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Prevalence and Outcome of Severe Acute Malnutrition among Children 6-59 Months, in Magumeri Local Government Area, Borno State, Attending General Hospital Magumeri, Borno State, Nigeria

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Abstract

This is a retrospective observational hospital-based study aimed to determine the prevalence and outcome of severe acute malnutrition (SAM) in children 6 – 59 months in Magumeri local Government area admitted to Magumeri General Hospital – INTERSOS Nigeria Stabilization centre during the period December 2018 to June 2019. A total of 171 children with severe acute malnutrition were identified; 104 of cases were male (60.8%) while 67 (39.2%) were females. The mean age of the admitted children was 15.8 months. Children 36–59 months were least affected. The overall prevalence of severe malnutrition was 4.0%, and the general mortality rate was 3.8% while mortality rate among children with severe malnutrition was 2.9%.

Amongst children admitted with SAM, 126 (73.7%) had marasmus, 30 (17.5%) had kwashiorkor and only 16 (9.4%) were marasmic-kwashiorkor. The highest prevalence rates occurred in February and April. The common clinical presentations were acute diarrhea disease, upper respiratory tract infection, malaria, urinary tract infections, dermatitis, measles, sepsis and pneumonia. Only 14.6% were fully vaccinated, while 49.7% were not vaccinated. Overall 81.9% improved and were discharged, 8.2% were transferred to the University of Maiduguri Teaching Hospital for management of other severe medical complications, 7 % discharged against medical advice and 2.9 % died. In conclusion, the prevalence and mortality among children with SAM at Magumeri Local Government area were high, and the current management strategies were inadequate to cater for the high cases as a result of the crisis in the region.

Keywords: *Severe acute malnutrition, Prevalence, Mortality, and Outcome.*

Introduction

The public health significance of malnutrition lies in its role as a preventable cause of several morbidities and mortality in children particularly, in low resource income countries and conflict plagued regions like Northeastern Nigeria. Malnutrition is a consequence of inadequate nutrient consumption as well as the catabolic effects of infections and infestations. It may exist in the acute or chronic forms. The former is characterized by reduced weight for-age despite relative preservation of height/length whereas both the weight and height/length are reduced in the latter. (Hendrickse et al, 1991).

The weight-for-height (WFH), measurement of mid upper arm circumference (MUAC) as well as presence of oedema are conventionally adopted for the assessment of acute malnutrition for clinical and research purposes. Aside underweight, wasting and stunting, which are more common forms of malnutrition, severe acute malnutrition (SAM) is more important in view of the high risk of death associated with it. (Sunguya et al 2006).

Malnutrition is a broad term that can be used to describe any imbalance in nutrition; over-nutrition often seen in the developed world, to under-nutrition seen in many developing countries, but also in hospitals and residential care facilities in developed nations. Malnutrition can develop as a consequence of deficiency in dietary intake, increased requirements associated with a disease state, from complications of an underlying illness such as poor absorption and excessive nutrient losses, or from a combination of these aforementioned factors (Naber et al, 1997).

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Malnutrition is associated with negative outcomes for children, including higher infection and complication rates (Baldwin et al, 2004), increased muscle loss (Chandra, 1997), impaired wound healing (Machanick, 2004), longer length of hospital stays and increased morbidity and mortality (Middleton et al, 2001). It kills, retards, cripples, blinds and impairs human developments on truly massive scale worldwide (WHO report, 2001). Severe acute malnutrition (SAM) is a leading cause of death among children younger than five years of age. Malnutrition is classified into two classical syndromes, marasmus (wasting syndrome) and kwashiorkor, or a mixture of both (marasmic-Kwashiorkor).

Children are the most nutritionally vulnerable group especially in the developing world. According to surveys conducted between 1987 and 1998, two out of five of these children are stunted, one in three is underweight and one in ten is wasted; the numbers vary considerably among regions. Annually, some 30 million infants, around 82,000 every day, are born with intrauterine malnutrition growth retardation mainly due to poor maternal nutritional status. The highest level of stunting is found in Eastern Africa, where 48.1% of preschool children were affected in the year 2000. In this part of the world stunting is increasing at 0.08 % per year (UNICEF 1994-1999 plan).

Magumeri is local government area in Borno state, northeastern Nigeria with a current population estimated to be 213,975 of which 42,795 are children under the age of five years. (NPopC 2017).

Study justification

Reducing malnutrition and its consequences is a global and development goal as stated by the Sustainable Development Goals (SDGs) and the Nigeria Nutrition in Emergency working Group. The prevalence of malnutrition imposes significant costs on the social and economic development of the entire Northeast region, predisposing the children to different infectious diseases, psychosocial apathy, and cognitive deficiencies. This study targets the latter by providing information that may assist in improving current available services for treatment of severe malnutrition.

Study objective

Although severe acute malnutrition is acknowledged as one of the major health problems, there is paucity of data on the prevalence and outcome of this condition in Magumeri. Therefore, the objective of this study was to determine the prevalence of severe acute malnutrition and outcomes of severely malnourished children 6 – 59 months old admitted to Magumeri General Hospital and to provide recommendations for improvement accordingly.

Literature review

Background

Severe acute malnutrition is the most extreme and visible form of under-nutrition. Children with severe acute malnutrition have very low weight for their height and severe muscle wasting. They may also have nutritional oedema, characterized by swollen feet, face and limbs. Severe acute malnutrition is a major cause of death in children under 5, and its prevention and treatment are critical to child survival and development.

Across the globe, an estimated 16 million children under the age of 5 are affected by severe acute malnutrition. This number is staggering most importantly, because children with severe acute malnutrition are nine times more likely to die than well-nourished children. These deaths are the direct result of malnutrition itself, as well as the indirect result of childhood illnesses like diarrhea and pneumonia that malnourished children are too weak to survive. (Caulfield et al, 2004).

Severe acute malnutrition can increase dramatically in emergencies. But despite what we see in the headlines, the majority of cases occur in developing countries not affected by emergencies. These settings are plagued by chronic poverty, lack of education, poor hygiene, limited access to food and poor diets. The result is significant barriers to sustainable development in these nations.

Definition

The World Health Organization (WHO) defines malnutrition as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions" (Mehta NM et al, 2013). The term Severe acute Malnutrition applies to a group of related disorders that include marasmus, kwashiorkor (see the image in appendix 3), and intermediate states of marasmus-kwashiorkor. Children with kwashiorkor have nutritional edema and metabolic disturbances, including hypoalbuminemia and hepatic steatosis, whereas marasmus is characterized by severe wasting. (Balint, 1998).

Studies suggest that marasmus represents an adaptive response to starvation, whereas kwashiorkor represents a maladaptive response to starvation. Children may also present with a mixed picture of marasmus and kwashiorkor or with milder forms of malnutrition.

Severe acute malnutrition is a global issue, seen primarily in resource-limited countries. Overall, malnutrition has decreased worldwide, but the rates vary by region. For example, Asia has seen declines in this condition, whereas there has been a continued increase in African nations. (WHO report, 2006).

Classification

Malnutrition can be classified as acute versus chronic. Features of chronic malnutrition include stunted growth, mental apathy, developmental delay, and poor weight gain. (Blossner et al, 2005). Acute malnutrition manifests itself in two major forms: marasmus (the most common form) and kwashiorkor, although some patients' condition may manifest as a combination of both forms (marasmic kwashiorkor). (Hendricks et al, 1995).

Children with marasmus are often low weight-for-height and have a reduced mid-upper arm circumference (MUAC), as well as a head that appears large relative to the rest of their body. Other findings include dry skin, thin hair, and irritability. Kwashiorkor is characterized by peripheral pitting edema, as well as "moon facies," hepatomegaly, and a pursed mouth.

Pathophysiology

Malnutrition affects virtually every organ system. Dietary protein is needed to provide amino acids for synthesis of body proteins and other compounds that have various functional roles. Energy is essential for all biochemical and physiologic functions in the body. Furthermore, micronutrients are essential in many metabolic functions in the body as components and cofactors in enzymatic processes.

In addition to the impairment of physical growth and of cognitive and other physiologic functions, immune response changes occur early in the course of significant malnutrition in a child. These immune response changes correlate with poor outcomes and mimic the changes observed in children with acquired immune deficiency syndrome (AIDS). Loss of delayed hypersensitivity, fewer T-lymphocytes, impaired lymphocyte response, impaired phagocytosis secondary to decreased complement and certain cytokines, and decreased secretory immunoglobulin A (IgA) are some changes that may occur. These immune changes predispose children to severe and chronic infections, most commonly, infectious diarrhea, which further compromises nutrition causing anorexia, decreased nutrient absorption, increased metabolic needs, and direct nutrient losses.

Early studies of malnourished children showed changes in the developing brain, including, a slower rate of growth of the brain, lower brain weight, thinner cerebral cortex, decreased number of neurons, insufficient myelinization, and changes in the dendritic spines. More recently, neuroimaging studies have found severe alterations in the dendritic spine apparatus of cortical neurons in infants with severe protein-calorie malnutrition. These changes are similar to those described in patients with mental retardation of different causes. There have not been definite studies to show that these changes are causal rather than coincidental. (Benitez et al, 1999).

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Etiology

Worldwide, the most common cause of malnutrition is inadequate food intake. Preschool-aged children in developing countries are often at risk for malnutrition because of their dependence on others for food, increased protein and energy requirements, immature immune systems causing a greater susceptibility to infection, and exposure to non-hygienic conditions. (Zeng et al, 2008).

Another significant factor is ineffective weaning secondary to ignorance, poor hygiene, economic factors, and cultural factors. The prognosis is worse when severe acute malnutrition occurs with human immunodeficiency virus (HIV) infection. Gastrointestinal infections can and often do precipitate clinical protein-energy malnutrition because of associated diarrhea, anorexia, vomiting, increased metabolic needs, and decreased intestinal absorption. In addition, parasitic infections play a major role in many parts of the world. (Detsky et al, 1987).

In developed nations, inadequate food intake is a less common cause of malnutrition than that caused by decreased absorption or abnormal metabolism. Thus, diseases, such as cystic fibrosis, chronic renal failure, childhood malignancies, congenital heart disease, and neuromuscular diseases contribute to malnutrition in developed countries. Fat diets, inappropriate management of food allergies and psychiatric diseases (e.g., anorexia nervosa) can also lead to severe acute malnutrition. (Lazzerini et al, 2008).

Populations in both acute and long-term facilities are at risk for clinically significant involuntary weight loss (IWL) that can result in severe acute malnutrition. IWL is defined as a loss of 4.5 kg or greater than 5% of the usual body weight over a period of 6-12 months. Severe acute malnutrition occurs when weight loss of greater than 10% of normal body weight occurs.

Anorexia of aging, defined as the loss of appetite and/or decreased food intake in late life, is used to describe multifaceted clinical conditions that are common among frail older persons but not easily grouped into specific diseases or syndrome categories. Common causes of resulting malnutrition include decreased appetite, dependency on help for eating, impaired cognition and/or communication, poor positioning, frequent acute illnesses with gastrointestinal losses, medications that decrease appetite or increase nutrient losses, decreased thirst response, decreased ability to concentrate urine, intentional fluid restriction due to fear of incontinence or choking if dysphagic, psychosocial factors such as isolation and depression, monotony of diet, higher nutrient density requirements, and other demands of age, illness, and disease on the body. (Stobaugh et al, 2016).

Severe acute malnutrition is one of the most common complications in liver cirrhosis patients, with reported rates of 25.1% to 65.5%. Patients on long-term hemodialysis also may develop protein-energy malnutrition; this is associated with increased morbidity and mortality. Patients with squamous cell carcinoma of the esophagus are at risk for protein-energy malnutrition. Bariatric surgery can be associated with iatrogenic kwashiorkor. (Blecker et al, 2000).

Presentation

a. History

Clinical signs and symptoms of severe acute malnutrition include the following:

i. Poor weight gain
ii. Slowing of linear growth
iii. Behavioral changes - Irritability, apathy, decreased social responsiveness, anxiety, and
iv. attention deficits

b. Physical

Physical findings that are associated with SAM include the following:

i. Decreased subcutaneous tissue: Areas that are most affected are the legs, arms, buttocks, and face.
ii. Edema: Areas that are most affected are the distal extremities and anasarca (generalized edema).

- Oral changes
- Cheilosis
- Angular stomatitis

- Papillar atrophy

iii. Abdominal findings

- Abdominal distension secondary to poor abdominal musculature
- Hepatomegaly secondary to fatty infiltration

iv. Skin changes

- Dry peeling skin with raw exposed areas
- Hyper-pigmentation
- ted plaques over areas of trauma

v. Nail changes: Nails become fissured or ridged.

vi. Hair changes: Hair is thin, sparse and brittle, easily pulled out, and turns a dull brown or reddish color. (Balint 1997).

Epidemiology

Nigeria data

Malnutrition and nutrition related diseases continue to be problems of public health importance in Nigeria with the under-five mortality rate unacceptably high at 158 per 1,000 live births. (UNICEF 2011 report) Malnutrition is the underlying cause of 53% of these deaths.

In Nigeria, about 14 million people – 8.5% of the total population - are undernourished. (FAO; WFP 2012, report) It is also home to the highest number of stunted children in the continent and ranks second globally with more than 10 million stunted children. The 2013 Nigeria Demographic and Health Survey (NDHS) conducted by the National Population Commission reported 37% of children under five as being stunted, 29% as underweight, and 18% as wasted. In addition to a lack of basic protein and energy, the immediate causes of malnutrition are a lack of micronutrients such as vitamin A, iodine, iron, and zinc.

Severe acute malnutrition is the most common form of nutritional deficiency among patients who are hospitalized in Nigeria. Up to half of all patients admitted to the hospital have malnutrition to some degree. In a survey of a large children's hospital, the prevalence of acute and chronic malnutrition was more than 50%.

International data

In 2000, the World Health Organization (WHO) estimated that malnourished children numbered 181.9 million (32%) in developing countries. In addition, approximately 149.6 million children younger than 5 years were malnourished when measured in terms of weight for age. In south central Asia and eastern Africa, about half the children had growth retardation due to protein-energy malnutrition. This figure was five times the prevalence in the western world.

More recent data (2016) indicate that severe acute malnutrition including kwashiorkor and marasmus affects more than 18 million children each year, most living in low-income settings. (Di Giovani et al, 2016).

According to 2018 WHO data, 52 million children younger than 5 years are wasted (low weight for height), 17 million are severely wasted, and 155 million are stunted (low height-for-age). (WHO 2019 report).

In a similar study, a retrospective observational hospital approach in Omdurman Pediatric Hospital, Sudan. The overall prevalence of severe malnutrition was 6.5%, and the general mortality rate was 2.4% while mortality rate among children with severe malnutrition was 9.3%. (Shaza et al, 2015).

Borno state

Although malnutrition is a problem throughout the country, there are three zones in Nigeria that represent the majority of those affected – North West, North East, and North Central. Borno state remains the largest state in the northeastern Nigeria affected by the Boko-Haram conflict in Nigeria.

The overall nutrition situation in the North Eastern Nigeria (Adamawa, Borno, and Yobe) has remained precarious, the results of surveillance established by the sector and funded by UNICEF unveiled GAM exceeded the WHO crisis classification threshold for “serious” (10%) in 5 domains:

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Central Borno, MMC/Jere, Northern Yobe, Central Yobe, and Southern Yobe. Prevalence of GAM was highest in Northern Yobe both as assessed by weight-for-height and/or oedema (14.3%), and as assessed by MUAC (10.5%) (Nigeria Nutrition in Emergency Working Group 2018 report).

Rural Magumeri like other rural areas of the state is also disproportionately affected for many reasons, conflict and displacement, negative coping strategies, increasing spread of endemic diseases, low coverage of programs targeting children with moderate acute malnutrition, limited dietary diversity, loss of livelihoods, disruption of access to quality water and optimal sanitation, population displacement and destruction of housing, compromising the privacy necessary for breastfeeding; and the poor and deteriorating health care system as well as limited education resources.

Materials and methods

Study setting

Magumeri is a local government area of Borno Sate, Nigeria. It has an area of 4,856km^2, 14 wards and a population of 140,231 as per the 2006 census which has since increased to an estimated 213,975. Magumeri General Hospital currently runs comprehensive healthcare services as well as a stabilization centre for management of severe acute malnutrition with medical complications.

Methods

This is seven months (December 2018 – June 2019) retrospective, quantitative and hospital-based study. We identified cases of SAM from hospital registers and obtained relevant information of the study population from patient's hospital records. This information includes type of SAM (marasmus, kwashiorkor, or marasmic-kwashiorkor), date of admission and discharge, associated co-morbidities, vaccination history, and the outcome (improved and discharge, discharge against medical advice or died).

Inclusion and exclusion criteria

All children with age between 6 and 59 months admitted to Magumeri General Hospital-Stabilization centre with severe acute malnutrition (with co-morbidities like malaria, gastroenteritis, anaemia and measles) in 2019 were included. Those with chronic illness in addition to severe malnutrition were excluded (e.g. cardiovascular disease, tuberculosis, cerebral palsy, microcephaly or sickle cell disease).

Ethical considerations

Ethical approval was obtained from the hospital administration board to review patient's records at the hospital statistical office**.**

Statistical analysis

Data were analysed using SPSS version 17.0 software. The parameters of children with normal nutritional status and SAM were compared. Odds ratio (OR) with 95% Confidence Interval (CI) was used to compare proportions and p-values were determined. Statistical significance was defined by p-values less than 0.05 and CI excluding unity.

Results

During the study period December 2018 to June 2019, a total of 193 children were admitted to the Stabilization unit of Magumeri General Hospital, of which 185 were 6 – 59 months old.

179 of these were admitted because of severe acute malnutrition, this represent 88.6% of total hospital admissions, explainable as the facility was activated for management of the emergency as a fall out of the over 10 years crisis in the region. 8 out of the 179 were excluded as per study protocol. The total of children between the age of 6 -59 months affected by severe acute malnutrition was 171; of these 104 were males (60.8%). The mean age of children admitted with acute severe malnutrition was 15.8 months. Children aged 36–59 months were least affected as shown in Table 1.

During the study, the overall prevalence of severe malnutrition was 4.0%, and the general mortality rate was 3.8% while mortality rate among children with severe malnutrition was 2.9%.

Table 1. Shows the distribution of children, with severe acute malnutrition, according to age group in the hospital during the study duration

Age Group	Frequency	Percent (%)
0 – 12	72	42
12 – 24	48	28
24 – 36	36	21
36 – 48	11	7
48 – 59	4	2
Total	171	100

Children within the age group 36 – 59 months were the least affected.

Table 2. Shows the outcome of children admitted to the hospital during the period of the study.

Outcome	Frequency	Percent (%)
Improved & discharged	140	82
Transferred	14	8
Discharged against medical advice	12	7
Death	5	3
Total	**171**	**100**

The majority (81.9%) of the study population recovered and were discharged from the hospital, 8.2% were transferred to the University of Maiduguri Teaching Hospital for management of severe medical complications, while 7% were discharged against medical advice and 2.9% died as shown in Table 4.

Table 3. Vaccination status of children admitted during the period of the study

Vaccination status	Frequency	Percent (%)
Fully Vaccinated	25	14
No Vaccination	85	50
Partial Vaccination	20	12
No vaccination data	41	24
Total	**171**	**100**

Fully vaccinated children represented only 14.6%, while 49.7% were not vaccinated and 11.7% were partially vaccinated and no data was available for 24% of the children.

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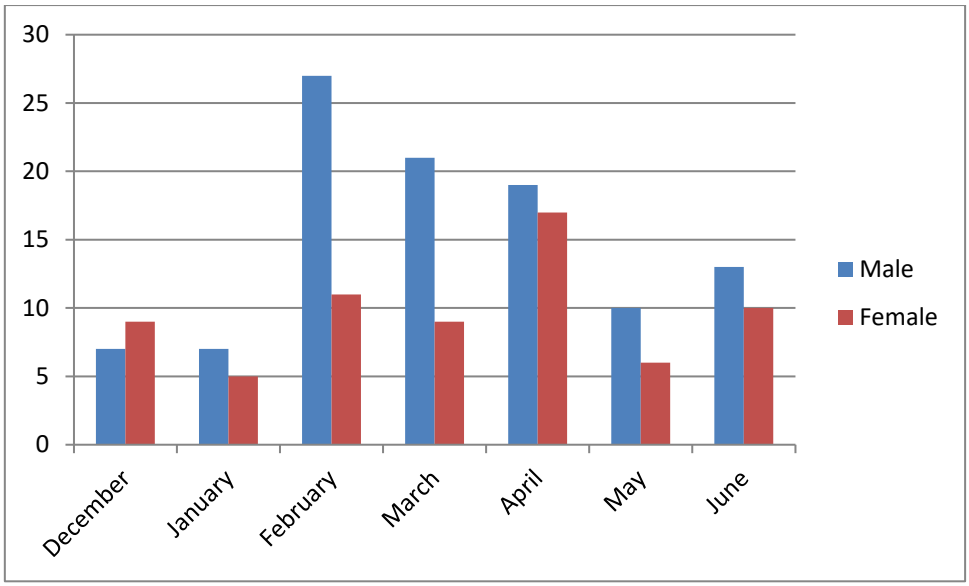

Figure 1.0. Gender distribution of children 6 - 59 months admitted with SAM during the period of the study to Magumeri General Hospital-Stabilization unit

The highest prevalence rates occurred in February and April.

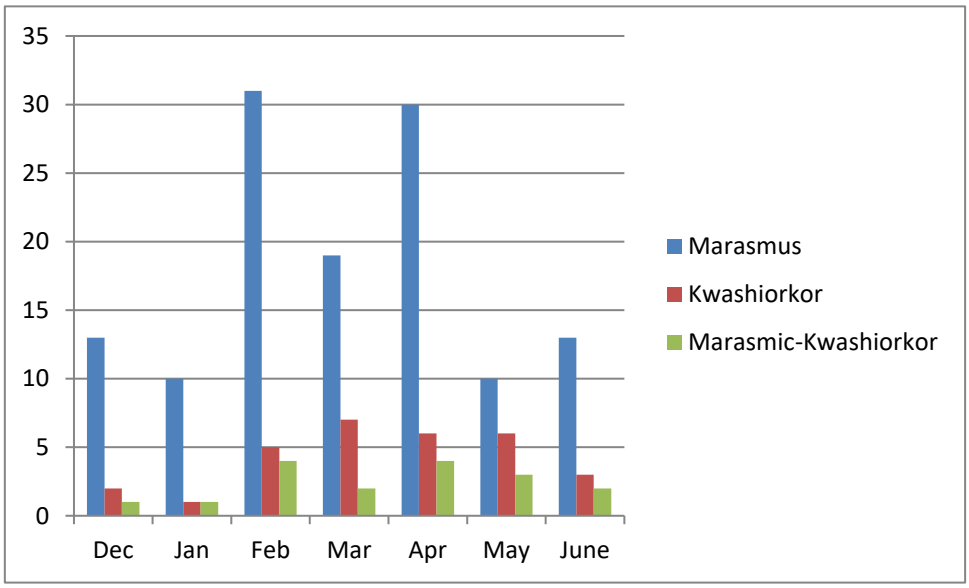

Figure 2.0. Distribution of different types of malnutrition among children less than 6 – 59 months-old admitted, during the period of the study

Among the 171 admitted children with severe acute malnutrition, 126 (73.7%) had marasmus, 30 (17.5%) had kwashiorkor and only 16 (9.4%) were marasmic-kwashiorkor.

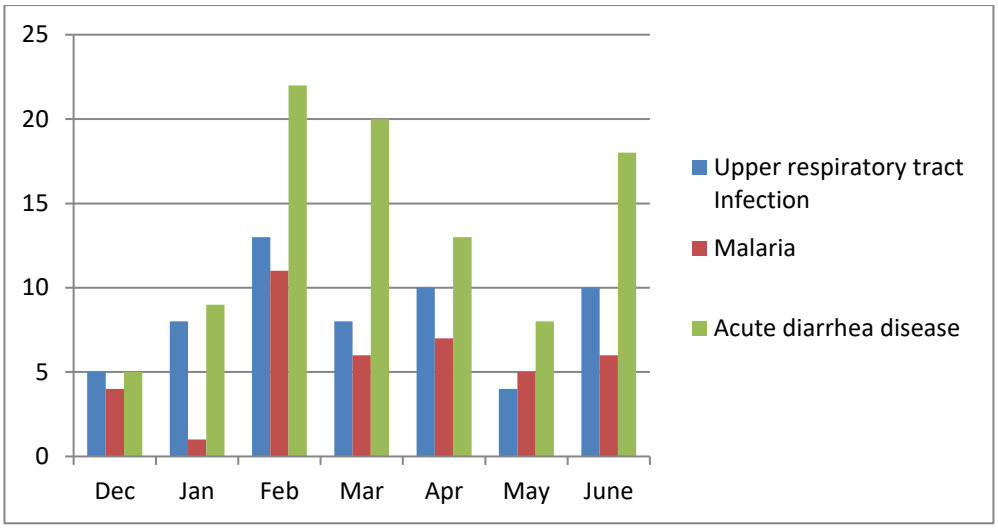

Figure 3.0. The most common clinical presentations were acute diarrhea disease, upper respiratory tract infection, malaria, urinary tract infections, dermatitis, measles, sepsis and pneumonia

Among the 171 children admitted for SAM during the study period, 58 (33.9%) had upper respiratory tract infection, 40 (23.4 %) had Malaria and 95 (55.6%) had acute diarrhea disease. Some children had other co-morbidities, often presenting with two or three clinical diseases on admission.

Discussion

This is a retrospective observational study; involving children 6 – 59 months in Magumeri local Government area, admitted with severe acute malnutrition to Magumeri General Hospital during the period of December 2018 to June 2019. Males were affected nearly twice the number of females. These results are similar to the findings of Cartmell et al and Shaza et al who reported a mean age of 21.7 months and 22.3 months respectively in under-five years old children admitted with SAM, while the mean age of the children in my study was 15.8 months.

70% of the affected children were younger than 24 months (Table 1). Two studies by Shaza et al and Nnakwe reported similar findings. It is apparent that children under 2 years of age are the most affected age group. This could be due to a number of factors including poverty, spread of endemic diseases, limited dietary diversity, loss of livelihoods, disruption of access to quality water and optimal sanitation, population displacement and destruction of housing, as well as poor weaning and feeding practices. Marasmus was the most common type of SAM noted in this study, affecting more than two thirds of the study population (73.7%). Similar results were reported by Shaza et al and Gernaat et al, 1998.

The overall mortality in this study was 2.9%. Certainly, this is a very high percentage compared with different studies conducted in various parts of Northeast Nigeria. Both crude and under-five mortality rates were highest in Central Yobe, 0.63 (0.39-1.01 95% CI) and 2.06 (1.24-3.38 95% CI), respectively. The under-five mortality rate in Central Yobe exceeds the emergency threshold of 2 deaths in children under five / 10,000 children under five / day. However, compared to others this rate might seem low. In another study in Omduman, Sudan, Shaza and Mohammed documented an overall mortality rate of 9.3% while, in Oshogbo, South West Nigeria, Ibekwe and Ashworth documented an average mortality rate of 22% over a five-year-period among 803 children admitted with PEM in a nutritional rehabilitation centre. There is a strong association between vaccination and malnutrition, as the role of vaccination in preventing contagious diseases cannot be over-emphasized. Lack of vaccination, fully or partially may be a predisposing factor for malnutrition as shown by a study in Uganda and southern Nigeria. Lack of vaccination in this study is linked to loss of livelihoods, population displacement and destruction of housing and the poor and deteriorating health care system as well as limited education resources, similar to reports from a study by Ogunlesi et al. In this study, vaccinated children represented only 14.6%, while 49.7% were not vaccinated and 11.7% were partially vaccinated and no data was available for history of vaccination in 24% of the children.

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Conclusion

This study showed an overall prevalence of severe acute malnutrition of 4.0% comparable to survey results from Nigeria Nutrition in Emergency Sector Strategic Response Plan 2017-2018 (By state, prevalence of severe acute malnutrition (MUAC < 214 mm) was highest among women of reproductive age in Yobe (9.6%) followed by Borno (4.9%) and (3.3%) in Adamawa). Also, high prevalence of severe malnutrition among children less than 24 months of age was noted, as well as a seasonal variation in the prevalence of malnutrition among the under five-year-old children, with a high prevalence in dry season (February to April) with increased mortality rate during this period. The predominant type of malnutrition among my cohort was marasmus.

Adopting policies to promote intensive community-based approach to the screening and identification of acute malnutrition, while encouraging exclusive breastfeeding in addition to complementary feeding programs (Infant and Young Child Feeding Practice) for up to 24 months of life is a recommendation of this research. Government at both national and state levels have an essential role to play in addition to stabilizing the region and providing security to the populace by; focusing on health education, improving water supply and sanitation systems and hygiene practices to protect children against communicable diseases.

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Appendix

List of acronyms

ACT	Artemisinin-based Combination Therapy
ANC	Antenatal Care
ARI	Acute Respiratory Infection
CI	Confidence Interval
CMAM	Community-based Management of Acute Malnutrition
DHS	Demographic and Health Survey
DPT	Diphtheria, Pertussis and Tetanus
EFB	Exclusive Breastfeeding
ENA	Emergency Nutrition Assessment
EPI	Expanded Programme on Immunization
FCT	Federal Capital Territory
FGON	Federal Government of Nigeria

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FMOH	Federal Ministry of Health
GAM	Global Acute Malnutrition
HAZ	Height for Age Z-score
IPTp	Intermittent Preventive Treatment in Pregnancy
IYCFP	Infant and Young Child Feeding Practice
LGA	Local Governmental Area
MAM	Moderate Acute Malnutrition
MDG	Millennium Development Goals
MNCHW	Maternal Newborn and Child Health Week
MMR	Maternal Mortality Rate
MUAC	Mid-Upper Arm Circumference
NBS	National Bureau of Statistics
NCHS	National Center for Health Statistics
NDHS	Nigeria Demographic and Health Survey
NIS	Nutrition Information System
NMCSP	National Malaria Control Strategic Plan
NNHS	National Nutrition and Health Survey
NPopC	National Population Commission
NSHDP	National Strategic Health Development Plan
NSPAN	National Strategic Plan of Action for Nutrition
ORS	Oral Rehydration Salts
ORT	Oral Rehydration Therapy
PENTA	Pentavalent vaccine
PHC	Primary Health Care
PPS	Probability Proportional to Size
PSU	Primary Sampling Unit
RDT	Rapid Diagnostic Testing
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SMART	Standardized Monitoring and Assessment of Relief and Transition
UCI	Universal Child Immunization
UNHCR	United Nation High Commission for Refugees
UNICEF	United Nations Children's Fund
VAD	Vitamin A Deficiency
WASH	Water Sanitation and Hygiene
WAZ	Weight for Age Z-score
WHZ	Weight for Height Z-score
WINNN	Working to Improve Nutrition in Northern Nigeria
WFP	World Food Program
WHO	World Health Organization