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Morbidity pattern of underfives with moderate acute malnutrition in southern Nigeria

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Abstract

Background: Moderate acute malnutrition (MAM) is a leading cause of childhood morbidity and mortality globally. The morbidity pattern of underfives with this condition is yet to be described.
Objective: To describe the morbidity pattern of underfives with MAM.
Method: A cross sectional study was conducted in two Primary Health Centres in Uruan Local Government Area of Akwa Ibom State. Caregivers' brought children aged 6- 59 months to the health facilities following community mobilization. Eligible children were recruited into the study after obtaining parental consent. A validated proforma was used to obtain the biodata and symptoms of common illnesses in the children. A general physical examination, anthropometric measurements and systemic examination were performed.
Results: A total of 162 children were recruited into the study. Their mean (±SD) age was 20.4 ± 13.0 months. Over 70% of them were 6 - 23 months of age. Their mean (±SD) length/height was 77.3 ± 29.6 cm, mean (±SD) weight was 8.3 ± 3.4 kg and mean (±SD) mid upper arm circumference was 12.4 ± 4.5 cm. The main symptoms noted in the children were; fever 99 (61.1%), cough 84 (51.9%), weight loss 81 (50.0%), diarrhoea 40 (24.7%) and vomiting 40 (24.7%) while pallor 77 (47.5%), lymphadenopathy 56 (34.6%), hair changes 49 (30.2%), skin changes 27 (16.6%) were the main signs in them.
Conclusion: The main symptomatology of underfives with MAM were fever, cough and weight loss while pallor, lymphadenopathy and hair changes were the topmost signs. This morbidity pattern is related to interactions between malnutrition and infection in childhood.

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Introduction

Acute malnutrition is a leading cause of childhood morbidity and mortality globally.[1] Of the six million under-five deaths that occur yearly worldwide, 12.6 % of them can be attributed to acute malnutrition, with almost 50% of them occurring in sub-Saharan Africa.[2-4] It occurs primarily from qualitative or quantitative dietary inadequacy which is usually attributable to poverty, household food insecurity, poor weaning practices, a low-protein diet or secondarily from nutrient malabsorption across the gastrointestinal tract, increased excretion of nutrients, high metabolic demand and severe or recurrent childhood infections.[5]

An estimated 52 million underfives have acute malnutrition. Of this number, about 35 million of them have moderate acute malnutrition (MAM) while 17 million have severe acute malnutrition (SAM).[6,7] Children with MAM are likely to progress to SAM, if appropriate and timely interventions are not taken.[7] The risk of death in children with MAM is three-to four-fold when compared to well-nourished children as against 10-fold in those with SAM. Although the risk of childhood death from SAM is higher than MAM, about 70.0% of all malnutrition-related childhood deaths are related to MAM.[8] This is mainly due to the relatively high global burden of MAM in underfives when compared to SAM.[6] The World Health Organization (WHO) has provided anthropometric parameters for the case definition of MAM and SAM based on weight for length/height Z scores.[9]

The morbidity pattern of underfives with SAM has been described in some malnutrition endemic regions of Africa but there is no documentation of a similar pattern in underfives with MAM in these regions despite the fact that this condition is more prevalent than SAM, contributes more than SAM to the overall childhood malnutrition-related mortality and is uniquely situated in the spectrum of childhood malnutrition.[10,11] It is therefore pertinent for more research to be conducted in children with MAM especially in Africa where the condition is most prevalent. A description of the morbidity pattern of underfives with MAM will provide insights into the understanding of this unique nutritional entity and form a basis for further research in the area. While the WHO case definition of MAM based on anthropometric indices is appreciated, a description of the morbidity pattern of under-fives with MAM is also of paramount importance. This will be useful for prognostication of treatment outcome. This study therefore aimed to describe the morbidity pattern of under-fives with MAM in Southern Nigeria.

Methods

Study area: The study was conducted in Adadiah and Ndon Ebom in Uruan Local Government Area (LGA) of Akwa Ibom State. The choice of Uruan LGA for the conduct of the study was based on the report of high prevalence of childhood malnutrition at the area in the 2015 maternal, new born and child-health week screening (Source: Akwa Ibom State Ministry of Health). The weather of the study area is characterized by a rainy season which spanned from April till October and a dry season from November to March annually. The range of the annual rainfall, temperature and relative humidity of the area were 1,350 – 3,000mm, 23.6 – 31.3^{0}C and 77 – 84% respectively. The inhabitants of the State are predominantly farmers, fishermen, traders and civil servants. Ibibio is the language commonly spoken in the study area.

Study setting: The study was conducted at two Primary Health Care centres (PHCs) in Uruan LGA of Akwa Ibom State. They were Adadiah PHC and Ndon Ebom PHC. The staff strength of each PHC consisted of a Matron, four junior nurses, two Community Health Extension Workers and a security personnel. The Matron was charged with the day-to-day running of the facility. The basic services offered in the facilities included general health promotion, nutrition counselling, growth monitoring and promotion, immunization (on-site and outreach), and family planning services. The health conditions commonly managed in these facilities are febrile illnesses, cough and catarrh, skin infections/rashes and injuries from cuts. Children with MAM were identified by the nurses after obtaining a mid-upper arm circumference (MUAC) of 11.5 cm -12.5 in the absence of pedal edema as against those with severe acute malnutrition (SAM) that were identified by a MUAC of < 11.5cm or the presence of pedal edema. The nurses gave nutritional counselling to their caregivers and referred those with SAM to higher levels of care.

Study design/duration of study: This was a cross sectional study conducted as a preliminary phase of a randomized clinical trial that compared the effectiveness of standardized corn-soy blend formulation with nutrition counselling versus nutrition counselling alone in the management of under-fives with moderate acute malnutrition. The study was conducted from April 2022 – August 2022.

Sample size calculation: The sample size was calculated based on 80% power to detect a 20% difference in the effect of the intervention between the two arms of the randomized clinical trial (standardized corn-soy blend formulation and nutrition counselling arm versus nutrition counselling alone) at a 95% level of significance. The minimum sample size of the study population was 146 (73 children per arm). To account for possible attrition, the sample size was increased by 10%. Thus, making a total of 160 (80 children as the minimum sample size per study arm).

Study population: Children aged 6 to 59 months with MAM residing in the catchment area of the selected PHC were screened for eligibility into the study. The case definition of MAM was based on weight-for-height/length between 70-80% (or between -2 and -3 Z scores) or Mid upper arm circumference of 11.5 cm to 12.5 cm in the absence of oedema.[9]

Community mobilization: A simple random sampling technique was used to select communities based on the availability of PHCs. Community entry was conducted with a visit by the research team to the Heads of the selected communities and their co-operation was solicited. The PHCs were visited and the staff intimated on the study. Letters of notification about the study were distributed to the different places of worship in the community and the village announcers went about the communities three days to the commencement of the study to create awareness and mobilize caregivers of underfives to the study site.

Eligibility criteria

Inclusion criteria: 1. Children aged 6 – 59 months with MAM (weight-for-height/length < 80%) or between -2 and -3 Z scores or MUAC 11.5 cm – 12.5 cm. 2. Children whose parents/guardian gave consent to their participation.

Exclusion criteria: 1. Children with severe acute malnutrition (weight-for-height/length Z score of <-3 or MUAC < 11.5cm). 2. Children below 6 months or above 59 months of age.

Selection of participants: All children presenting in the health facilities were screened for eligibility based on the pre-defined eligibility criteria. Their ages were determined from their immunization cards. The anthropometric indices (weight, mid upper arm circumference and length/height) of the children were measured using standard techniques.

Sampling technique: Consecutive eligible children that met the WHO case definition for MAM were enrolled into the study after an informed parental consent.

Assessment of participants: Assessment for common childhood illnesses that occurred two weeks prior to inclusion in the study. These were; diarrhoea, fever, cough, convulsion, difficulty in breathing, ear discharge, vomiting, body swelling and weight loss. A general physical examination was performed to check for pallor, jaundice, respiratory distress, lymphadenopathy, cyanosis, pedal oedema, finger clubbing as well as a systemic examination was carried out. The assessment findings were recorded in validated proforma.

Ethical issues: Approval for the study was obtained from the Health Research Ethics Committee of the University of Uyo Teaching Hospital. Appropriate translation was carried out in the local dialect for those that did not understand English Language. Informed parental consent was obtained either in writing or as thumbprint. The confidentiality of the participants was preserved by keeping the patients' case records under lock in a cupboard in the office of the Principal Investigator.

Data management and analyses: Data generated from the proforma was entered into Microsoft Excel which was also used for the analysis. The patient's characteristics were presented using descriptive statistics (frequency, percentage and mean with corresponding standard deviation). The results were presented as text and tables.

Results

A total of 162 underfives with moderate acute malnutrition (MAM) were enrolled into the study. Over 70% of the children were 6-23 months of age as displayed in Table 1.

Table 1: Age group of underfives with moderate acute malnutrition

Age group (months)	N=162	%
6 – 11	44	27.2
12 – 23	73	45.0
24 – 35	22	13.6
36 – 47	11	6.8
48 – 59	12	7.4

There were 68 males and 94 females giving a male to female ratio of 1:1.4. The mean age of the children was 20.4 ± 13.0 months. The anthropometric indices of the children based on sex were very similar as displayed in Table 2 below.

Table 2: Anthropometric indices of underfives with moderate acute malnutrition

Anthropometric indices	Males n = 68	Females n = 94
Mean weight (kg)	8.3 ± 3.4	8.3 ± 3.4
Mean length/height (cm)	77.3 ± 28.9	77.3 ± 30.5
Mean MUAC (cm)	12.4 ± 4.5	12.4 ± 4.7

The main symptoms reported in the children were; fever 99 (61.1%), cough 84 (51.9%) and weight loss 81 (50.0%) as displayed in Table 3.

Table 3: Common symptoms in under-fives with moderate acute malnutrition

Common childhood symptoms	N– 162	%
Fever	99	61.1
Cough	84	51.9
Weight loss	81	50.0
Diarrhoea	40	24.7
Vomiting	40	24.7
Difficulty in breathing	15	9.3
Convulsion	6	3.7
Ear discharge	6	3.7

The main clinical signs in the children were; pallor 77 (47.5%), lymphadenopathy 56 (34.6%), hair changes 49 (30.2%) and skin changes 27 (16.6%) as presented in Table 4.

Table 4: Physical signs of under-five children with moderate acute malnutrition

Signs	N– 162	%
Pallor	77	47.5
Lymphadenopathy	56	34.6
Hair changes*	49	30.2
Skin changes**	27	16.6
Perianal lesion	15	9.3
Hepatomegaly	13	8.0
Respiratory distress	6	3.7
Splenomegaly	4	2.5
Jaundice	2	1.2
Finger clubbing	1	0.6

Hair changes* – brownish discolouration, brittleness and sparseness of the hair
Skin changes** -skin depigmentation

Discussion

Most of the children in this study were aged 6-23 months. This age group is known to be most vulnerable to malnutrition and also lies within the first 1000 days of life, which is the window of opportunity for correcting nutritional insults in young children.[12] The promotion of exclusive breast feeding for the first six months of life, continuation of breast feeding up to two years, availability of potable water, appropriate and adequate energy dense food prepared from locally available foodstuff, micronutrient supplementation and fortification, community-based surveillance for early identification and management of childhood malnutrition through nutrition counselling and supplementary feeding programme are important strategies for achieving optimum growth and development in this category of children.[12,13]

Fever, cough and weight loss were the most prevalent symptoms that occurred in the children two weeks prior to recruitment into the study. These symptoms are generally related to poverty, infectious diseases, overcrowding, household food insecurity, poor infant and young child feeding practices and poor health seeking behaviour. The above are known risk factors for childhood malnutrition. Inadequate dietary intake results in poor growth, mucosal damage, impaired cell-mediated immunity and reduction in neutrophil action. The lowered body immunity results in pathogen invasion, impaired gut function which worsens the nutritional state of the patient, giving rise to a vicious cycle of malnutrition and infection.[14,15] Bacteria, protozoa, viruses and helminths are the common agents associated with the above-mentioned symptoms.[16] Malaria is the commonest cause of fever among underfive children residing in sub-Saharan Africa.[17] Upper respiratory tract infections like pharyngitis, tonsillitis, adenoiditis and laryngitis as well as lower respiratory illnesses like bronchiolitis, bronchopneumonia or lobar pneumonia are common childhood morbidities that are associated with fever. The point prevalence of fever in this study was 61.1% which is much higher than 24% reported among underfives in the 2018 National Demographic and Health Survey (NDHS).[18]

Cough is often an indication of respiratory tract illness. Using it as a proxy for respiratory illnesses,

the prevalence of 51.9% reported in this study is much higher than 3.0% prevalence for the general underfive population of the country based on the 2018 NDHS report.[18] Cough and fever could occur concurrently in malnourished children with acute respiratory tract infection or otitis media. We reported 3.7% of ear discharge in this study which is a sequelae of otitis media in the children. Chronic suppurative otitis media (CSOM) is a known clinical feature of malnourished children and has been reported in 4.2% - 4.6% of children with SAM.[19] Children with MAM are twice more likely to develop acute otitis media compared to well-nourished children.[19] CSOM is associated with poor socioeconomic status, malnutrition, overcrowding and poor hygiene.[20] Saxena et al[14] in a study among underfives managed for otitis media over a year in India demonstrated a statistically significant association between the occurrence of CSOM and the severity of wasting and stunting. They noted that the likelihood of CSOM increased with an increase in the severity of the malnutrition.[14] CSOM is a leading cause of preventable hearing loss globally and its occurrence among children in this study is of great concern because of the adverse effect it could have on language, communication, psychosocial and cognitive development. These impediments could hinder the academic attainments of the children.[14]

Weight loss was reported in 50% of the children in this study. This would mainly be from primary dietary inadequacy based on the fact that children with concomitant comorbidities that could impact on growth were excluded from the study. The presence of fever and cough in some of the children could have led to an increase in the metabolic demand and tissue catabolism which would have impacted negatively on the weight of the children. The symptoms of diarrhoea and vomiting noted in some of the children could have led to dehydration and subsequent weight loss.[21]

Pallor was topmost among the clinical signs seen in the children. It was observed in about half of the children. This could be due to anaemia from dietary protein and micronutrient deficiencies like iron, folate and Vitamin B 12 which are required for haemotopoesis or coexisting infectious diseases and parasitic infestations. Intestinal parasites like Ancylostoma duodenales compete with the host for nutrients while hookworm infestation causes direct injury to the endothelial lining of the gut resulting in chronic blood loss and anaemia.[16] Parasitic infection like Plasmodium falciparum malaria and bacterial infection are quite prevalent among underfives in the tropics. They are associated with direct red blood cell haemolysis and bone marrow suppression. These children are therefore at risk of impaired cognitive function, metabolic disorders and increased susceptibility to infectious diseases.

About one-third of the children had lymphadenopathy. This is usually due to continuous exposure of the host to new antigens with the induction of immune responses by the host against the antigens. Infections are the commonest causes of lymphadenopathy in children.[22] The primary role of the lymphatic system is to contain the spread of infection which is a common phenomenon in malnourished children. The observation of upper respiratory tract infections, pharyngitis, otitis media and conjunctivitis as frequent causes of reactive cervical or submandibular lymphadenopathy by Gosche et al[23] is similar to the finding in this study. Axillary lymphadenopathy could be associated with infections of the arm, chest, breast and neck. Inguinal lymphadenopathy is usually associated with infection or infestations of the lower limbs, lower abdomen, buttock and groin. It might also follow traumatic injuries to the lower limbs which are quite common among preschool and school age children of low social class that often walk about on barefoot in most developing countries. This behaviour increases the risk of skin penetration by the larvae stage of some soil transmitted helminths and partly explains the high prevalence of helminthic infestation in under-fives in the tropics. Untreated injuries of the lower limbs often get secondarily infected and evoke immunological response that leads to inflammation of the draining lymphatic channels and adjourning lymph nodes.

Hair changes was noted in about one-third of the children. The pattern of hair changes observed in the children were mainly brownish discolouration, brittleness and sparseness of the hair. The observed hair changes in this study have been reported to a large extent in children with SAM. The hair could be dry, lustreless, straight or hypopigmented with flag sign.[24] However, easy pluckability of the hair which is a common feature in children with SAM was not

observed in this study. The nutrient deficiencies associated with hair changes in malnourished children include zinc, iron, biotin, vitamin A, vitamin B 12 and copper deficiencies.[24] The severity of the hair changes in malnourished children is directly related to the severity of the malnutrition. This might explain why easy pluckability of the hair, which is a common feature in those with SAM was not observed among the children. The severity of hair changes can therefore be a differentiating feature between underfives with moderate and severe acute malnutrition.

Skin changes, like hair changes, are also common in malnourished children. The exact pathogenesis of skin depigmentation in malnutrition has not been fully elucidated. However, deficiency of niacin, pyridoxine, Vitamin B12, and zinc have been implicated in the dermatological changes in children. These nutritional deficiencies impair the structural integrity and biological function of the skin. The abnormal skin barrier that ensues increases the susceptibility of the skin to infections with attendant sepsis which significantly correlates with increased mortality in the children.[25] The point prevalence of skin changes was 16% in this study. This finding could not be compared with others due to absence of similar studies in underfives with MAM. The report of skin changes in SAM is twice as much as was observed in this study.[26]

Perianal lesions from scabies with secondary bacterial infections occurred in 9.3% of the children. These lesions are pointers to poor personal hygiene, overcrowding, sharing of personal belongings, malnutrition and low social class which are common risk factors for scabies. Salsabila et al[27] in a two years retrospective study among underfives treated for scabies in a general hospital in Indonesia, noted that 9.5% of the children were wasted while 22.1% were severely wasted. This observation shows that the incidence of scabies increases with worsening nutritional status. The proportion of children in this study with scabies is similar to 9.5% reported by Salsabila et al[27] among children that were wasted. This also indicates that the severity of malnutrition impacts on the spectrum and severity of the morbidity pattern of the children.

Conclusion

Moderate acute malnutrition is common in children aged 6- 23 months with fever, cough and weight loss as the main symptoms. Pallor, lymphadenopathy and hair changes were the predominant signs in the children. The morbidity pattern of the children is primarily due to the synergism of malnutrition and infection in childhood.

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