between malnutrition diagnosis and hand washing.

Variables		Nutritional diagnosis of the child				
		Un-W (percent)	MAR (percent)	KWA (percent)	M-KW (percent)	Un-S (percent)
How does the caregiver /mother wash his/her hands?	With water only	30.9%	23.8%	0%	50.0%	14.3%
	Some times with soap	43.6%	53.4%	100%	33.3%	71.4%
	Always with soap	25.5%	22.8%	0%	16.7%	14.3%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%

KEY: Un-W: underweight MAR: marasmus KWA: Kwashiorkor, Un-S: unclassified

Results in Table 4.15 indicate that as regards the hand washing practice of the child's mother/caregiver, very few children diagnosed malnutrition belonged to mothers/caregivers who always washed their hands with soap. For instance, of all the patients diagnosed underweight, 30.9% and 43.6% belonged to mothers/caregivers who washed their hands with water only and sometimes with soap respectively while only 25.5% of the children diagnosed underweight belonged to mothers who always washed their hands with soap. For patients diagnosed marasmus, 23.8% and 53.4% of the patients belonged to mothers/caregivers who washed their hands with water only and sometimes with soap respectively while only 22.8% of these belonged to mothers/caregivers who always washed their hands with soap. among the children diagnosed Marasimic – kwashiorkor, 50% and 33.3% of the patients belonged to mothers who washed their hand with water only and sometimes with soap respectively while only 16.7% of the patients belonged to mothers/caregivers who always washed their hands with soap. Similarly as regards patients whose diagnosis was unclassified, 14.3% and 71.4% belonged the mothers/caregivers who washed their hands with water only and sometimes with soap respectively while only 14.3% belonged to mothers/caregivers who always washed their hands with soap. However, as regards those patients diagnosed kwashiorkor, they all belonged to mothers/caregivers who sometimes washed their hands with soap.

Malnutrition diagnosis and maternal factors

The association between malnutrition diagnosis and maternal factors is presented in the following sections.

4.7.2.1 Malnutrition diagnosis and mother/caregiver maternal counselling

Table 4.16. Association between malnutrition diagnosis and the counselling received by the mother/caregiver.

Counselling Topic	Yes (Percentage)	No (Percentage)	Pr (Chi2) at 95%
Diarrhea	63%	37%	0.173
Healthy eating/diet	52.3%	47.7%	0.004
Breastfeeding	60.4%	39.6%	0.148
Complementary feeding	28.9%	71.1%	0.755
Food fortification	15.4%	84.6%	0.761
Growth chart	14.1%	85.9%	0.812
Hygiene	49.2%	50.8%	0.615

The findings in Table 4.16 reveal that as regards the counselling received by the mother/caregiver, the mothers/caregiver of 63%, 60%, 52.3%, and 49.2% of the malnourished children under-five received counselling on diarrhea, breastfeeding, healthy eating, and hygiene respectively. While mothers/caregivers of 85.9%, 84.6%, 71.1%, 50.8%, and 47.7% of the malnourished children under-five admitted to Mogadishu hospital did not receive counselling on Growth chart monitoring, food fortification, complementary feeding, hygiene and healthy eating respectively. However, the study findings indicates that among the counselling topics, it is only counselling on healthy eating that is significantly associated/related to malnutrition diagnosis of the children under five years admitted to SOS hospital. This is so because of its Probability of the chi-square value that is far lower than the 0.05 (Pr(chi2) = 0.004 <0.05).

Malnutrition diagnosis and Antenatal clinic visits during pregnancy

Table 4.17. Association between malnutrition diagnosis and Antenatal clinic visits during pregnancy.

Malnutrition diagnosis	Antenatal clinic visits during pregnancy			Total
	Do not know	No	Yes	
Kwashiorkor	0%	50.0%	50.0%	100.0%
Marasmic-Kwashiorkor	0%	50.0%	50.0%	100.0%
Marasmus	6.9%	40.1%	53.0%	100.0%
Unclassified	14.3%	42.9%	42.9%	100.0%
Underweight	8.5%	40.0%	51.5%	100.0%
Total	7.6%	40.4%	52.1%	100.0%
Pearson chi2(8) = 1.8821 Pr = 0.984				

Results in Table 4.17 above show that antenatal visits during pregnancy, for majority of the malnourished children (52.1%) their mothers made antenatal clinic visits while pregnant while for 40.4% of the malnourished children, their mothers did not make antenatal clinic visits while pregnant for the child. Only 7.6% of the caregivers did not know whether the children's mothers made antenatal clinic visits while

pregnant. However, study findings further indicates no significant relationship between antenatal clinic visits during pregnancy and the malnutrition diagnosis of the patient. This is indicated by the high probability of the Chi-square value(0.984) as compared to the level of significance at 95% level(0.05).

Malnutrition diagnosis and place of birth of the child

Table 4.18. Association between malnutrition diagnosis and the child's birth place.

Malnutrition diagnosis	Birth place of the child			Total
	Healthy facility	Home	Others	
Kwashiorkor	50.0%	50.0%	0%	100.0%
Marasmic-Kwashiorkor	16.7%	83.3%	0%	100.0%
Marasmus	43.6%	50.0%	6.4%	100.0%
Unclassified	85.7%	14.3%	0%	100.0%
Underweight	35.2%	59.4%	5.5%	100.0%
Total	40.4%	53.9%	5.7%	100.0%
Pearson chi2(8) = 11.795 Pr = 0.161				

As far as the child's birth place, the results revealed that for the children who were born from hospitals/health facility, only; 35.2%, 43.6%, 50%, 16.7% and 85.7% were diagnosed underweight, marasmus, kwashiorkor, Marasimic-kwashiorkor and unclassified malnutrition, respectively. This means that with the exception of those who were diagnosed unclassified, malnutrition was high among children born elsewhere other than hospitals/health facilities. Overall, only 40.4% of the patients were born from a hospital/healthy facility while 59.6% were born in homes and elsewhere. However, the birth place of a child does significantly associate with malnutrition diagnosis of the child as evidenced by a high P – value(0.161) which is above the level of significance (0.05).

Malnutrition diagnosis and child factors

As far as the association between child factors and the child's malnutrition diagnosis are concerned, the study results are presented and discussed in the following sections.

Malnutrition diagnosis and gender of the child

Table 4.19. Association between malnutrition diagnosis and gender of the child.

Malnutrition diagnosis	Gender of the Child		Total
	Female	Male	
Kwashiorkor	50.0%	50.0%	100.0%
Marasmic-Kwashiorkor	66.7%	33.3%	100.0%
Marasmus	54.5%	45.5%	100.0%
Unclassified	14.3%	85.7%	100.0%
Underweight	57.0%	43.0%	100.0%
Total	54.9%	45.1%	100.0%
Pearson chi2(4) = 5.340 Pr = 0.254			

As far as the gender of the child is concerned, the results indicate that more female children than males were diagnosed 57.0%, 55.4% and 66.7% suffered from underweight, marasmus and marasmic -kwashiorkor respectively while 85.7% of the male diagnosed children were found to have unspecified malnutrition condition as compared to only 14.3% of their female counterpart. Kwashiorkor was equally distributed among male and female children. Overall, female children had more cases than the males, but however, the findings revealed no significant relationship between gender and malnutrition diagnosis of the patients. That is to say, p-value (0.254) is greater than the significance level (0.05).

Malnutrition diagnosis and age of the child

Table 4.20. Association between malnutrition diagnosis and the age of the child.

Malnutrition Diagnosis	Age of the Child (months)				Total
	0-6	6-12	13-24	24-59	
Kwashiorkor	0%	50.0%	50.0%	0%	100.0%
Marasmic-Kwashiorkor	0%	33.3%	50.0%	16.7%	100.0%
Marasmus	17.8%	63.9%	14.4%	4.0%	100.0%
Unclassified	71.4%	28.6%	0%	0%	100.0%
Underweight	3.0%	72.7%	21.2%	3.0%	100.0%
Total	12.0%	66.4%	18.0%	3.6%	100.0%
Pearson chi2(12) = 55.304 Pr = 0.001					

As regards the relationship between the age of the child and malnutrition diagnosis, the study results in Table 4.20 above, show that the two variables are significantly related. This is exhibited by lower probability value (Pr = 0.001). Overall, the study results indicate that malnutrition incidence is highly associated with the age group of 6 – 12 months, followed by that of 13 – 24months, then that of 0 – 6 months while the age group of 24 – 59 months had the least.

Malnutrition diagnosis and age of the child

Table 4.21. Association between malnutrition diagnosis and the premature birth status of the child.

Malnutrition Diagnosis	Was the child born Premature?		Total
	No	Yes	
Kwashiorkor	100.0%	0%	100.0%
Marasmic-Kwashiorkor	83.3%	16.7%	100.0%
Marasmus	82.2%	17.8%	100.0%
Unclassified	71.4%	28.6%	100.0%
Underweight	83.0%	17.0%	100.0%
Total	82.6%	17.4%	100.0%
Pearson chi2(4) = 1.495 Pr = 0.828			

As regards to whether the child was born premature, the findings in the above table indicate that majority of the malnourished children were born normally (not premature) while only 17%, 17.3%, 16.7% and 28.6% of the children diagnosed underweight, marasmus, Marasimic-kwashiorkor, and unclassified malnutrition conditions respectively. The findings also reveals that there is no significant relationship between the malnutrition diagnosis of the patient and whether he/she was born premature (P – value, 0.828 > 0.05).

Malnutrition diagnosis and immunization status of the child

Table 4.22. Association between malnutrition diagnosis and immunization status of the child.

Malnutrition diagnosis	Immunization schedule up-to date		Total
	Yes	No	
Kwashiorkor	50.0%	50.0%	100.0%
Marasmic-Kwashiorkor	83.3%	16.7%	100.0%
Marasmus	67.3%	32.7%	100.0%
Unclassified	57.1%	42.9%	100.0%
Underweight	74.5%	25.5%	100.0%
Total	70.3%	29.7%	100.0%
Pearson chi2(4) = 4.139 Pr = 0.388			

As regards immunization, the findings revealed that 74.5%, 63.4% and 57.1% of those diagnosed underweight, marasmus, and unclassified were immunized up to date. While 50% and 83.3% of the children diagnosed with kwashiorkor and Marasimic – kwashiorkor. However, the study findings reveal no significant relationship between the child's immunization status and the malnutrition diagnosis of the patient/child.

Malnutrition diagnosis and Vitamin A supplementation status

Table 4.23. Association between malnutrition diagnosis and Vitamin A supplementation status.

Malnutrition diagnosis	Vitamin A Supplementation up –to date		Total
	No	Yes	
Kwashiorkor	50.0%	50.0%	100.0%
Marasmic-Kwashiorkor	16.7%	83.3%	100.0%
Marasmus	36.6%	63.4%	100.0%
Unclassified	71.4%	28.6%	100.0%
Underweight	27.3%	72.7%	100.0%
Total	33.1%	66.9%	100.0%
Pearson chi2(4) = 9.565 Pr = 0.048			

The study findings in Table 4.23 further reveals that 72.7%, 63.4%, 50%, and 83.3% of those diagnosed Underweight, Marasmus, Kwashiorkor and Marasimic – Kwashiorkor had vitamin A supplementation up-to date while 71.4% of those diagnosed with unclassified malnutrition condition had their vitamin A supplementation programme not up to date. This shows that having vitamin A supplementation schedule up-to date reduces the risk of child malnutrition especially from the unclassified malnutrition condition. This is further supported by the significant relationship between the two variables, exhibited by the P- value (0.048) which is slightly lower than the significant value (0.05).

Malnutrition diagnosis and breastfeeding status of the child

Table 4.24. Association between malnutrition diagnosis and breastfeeding status of the child.

Malnutrition diagnosis	Child Breastfed		Total
	No	Yes	
Kwashiorkor	75.0%	25.0%	100.0%
Marasmic-Kwashiorkor	50.0%	50.0%	100.0%
Marasmus	43.1%	56.9%	100.0%
Unclassified	28.6%	71.4%	100.0%
Underweight	43.6%	56.4%	100.0%
Total	43.5%	56.5%	100.0%
Pearson chi2(4) = 2.369 Pr = 0.668			

As regards to the association between breastfeeding of a child and malnutrition diagnosis, the findings in Table 4.24 reveal that; 56.4%, 56.9%, 25%, 50% and 71.4% of the children diagnosed; Underweight, Marasmus, Marasmic-kwashiorkor, and unclassified respectively, had breastfed while the rest were not breastfed. However the study findings indicate that breastfeeding status of a child is not significantly associated with the malnutrition diagnosis of the child admitted to the hospital, since the P – value is high (0.668), as compared to $\alpha = 0.05$ value.

Malnutrition diagnosis and Age up-to when the child was breastfed

Table 4.25. Association between malnutrition diagnosis and Age up-to when the child was breastfed.

Malnutrition diagnosis	Age up-to when the child was breastfed(months)			Total
	1 – 6	7 – 12	13 – 24	
Kwashiorkor	0%	0%	100.0%	100.0%
Marasmic-Kwashiorkor	33.3%	66.7%	0%	100.0%
Marasmus	37.3%	54.2%	8.5%	100.0%
Unclassified	100.0%	0%	0%	100.0%
Underweight	16.3%	69.6%	14.1%	100.0%
Total	29.7%	59.3%	10.0%	100.0%
Pearson chi2(4) = 31.832 Pr = 0.001				

Regarding the age up to which the child was breastfed, the results indicate that majority of the children diagnosed with Underweight(69.6%), Marasmus(54.2%) and Marasmic – kwashiorkor(66.7%) were breastfed up to the age between 7 months and 12 months while 100% of those diagnosed with kwashiorkor were breastfed up – to the age of between 13 – 24 months. While those diagnosed with unclassified malnutrition were fed for between 1 and 6 months. The study findings in Table 4.25 further reveals s strong and significant relationship between the age up-to when a child is breastfed and the malnutrition diagnosis(P-value = 0.001). It is evident that breastfeeding reduces the risk of a child suffering from all the malnutrition conditions as only 10% of the admitted children were breastfed up to 13 – 24 months.

Malnutrition diagnosis and Type of Milk Used to Feed the Baby

Table 4.26. Association between malnutrition diagnosis and Type of Milk Used to Feed the Baby.

Malnutrition Diagnosis	Type of Milk Used to Feed the Baby			Total
	Formula	Cow milk	Other	
Kwashiorkor	33.3%	66.7%	0%	100.0%
Marasmic-Kwashiorkor	25.0%	75.0%	0%	100.0%
Marasmus	57.5%	27.6%	14.9%	100.0%
Unclassified	50.0%	0%	50.0%	100.0%
Underweight	56.2%	42.5%	1.3%	100.0%
Total	55.6%	35.5%	8.9%	100.0%
Pearson chi2(8) = 19.5055 Pr = 0.012				

Regarding the type of milk upon which the child was fed on other than breast milk, the results in Table 4.26 above indicate that among those fed on formula milk; 56.2%, 57.5% and 33.3%, 25% and 50% were diagnosed with Underweight, Marasmus, Kwashiorkor, Marasmic – kwashiorkor and Unclassified conditions respectively while among those fed on cow's milk; 42.5%, 27.5%, 66.7%, 75% and 0% were diagnosed with Underweight, Marasmus, Kwashiorkor, Marasmic – Kwashiorkor and Unclassified conditions respectively. This shows that formula milk reduces on the child's vulnerability for Kwashiorkor and Marasimic-Kwashiorkor malnutrition conditions while cow's milk worked preferably better for the child as far as reducing the risk of Underweight and Marasmus as seen by the lower proportions of malnourished children diagnosed with such conditions as compared across the cases. The finding is further supported by the low probability value of the Chi-square (P – value = 0.012) statistic indicating a strong association between the type of milk the baby is fed on and the malnutrition diagnosis.

Malnutrition diagnosis and Method of feeding the baby

Table 4.27. Association between malnutrition diagnosis and Method of feeding the baby.

Malnutrition diagnosis	Method of feeding the baby		Total
	Feeding Bottle	Cup	
Kwashiorkor	66.7%	33.3%	100.0%
Marasmic-Kwashiorkor	25.0%	75.0%	100.0%
Marasmus	42.1%	57.9%	100.0%
Unclassified	50.0%	50.0%	100.0%
Underweight	37.1%	62.9%	100.0%
Total	40.1%	59.9%	100.0%
Pearson chi2(4) = 1.736 Pr = 0.784			

Regarding the mode of feeding (the way milk was given to the baby), results indicate that; 37.1%, 42%, 66.7%, 25% and 50% of the malnourished children diagnosed with underweight, marasmus, kwashiorkor, marasmic– kwashiorkor and unclassified conditions respectively were fed using a bottle while 62.9%, 58%, 33.3%, 75% and 50 of the malnourished children diagnosed with underweight, marasmus, kwashiorkor, marasmic – kwashiorkor and

unclassified conditions respectively were fed using a cup. This shows that bottle feeding yielded good results as regards the prevalence of malnutrition conditions with the exception of kwashiorkor where bottle feeding was associated with 66.7% while cup feeding was associated with only 33.3%. However, the study results in Table 4.27 indicate no significant relationship between the mode of feeding and the malnutrition diagnosis of the children under-five. This is because of the large Probability value of the Chi-square statistic (0.784) as compared to the $\alpha = 0.05$.

Malnutrition diagnosis and Number of meals per day

Table 4.28. Association between malnutrition diagnosis and Number of meals per day.

Malnutrition diagnosis	Number of meals per day			Total
	< Three	Three	> Three	
Kwashiorkor	25.0%	50.0%	25.0%	100.0%
Marasmic-Kwashiorkor	50.0%	33.3.0%	16.7%	100.0%
Marasmus	26.7%	46.0%	27.3%	100.0%
Unclassified	42.9%	28.6%	28.5%	100.0%
Underweight	24.9%	49.7%	25.4%	100.0%
Total	26.6%	47.1%	26.3%	100.0%
Pearson chi2(8) = 3.5102 Pr = 0.898				

As regards the association between the number of meals per day and the child's malnutrition diagnosis, the study results indicates that malnutrition conditions were more prevalent among children who had three meals and less in a day as compared to those who had more than three meals per day. For instance results indicate that only 42.5%, 27.3%, 25% 16.7% and 28.6% of the children diagnosed with Underweight, Marasmus, Kwashiorkor, Marasmic – Kwashiorkor and Unclassified conditions respectively had more than three meals per day while the rest belonged to families with three meals or less per day. However the study results indicate that there exists no significant relationship between number of meals per day and the malnutrition diagnosis.

Malnutrition diagnosis and previous hospital admission record

Table 4.29. Association between malnutrition diagnosis and previous hospital admission record.

	Previously admitted to hospital		
Malnutrition diagnosis	Yes	No	Total
Kwashiorkor	25.0%	75.0%	100.0%
Marasmic-Kwashiorkor	33.3%	66.7%	100.0%
Marasmus	45.5%	54.5%	100.0%
Unclassified	28.6%	71.4%	100.0%
Underweight	42.3%	57.7%	100.0%
Total	43.5%	56.5%	100.0%
Pearson chi2(4) = 1.8784 Pr = 0.758			

Results in Table 4.29 further indicates that malnutrition conditions were more prevalent among children who had not been previously admitted to hospital/any health facility as compared to those that had been admitted. For instance, 57.6%, 54.5%, 75%, 66.7% and 71.4% of the children diagnosed with Underweight, Marasmus, Kwashiorkor, Marasmic – Kwashiorkor and Unclassified conditions respectively had not been previously admitted. The findings also indicate no significant relationship between malnutrition diagnosis and patient's previous hospital admission records (P value = 0.758 > 0.05).

Discussion

Discussion of the findings

In this section, the results of the study will be discussed and where possible compared to the results of relevant studies of the same nature.

Socio-demographic factors

Age of the caregiver

Rikimaru et al. (1998) determined the risk factors for developing severe malnutrition, underweight and low birth weight amongst children eight to 36 months old in the Princess Marie Louise Hospital in Accra, Ghana and found that severely malnourished were more likely to have young mothers (Rikimaru *et al*., 1998). Studies done in the Mulago Hospital in Kampala, Uganda and the Moi Teaching and Referral Hospital in Eldoret, Kenya looked at children zero to 60 months and three to 35 months respectively and found an association between PEM and young (15-25 years), single mothers (Owor *et al.*, 2000; Ayaya *et al.*, 2004). The age of the mother is important when she is pregnant, as younger and older women usually have a higher risk of having babies that are already malnourished or have other complications (Teller and Yimar, 2000). In this study (Table 4.1) the majority of mothers (43.5%) were between 26-34 years of age and 43% of mothers were younger (19-25 years old), which showed that majority of the children caregivers (86.5%) were below the age of 35 years and only 13.5% of the caregivers were 35 years and above.

Literacy status of parents

Malnutrition affects poor people who also have poor health seeking behavior. Studies had shown that in women who didn't attend school and ones with primary level of education, their children had high chance of getting malnutrition compared to educated mothers who are more cautious about their children's health, have a tendency of health seeking behavior and taking care in a better ways (USAID, 2004; Rayhan and Khan, 2006; Kandala *et al.*, 2011). In this study, the illiteracy status (inability to read and write) of the parents of the child was slightly high among the mothers (77.9%) as compared to fathers (63.1%). Only 22.1% and 36.9% of the child mothers and fathers respectively could read and write (Table 4.1). Similar findings were found in a study in Machakel Woreda, Northwest Ethiopia where illiteracy was high among mothers (84.3%) compared to fathers (63.20%) (Bantamen *et al.*, 2014). This was also consistent with a study in Ethiopia (Christiaenson and Alderson, 2001) determined maternal knowledge in Ethiopia and found that the males in a household were often better educated than females. Household members in Ethiopia with post secondary education were only found in cities and of all parents with a post-secondary education, only 3% were women and 6% men (Christiaenson and Alderson, 2001). Falbo and Alves (2002) found that 15.2% of mothers of children hospitalised in the Instituto Materno Infantil de Pernambuco in Brazil were illiterate. Saito et al. (1997) found an association between nutrition related knowledge and mild mixed malnutrition in children younger than four years old in India. There was, however no significant difference in the mother's attitudes regarding seeking health care for their children. When the mothers were questioned about their traditional beliefs, they did not believe that medical care was needed to manage childhood illnesses such as malnutrition and measles (Saito *et al.*, 1997).

Mother/caregiver Marital status

The study revealed that (Table 4.1), 79.4% of the caregivers were married, 15.6% of the caregivers had divorced while only 2.9%, 1.8% and 0.3% of the caregivers were widowed, single and others respectively. This was in contrast to a study by Mahgoub et al. (2006) undertaken in Botswana amongst children zero to three years old, where 76.4% of the mothers with malnourished children were single and 22.1% of

the mothers were married (Mahgoub *et al.*, 2006). Maternal marital status also has an effect on child malnutrition, with the married mother being economically sounder than a single, divorced or separated mother. If the mother is married and still living with the child's father, the family can be considered economically stronger (Teller and Yimar, 2000).

Mother's Occupation

This study's findings correlate well with the findings of a study by Bantamen et al. (2014) undertaken in Machakel Woreda, Northwest Ethiopia among under five year children, where 88.2% of the mothers with malnourished children were housewife and 2% of the mothers were employed (Bantamen *et al.,* 2014). In this study, 89.8% of the mothers with malnourished children were housewife, 8.1% were merchants while only 2.1% of them were employed.

Family/ household income

Socio-economic status is linked to income and malnutrition (Pierecchi-Marti *et al.*, 2006). Households that cannot attain nutritious foods due to income poverty are most associated with the inadequate diet and disease that leads to malnutrition (Horton *et al*., 2008). In this study (Table 4.1), majority of the families (89.1%) with the malnourished children who participated in this study had a daily income of not more than $5. This study further showed that families with income between $0 and $5 had 91.5%, 89.6% and 100% of underweight, marasmus and marasmic-kwashiorkor respectively (P –value = 0.000) (Table 4.10).

Household size

Household size and composition can have different effects. Anthropologists writing of different continents have documented how parents reluctantly practice triage, neglecting the care of certain children who die as a result (Turnbull, 1973; Scheper-Hughes, 1992), or even actively intervene to bring about death usually of daughters (Croll, E. 2000; Venkatramani, 1992). In South Africa, stunted children often live in households that are bigger or have more people (Kleynhans *et al*., 2006) and therefore the risk for stunting has been found to be highest in households with nine or more people in the household (Mamabola *et al.,* 2005). In South Africa about 56% of households have a size of five to nine people (Kleynhans *et al.,* 2006). The risk of children from a household in Zimbabwe and Ethiopia being stunted increased from 7% when it was only one child to 38% when the household had seven children younger than ten. In Ethiopian communities, 24% of households with more than four children were malnourished (James *et al.,* 1999) and Bantamen et al. (2014) found that most of malnutrition case (62.5%) in Machakel Woreda, Northwest Ethiopia had household size greater than three. The above data was consistent with this study's findings (Table 4.1) where most of the malnutrition cases (81.3%) came from large households (more than three persons) with only 18.7% of the households had three persons. There was a significant relationship between malnutrition status in children under five admitted to SOS Hospital and the household/family size (P –value = 0.002) (Table 4.11).

Household head

This study revealed that males headed 80.5% of the households, while females headed only 19.5% of the households. Bantamen et al. (2014) reported similar findings where males headed 93.13% of the households.

Household Location

This study showed no significant association between the nutritional diagnosis (underweight, marasmus, kwashiorkor, marasmic-kwashiorkor and unclassified) and location of the residence where children from families in IDPs had lower cases of malnutrition diagnosis across all the categories of malnutrition while there was no meaningful difference between the children from near and far major towns regarding their malnutrition diagnosis.

Number of rooms in the house used for sleeping, Source of drinking water and Malnutrition diagnosis of the child

This study revealed that about two-thirds (66.4%) of the families with malnourished children had house with utmost 2 rooms used for sleeping. Only 25.5% and 8.1% of the families had houses with 3 – 4 and more than 4 rooms used for sleeping respectively (Table 4.1). The study further revealed that malnutrition conditions of underweight, marasmus, marasimic-kwashiorkor and un-classified cases were high among children whose families had houses with 1 – 2 rooms used for sleeping, that was; 69.1%, 65.3%, 66.7% and 57.1% respectively (Table 4.13). Most of the houses were of Corrugated iron sheets (72.1%). In this study, a large proportion (91.7%) of the families with malnourished children drink water from unprotected sources (Table 4.1). It was established that almost all children; 93.3%, 90.1%, and 85.7% diagnosed with malnutrition conditions; underweight, marasmus, and unclassified malnutrition used water from unprotected sources, while none of the children who used water from protected sources for drinking was diagnosed with kwashiorkor and marasimic-kwashiorkor. Only 6.7%, 9.9%, and 14.3% of the children who used drinking water from protected sources were diagnosed underweight, marasmus, and unclassified, respectively (Table 4.14). The above findings were in line with Bantamen et al. (2014) findings where most of the houses were of Corrugated iron sheet (81.38%) and the households used unprotected drinking water source accounts 58%.

Hand washing practice and malnutrition diagnosis of the child

The provision of sanitation and drinking water is seen as an essential complement to the availability of food in preventing child malnutrition. The study showed that (Table 4.15) as regards the hand washing practice of the child's mother/caregiver, very few children diagnosed malnutrition belonged to mothers/caregivers who always washed their hands with soap with proportions of only 25.5%, 22.8%, 16.7% and 14.3% for the children diagnosed underweight, marasmus, marasimic – kwashiorkor and unclassified respectively. While none of patients diagnosed as kwashiorkor belonged to mothers/caregivers who always washed their hands with soap. Caregiver's poor hand washing practices was also found by Bantamen et al. (2014) where only 5.88% of mothers/caregivers reported always washed their hands with soap.

Maternal factors associated with malnutrition children

In this study (Table 4.2), almost all the mothers were alive (97.9%) while only 2.1% had lost their mothers. Kleynhans et al. (2006) found that children that lived in households where grandparents were caregivers had the highest rate of stunting. In rural areas it is usually the grandmothers that caregivers, but evidence from a study in Limpopo, South Africa amongst children twelve to 24 months of age showed that children had a lower risk of stunting if the mother was the caregiver (Kleynhans *et al.,* 2006). In Nigeria 450 mothers were interviewed and 77% of mothers cared for their own children, while 23% of mothers had somebody that cared for their children (Ogunba, 2008). In this study, 90.1% of the children (Table 4.2) stayed with their mothers most of the time and therefore cared for by their parents while 4.7%, 3.1% and 2.1% of the children stayed with grandparents, other family

members and aunt/uncle respectively. In a study done in Kenya amongst children three to 36 months old, the caretaker of the malnourished children was most often not married to the child's parent and children with malnutrition had not been staying with both parents during the previous six months (Ayaya *et al.,* 2004).

In this study (Table 4.2), majority of mothers/caregivers (60.2%) received breastfeeding counselling, this was followed by 56.3% of the mothers/caregivers who received counselling on diarrhea, 52.3% of the mothers/caregivers received counselling on healthy eating and nearly a half (49.0%) of the mothers/caregivers received counselling on hygiene. However, only 28.9%, 15.4% and 13.8% of the mothers/caregivers received counselling on complementary feeding, food fortification, and growth chart monitoring while only 13.3% received counselling on other health related topics. This study further revealed that there was a significant association between nutritional diagnosis and counselling on healthy eating with a P-value = 0.004 (Table 4.16). A study in Ethiopia amongst children three to 36 months old showed no significant difference between the health practices of mothers with malnourished children (38.5%) that withheld food during episodes of diarrhoea and those of well-nourished children (40.1%). The mothers in the Ethiopian study, which withheld food from their children during episodes of diarrhoea, did not give fruit, vegetables and milk. In malnourished children, the foods that were withheld during diarrhoea included porridge and potatoes (Abate *et al.,* 2001).

In this study, only 11.7% of the caregivers/mothers or any member of the households had TB while 88.3% had no TB (Table 4.2). It was also revealed that majority of the mothers/caregivers (62.8%) were not on any treatment, 25.0% and 11.2% were on antimalarial and anti TB therapy while 3.9% were on other treatments (Table 4.2). Studies reported by the United States Agency for International Development (2009) and Chatterjee et al., (2007) showed the importance of mothers receiving treatment for illnesses (USAID, 2009) and (Chatterjee *et al.,* 2007).

Clinic attendance of mothers during pregnancy was relatively low, with only 52.1% accessing antenatal care during pregnancy. 40.4% of the mothers did not attend antenatal clinics while 7.6% did not know whether the child mothers attended antenatal clinics during pregnancy (Table 4.2). In a study by Teller and Yimar (2000) in Ethiopia aimed at determining the nutritional status of women and children younger than five years of age, antenatal visits were related to stunting in a child, with the prevalence of stunting decreasing as the number of antenatal visits of the mother increased.

Of the 384 mothers participating in the study, the findings (Table 4.2) revealed that 52.9% of the respondents did not use any drug/alcohol during pregnancy of the malnourished child. Only 19%, 6.0%, and 13.5% of the mothers used khat, cigarette, and other drugs while only 1% and 7.6% of the mothers used alcohol and did not know whether the mothers used any drug respectively. A study undertaken by Setswe (1994) in Bophuthatswana (South Africa) amongst children younger than five years of age, showed an association between child malnutrition and the consumption of alcohol (Setswe, 1994). According to Taylor and Wadsworth (1987) the rates of lower respiratory tract illness in children are higher in children with mother's that smoked during and after pregnancy. In a study undertaken in the United Kingdom amongst children from birth to five years of age, most of the hospital admittance of children for bronchitis and upper respiratory infections were related to maternal smoking as well as the number of cigarettes smoked per day. Mothers were followed up after birth and 90% of mothers that smoked during the pregnancy still smoked five years later. If a mother started smoking after birth the impact on the health of the child was lower than during pregnancy (Taylor and Wadsworth, 1987).

Most of the children (53.9%) included in this study (Table 4.2) were born at home and majority of the mothers (58.6%) did not regularly take their children to hospital after birth for checkup while only 3.4% and 19.8% regularly take their children to health facility for checkup weekly and monthly respectively. This was in contrast with a study undertaken by Abate et al. (2001) amongst children three to 36 months old, 76% of mothers took their children to hospital or clinics for the treatment of diarrhoea.

This study showed significant association between the nutritional diagnosis and number of live births, where 45.3% of the child's mothers had 4 – 6 live births, 32.6% had 1 – 3 live births while 18.5% and 3.7% child mothers had 7 – 9 live births and more than 9 live births respectively (Table 4.2). This means that over 67.4% of the child's mothers had more than 4 live births. This study also indicated the child's malnutrition chances increased as the child's birth order increased (Table 4.2) where only 9.4% were the first child, 11.7% were the second child, 14.3% were of the third order and 23.4% and 41.1% of the children were of the fourth and other birth orders respectively. This was in line with a study undertaken by Jeyaseelan and Lakshman (1997) in India amongst children five to seven years old, found that the high birth order of a child was associated with the child being malnourished (Jeyaseelan and Lakshman, 1997). Similarly, a study undertaken by Teller and Yimar (2000) in Ethiopia amongst mothers 15 to 49 years old and children younger than five years old, showed the highest rate of stunting in children with a birth order of four or five (54%) and then a birth order of six or more (53%).

Child factors associated with malnutrition children

Sex of child

In a study by Saito et al. (1997) in Tamil Nadu, India amongst children younger than four years old, poor nutritional status was directly associated with the gender of the child (Saito *et al.,* 1997). However, this study showed that (Table 4.3) and (Figure 4.11) more than a half (55.7%) of the malnourished children were females while the males/boys accounted for only 44.3%. This study further indicated that (Table 4.19) more female children than males were diagnosed 57.6%, 55.4% and 66.7% suffered from underweight, marasmus and marasmic -kwashiorkor respectively. Kwashiorkor was equally distributed among male and female children. This was in contrast with a study in Machakel Woreda, Northwest Ethiopia where malnutrition was high among males (52.94%) compared to females (47.06)%) (Bantamen *et al.,* 2014). In most studies more males are malnourished. In a study in Bangladesh on malnutrition in children six to 60 months old, there were an equal number of males and females (240 males and 239 females) (Iqbal *et al.,* 1999). A study in Nairobi, Kenya, found that in the malnourished group of children three to 36 months old, 51.2% were males and 48.8% were female (Abate *et al*., 2001).

Age of child

This study specifically looked at children 0 to 59 months old and found that 66.4% of the malnourished children had an average age of 6-12 months followed by those aged between 13 and 24 months (18.0%) (Table 4.3) and (Figure 4.12). This study also revealed that there there was as a significant

association between nutritional diagnosis and age of the child with P-value = 0.001 (Table 4.20). Cartmell et al. (2005) looked at children (six months to five years old) admitted to the malnutrition ward in the Central Hospital of Maputo in 1983 and again in 2001 and found an average age of 23.8 months in 1983 and 21.7 months in 2001 (Cartmell *et al.*, 2005). Kleynhans et al. (2006) investigated the nutritional status of children 12 to 24 months old in Limpopo in rural villages and urban informal settlement areas and found a mean age of 18.63 months in malnourished children. A study conducted in Nigeria showed that the most common age groups with PEM were 6 to 12 months (55.7%) followed by 13 to 24 months (36.8%) and the lower household socio-economic class was found to be significantly associated with mortality of child malnutrition (Ubesie *et al*., 2012). A study done in Kenya, the mean age was 29.5 months in 1993, 28.3 months in 1998 months, 27.8 months in 2003, and 28.7 months in 2008-09. (Masibo, 2013). If these children are not given special care in diet and are not treated for severe infections, they have a higher chance to develop malnutrition compared to children of other age group.

Prematurity birth status of the child

In this study, the findings indicate that only 17.2% of the malnourished children were born prematurely (Table 4.3) and (Figure 4.13). This is in agreement with a similar study undertaken by Falbo and Alves (2002) amongst infants younger than six months old, which reported that only 36.4% of the malnourished children were born prematurely.

Immunization and Vitamin A supplementation

More than 30 million children are unimmunized either because vaccines are unavailable, because health services are poorly provided or inaccessible, or because families are uninformed or misinformed about when and why to bring their children for immunization. Pneumonia, diarrhoea, malaria, measles, HIV/AIDS and malnutrition are the primary killers of children in the developing world. These children die because they are poor, they do not have access to routine immunization or health services, their diets lack sufficient vitamin A and other essential micronutrients, and they live in circumstances that allow pathogens (disease-causing organisms) to thrive (UNICEF, 2015b). In this study (Table 4.3), 70.3% of the children under study were immunized up to-date and only 29.7% had their immunization schedules not up to-date. This shows that over two-thirds of the children admitted to the nutrition ward of SOS hospital were immunized. Furthermore, the findings revealed that 74.5%, 63.4% and 57.1% of those diagnosed underweight, marasmus, and unclassified were immunized up to date. While 50% and 83.3% of the children diagnosed with kwashiorkor and marasimic – kwashiorkor (Table 4.22). In Ethiopia 80.2% of children three to 36 months old were fully immunized and the proportion of malnourished children that were fully immunized for age was not significantly different from that of well-nourished children (77.6%) (Abate *et al.*, 2001). In Bangladesh 77% of children between six and 60 months of age received BCG and 82% received full or partial DPT and polio immunizations. There was a significant association with malnutrition when no vaccines were available. Of the children in Bangladesh, 75% had received measles immunizations (Iqbal Hossain *et al.*, 1999).

Vitamin A is necessary for a well functioning immune system and a deficiency can cause high risk of mortality. In 2008, 71% of 6-59 month old children were protected against a deficiency because of the two doses they received twice per year through the vitamin A supplementation programme. In 2008, 22 of the 34 least developed countries passed the 80% coverage rate. The coverage doubled from 41% in 2000 to 88% in 2008 (UNICEF, 2009a). In this study, 66.9% of the malnourished children had their vitamin A supplementation up to-date with only 33.1% who had their vitamin A supplementation not up to-date at the time of interview (Table 4.3). This study further revealed that there is a significant asscociation between malnutrition and vitamin A supplementation with P-value = 0.048 (Table 4.23). In a study undertaken in an informal settlement in Durban, South Africa by Coutsoudis et al. (1993) amongst children three months to six years, the preschool children presented with low vitamin A status in 44% of the group. Five percent 5% had a vitamin A deficiency (Coutsoudis *et al.*, 1993). A study undertaken by Ferraz et al. (2005) in Brazil amongst children older than 24 months and younger than 72 months found that 75% of this age group were still deficient in vitamin A (Ferraz *et al.*, 2005).

Breastfeeding status of the child

According to UNICEF (2009), less than 40% of infants in the developing world receive immediate breastfeeding after birth. Only 39% of babies are put to the breast one hour after birth despite the fact,that early initiation of breastfeeding can contribute to reduced neonatal mortality through skin-to-skin contact that can prevent hypothermia (UNICEF, 2009a). In study in Ethiopia, researchers found that 57.84% of mothers cases were squeeze out their first breast milk whereas 42.16% of mothers cases were not squeeze out their first breast milk (Bantamen *et al.*, 2014). Similarly, this study showed that a proportion slightly above average (56.8%) of the total children had been breastfed while 43.2% were not breastfed (Table 4.3).

Regarding the age up to which the child was breastfed, this study revealed that majority of the children diagnosed with underweight (69.6%), marasmus(54.2%) and marasmic – kwashiorkor(66.7%) were breastfed up to the age between 7 months and 12 months while 100% of those diagnosed with kwashiorkor were breastfed up – to the age of between 13 – 24 months. While those diagnosed with unclassified malnutrition were fed for between 1 and 6 months (Table 4.25). It is evident that breastfeeding reduces the risk of a child suffering from all the malnutrition conditions as only 10% of the admitted children were breastfed up to 13 – 24 months and the age up-to which the child was breastfed was significantly associated with malnutrition with P-value = 0.001 (Table 4.25). According to a study undertaken in Brazil on children admitted to hospital, 19.2% of mothers never breastfed and 49.5% of children were breastfed for less than two months (Falbo and Alves, 2002).

In this study, 41.1% of the children were exclusively breastfed up to the 5^{th} and 6^{th} month of the child's age, 36.1% were exclusively breastfed to the age of between 3 and 4 months while only 28.3% were exclusively breastfed for a duration between 1 and two months (Table 4.3). This study in contrast with other studies undertaken in Africa and the world where exclusive breastfeeding practice is not common; this may be because of mothers reported longer period of exclusive breastfeeding than actually happening. Worldwide 37% of infants younger than six months of age are exclusively breastfed. The rate is low in Africa with less than one third of infants younger than six months receiving exclusive breastfeeding. Over the last ten to fifteen years exclusive breastfeeding increased in Africa from 33% in 1995 to 38% in 2008 (UNICEF, 2009a). In a study undertaken in Malawi, infants were followed up from birth to twelve months and only

13.3% of mothers exclusively breastfed their children (Kalanda, 2006).

In this study, 66.2% of the children were partially breastfed between the age of 7 and 12 months, 28.3% were breastfed between the age of 1 and 6 months while only 5.5% were partially breastfed between the age of 13 and 24 months (Table 4.3). A study in Ethiopia amongst children younger than five years old showed a positive association between malnutrition and prolonged breastfeeding (Getaneh *et al.*, 1998) and a study undertaken in Kampala amongst children zero to 60 months showed a positive association between malnutrition and lack of breastfeeding (Owor *et al.*, 2000).

Mothers that were not breastfeeding at the time of the interview, majority of their children (55.6%) were fed on formula milk, followed by 35.5% of the children were fed on cow's milk while the remaining 8.9% were fed on other milk types other than formula and cow's milk such as Goat's milk, camel's milk and Nido. This study also revealed a significant association between malnutrition and the type of milk the baby is fed particularly Cow's milk with P-value = 0.012 (Table 4.26). In this study, majority of the children (59.9%) were fed using a cup while only 40.1% were fed using a feeding bottle (Table 4.3). According to a study in Bangladesh amongst babies six to 60 months old, 48.3 % of babies received milk via a bottle and only 7% were breastfed (Iqbal *et al.*, 1999).

Solid food introduction

In this study, 59.3% of the breastfed malnourished children (n=219), were introduced to solid foods at the age between 7 and 12 months. 29.7% of the breastfed malnourished children were introduce to solid foods before the age of 6 months while only 11.0% of the children had solid foods introduced at the age between 13 and 24 months (Table 4.3).

Number of meals per day

According to the number of meals the child had per day, this study revealed that (Table 4.3) majority of the malnourished children (73.7%) were subjected to not more than three meals per day.

The child's health/medical history

Because of low immunity, malnourished children suffer from many symptoms; in this study (Table 4.4), fever, cough, diarrhea and the child's failure to gain weight were the major history of current illnesses among the children with proportions of 71.6%, 63.8%, 44.8% and 38.3% respectively. Majority (70.0%) of the malnourished children studied had no history of any known chronic disease. Only 7.6% and 7% of the total children studied had history of congenital heart diseases and PTB, respectively with previous hospital admissions of 43.5% of the total malnourished children. According to who referred the child to the hospital, the study revealed that only 53.8% of the total malnourished children admitted to SOS hospital were referred by known medical practitioners of which 41.1%, 9.6% and 3.1% were referred by a doctor, nurse and dietitian respectively. However, other people other than the nurse, doctor or dietitian referred the remaining proportion of admissions, 46.2%.

Anthropometric measurements of the child and mother/caregiver

Birth weight is a predictor of malnutrition (Kleynhans *et al.*, 2006) and there is a direct link between maternal and child nutrition (Teller and Yimar, 2000). In a study done by Falbo and Alves (2002), the median birth weight of children was 2.80kg. The study was done in Brazil between 1999 and 2000, 88.9% of the children with severe malnutrition were younger than six months, and 42.4% had low birth weights (Falbo and Alves, 2002). A study done by Ramakrishnan (2004) found that the prevalence of low birth weight babies was 10% for Sub-Saharan Africa, but this is not very reliable, as two thirds of births in Africa are never reported. In India, low birth weight is related to maternal nutritional factors such as energy and protein intake during pregnancy and the weight of the mother before she got pregnant (Ramakrishnan, 2004). Gupta (2008) found that low birth weight babies had a higher risk of developing feeding problems and malnutrition (Gupta, 2008). In a study done in Limpopo, South Africa most children twelve to 24 months old that had a birth weight of less than 2.5kg, were more likely to develop stunting. About 25% of the stunted children weighed less than 2.5kg at birth (Kleynhans *et al.*, 2006).

In this study, (Table 4.5), the birth weight of the malnourished children ranged between 1.2 and 4kg with a median birth weight of 2.5kg. Thirty one percent (31%) of the children had a birth weight of less or equal to 2.5kg (Table 4.3).

The results of this study further revealed that the current weight ranged between 1.6 and 15kg with a median current weight of 6.5kg (Table 4.5) while the height/length of the children ranged between 45 and 114cm, with the median height of 66 cm (Table 4.5). In a study done in Limpopo, South Africa, children were followed from birth up to three years of age and results showed that when a child has a greater height at one year it protects the child against stunting. Normal length and weight at one year are very important as this can predict the nutritional status of the child at three years of age (Mamabola *et al.*, 2005).

With the interpretation of the MUAC in this study (Table 4.6), majority of the children (61.2%) had an MUAC ranging between 11.0 –12.5cm meaning that 61.2% of the children had moderate malnutrition. This was followed by 25.8% of the children who were severely malnourished (MUAC less than 11cm) and only 2.9% of the children had mild malnutrition based on the MUAC.

In a study done in Kenya on children twelve to 59 months, the clinical features associated with malnutrition were significantly more common in children that had a MUAC of less or equal to 11.5cm (Berkley *et al.*, 2005). Kikafunda et al. (1998) found that 21.6% of Ugandan children zero to 30 months old had a MUAC lower than 13.5 cm. The risk factors for low MUAC were poor health, lack of meat and cow's milk consumption, low energy through fat, mothers with low educational levels and older mothers (Kikafunda *et al.*, 1998).

In this study (Table 4.7), only 2.1% of the mothers/caregivers had BMI in the normal range of 18.5 and 24.9kg/m2 while 49.5% of the caregivers/mothers were morbidly obese, 20.6%, 20.1%, 7.6% and 0.3% of the mothers/caregivers were severely obese, obese, overweight and underweight respectively. In contrast, James et al. (1999) analysed data from Ethiopia, India and Zimbabwe and found that 56.3% of households had women with an average BMI of less than 18.5 kg/m2. In only 29.9% of the Indian households, children had a normal weight-for-height and the adults had an average BMI of more than 18.5 kg/m2 (James *et al.*, 1999).

Comorbidities associated with malnourished children

Malnutrition weakens immunity thus child becomes susceptible to many infectious agents; in this study (Table 4.8), bronchopneumonia, diarrhea, malaria and measles were the most prevalent comorbidities (diseases/conditions) among the malnourished children admitted to SOS hospital with a proportion of 62.2%, 55.5%, 33.1% and 24.2% respectively. This is followed by severe anaemia, chronic suppurative otitis

media and urinary tract infection with a proportion of 16.9%, 13.5% and 12% respectively, while TB, Sepsis and HIV were the least prevalent with proportions of 4.7%, 4.4% and 0.8% respectively. However, 12.2% of the malnourished children had different conditions other than those mentioned.

Bronchopneumonia

A study done in Dhaka, Bangladesh reported the prevalence of pneumonia in children with hypoxia and severe malnutrition to be 11% , which was lower compared with our study which reported all cases of pneumonia and not considering whether the child had hypoxia or not (Christi *et al.,* 2013). In this study, a high proportion of malnourished children (62.2%) had bronchopneumonia (Figure 4.20).

Diarrhea

Children who are malnourished, or have impaired immunity as well as people living with HIV are most at risk of life-threatening diarrhea. Children who die from diarrhea often suffer from underlying malnutrition, which makes them more vulnerable to diarrhea. Each diarrheal episode, in turn, makes their malnutrition even worse. Diarrhea is a leading cause of malnutrition in children under five years old (WHO, 2013a). In this study, diarrhea was found in 55.5% of malnourished children (Figure 4.20).

Malaria

A study done in Kenya on malaria and nutritional status in children living on the coast of Kenya concluded that the effect of malaria on nutritional status appears to be greatest during the first 2 y of life (Nyakeriga *et al*., 2004). In Enungu, Nigeria they reported a higher rate of 40.0% (Ubesie *et al.*, 2012). In this study, malaria was diagnosed in 33.1% of malnutrition cases (Figure 4.20).

Measles

Measles is one of the leading causes of death among young children even though a safe and cost-effective vaccine is available. In 2014, there were 114 900 measles deaths globally – about 314 deaths every day or 13 deaths every hour. Measles vaccination resulted in a 79% drop in measles deaths between 2000 and 2014 worldwide. In 2014, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services – up from 73% in 2000. During 2000-2014, measles vaccination prevented an estimated 17.1 million deaths making measles vaccine one of the best buys in public health (WHO, 2016).

Measles is an important acute childhood viral infection having severe consequences on the nutritional status. The adverse nutritional effects of measles are experienced by both the well-nourished and the malnourished children. However, the severe nutritional deficiencies like kwashiorkor/marasmus are precipitated only in children who are already malnourished. As high as 3-4 per cent of children with measles suffered from these clinical nutritional syndromes in their post-measles period (Bhaskaram, 1995). In this study, 24.2% of cases were reported with measles infection at the time of interview (Figure 4.20).

Treatment for comorbidities

In this study, over 90% (90.6%) of the malnourished children who had comorbidities were on treatment while only 9.4% were not under treatment (Figure 4.21). As regards the type of treatment received, results indicate that about 84% of the patients were receiving antibiotics, followed by 18.2%, 4.7% and 3.1% of the children who were on antimalarial therapy, anti TB therapy and blood transfusion respectively.

Conclusions

Majority of the children caregivers were female and below the age of 35 years.

The illiteracy status was high among caregivers and this leads to poor care practices and low household income, which was asscociated with poor nutritional status with resultant stunting.

Household size was directly linked to a child becoming malnourished with a household of more than three people being at higher risk and males headed most households.

The majority of the families with malnourished children had house with utmost two rooms used for sleeping.

Other factors are inappropriate child caring and feeding practices such as using unprotected source of water for drinking and caregiver poor hand washing practices.

In most cases, the mother was still alive and the children stayed with their parents and were cared for by their mother's during the day. If the parents were not caring for the children, the grandparents usually cared for them.

Counselling of the mother on healthy eating was significantly associated/related to malnutrition diagnosis of the children under five years in our setting.

Majority of mothers had no history of TB and did not take treaments for illnesses.

Antenatal clinic attendance was generally acceptable.

Majority of mothers did not consume alcohol or smoke during pregnancy.

Majority of the children were born at home and majority of the mothers did not regularly take their children to hospital after birth for checkup. Over two-thirds of the children's mothers had more than 4 live births. The child's malnutrition chances increased as the child's birth order increased with most children included in this study coming from homes with a high birth order (fourth or more).

In our setting, malnutrition is more prevalent in children between six to 12 months of age and significantly, more boys than girls in this study presented with malnutrition.

Majority of the malnourished children were not premature. Over two-thirds of the children admitted to the nutrition ward of SOS hospital were immunized up-to date. Vitamin A supplementation schedule up-to date reduced the risk of child malnutrition especially from the unclassified malnutrition condition.

There was a strong and significant relationship between breastfeeding particularly the age up-to when a child was breastfed and the malnutrition diagnosis. Even if the child was not breastfed, the type of milk the baby is fed on particularly cow's milk was significantly linked with malnutrition.

Majority of the malnourished children were subjected to not more than three meals per day.

Fever, cough, diarrhea and the child's failure to gain weight were the major current symptoms among the malnourished children admitted to SOS Hospital with majority of patients have no history of known chronic diseases or previous hospital admission.

Marasmus and underweight were the most prevalent nutritional diagonsis among the children admitted to our setting.

Majority of the malnourished children studied had normal birth weight. One third of babies included in this study were born with a low birth weight.

MUAC was found to be a very good screening tool.

Obese, overweight or underweight mothers have a higher chance of having malnourished children.

Bronchopneumonia, diarrhea, malaria and measles were the most prevalent comorbidities among the malnourished children admitted to SOS hospital. Of those with comorbidities, majority were on treatment in the form of

antibiotics, antimalarial therapy, anti TB therapy and blood transfusion.

Recommendations

Promotion of parental education especially mothers as this can improve nutritional education and household income.

Caregivers 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.

Use of protected water source for drinking to prevent diarrheal diseases.

For prevention of malnutrition, community-based counselling of the mother/caregiver on healthy eating and food fortification should be established and implemented at all community levels and there should be well-trained personnel.

Strengthen routine expanded program of vaccination at community level.

Strengthen and expending therapeutic malnutrition program by ministry of Health.

Food aid programs for malnourished children, including macronutrients and micronutrients, should be implemented to prevent food shortage.

Management of infections like bronchopneumonia and diarrheal disease to prevent undernutrion.

Screening of malnutrition should routinely be performed for under five children to identify early malnutrition cases for proper intervention and management of the cases to reduce morbidity and mortality associated with malnutrition.

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