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Saleh Awad Bahwal

College of Medicine and Health Sciences, Hadhramout University

Mazin Ahmed Jawass

College of Medicine and Health Sciences, Hadhramout University.

Faiza Salmeen Naji

College of Medicine and Health Sciences, Hadhramout University

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Risk Factors, Comorbidities and Outcomes of Severe Acute Malnutrition among Children in Mukalla Maternity and Child Hospital, Hadhrumout, Yemen

Saleh Awad Bahwal*

Mazin Ahmed Jawass*

Faiza Salmeen Naji**

Abstract

Severe acute malnutrition (SAM) is one of the major health problems in Yemen. The aim of this study is to determine the risk factors, comorbidities and outcomes of SAM in Mukalla Maternity and Child Hospital (MMCH) in Al-Mukalla city, Hadhrumout Governorate, Yemen. We conducted a case-control study on 200 children aged 6 to 59 months (100 cases and 100 controls) who were admitted to the pediatric nutrition departments (MMCH) between September 2018 and August 2019. The risk factors for SAM were children age 6-24 months (OR 2.99; CI: 1.66 - 5.36), residing in rural areas (OR= 1.83; CI: 1.04 - 3.23), who live in low-income families (OR= 2.35, 95% CI 1.04 - 5.30), with more than 5 people in the same family (OR 2.45; CI: 1.15 - 5.18) and who are their mothers illiterate (OR= 3.36, 95% CI= 1.34 - 8.43). SAM was also significantly more prevalent among non-vaccinated children (OR= 35.85, 95% CI 15.59 - 82.41), exclusive breastfeeding less than 6 months (OR= 1.94, 95% CI: 1.00 - 3.75), initiated complementary feeding before 6 months (OR= 2.17, 95% CI: 1.10 - 4.29) and bottle feeding (OR= 2.67, 95% CI: 1.50 - 4.73). Most common co-morbidity significantly associated with SAM were diarrhea (OR= 7.12, 95% CI 3.72 - 13.64) and pneumonia (OR= 6.10, 95% CI 2.90 - 12.80). Among the 100 admitted children with SAM, 88% had Marasmus, 9% had kwashiorkor and 3% had Marasmic- kwashiorkor. The majority 82% of SAM children recovered, while 8% were discharged against medical advice and 10% died. Younger children aged less than two years accounted for most of the admissions in this study. There is a need therefore for strengthening the infant feeding practices by promoting exclusive breastfeeding for the first 6 months of life, followed by appropriate weaning with continued breast feeding till second year of life.

Keywords: Severe Acute Malnutrition, Risk factors, Comorbidities, Outcomes, Children under 5 years of age, MMCH.

Introduction:

Severe acute malnutrition (SAM) is defined as severe wasting and/or bilateral edema. Severe wasting is extreme thinness diagnosed by a weight-for-length (or height) below -3 standard deviation (SD) of the World Health Organization (WHO) child growth standards [4]. Acute malnutrition affects more than 52 million children worldwide. Out of these children, an estimated 16 million have the severe form of acute malnutrition [10]. In Yemen, chronic malnutrition among children under five years old was remarkably high. It reaches over a half (53.1%), while acute malnutrition comes to 13 percent [38]. Severe acute malnutrition, is characterized by wasting (marasmus), oedema (as a result of kwashiorkor), or both (marasmic-kwashiorkor), and occurs mostly in children [9]. Globally different literatures revealed that the determinants of acute malnutrition in children aged 6–59 months include poverty, parental illiteracy, parental decision making, inadequate

feeding practices, large family size, non-exclusive breastfeeding, diarrhea, low birth weight, immunization status, disturbed (broken) family, maternal hand washing habit and repeated pregnancies according to published works [1,25,30].

Several studies have been reported on the magnitude of comorbidity with SAM which ranges from 1.9% (hypothermia) to 72.9% (diarrhea) and recovery rate which ranges from 60.4 to 87% [2,12,17,22,27].

The aim of this study is to determine the risk factors, comorbidities and outcomes for SAM in MMCH in Al- Mukalla city.

Patients and methods:

A case-control study was conducted among children under 5 years of age (6 to 59 months) admitted to pediatric nutrition department in MMCH, in Al- Mukalla city.

Inclusion criteria:

All children aged 6 to 59 months with SAM (as cases) and without SAM (as controls), were admitted to pediatric nutrition department of MMCH during the study period between September 2018 and August 2019. For the purpose of this study, the case definition of SAM is defined as severe wasting and/or bilateral

* Department of Pediatrics, College of Medicine and Health Sciences, Hadhrumout University, Republic of Yemen.

** Department of Pediatrics, College of Medicine and Health Sciences, Hadhrumout University, Republic of Yemen. Received on 17/12/2019 and Accepted for Publication on 10/3/2020

edema. Severe wasting is an extreme thinness diagnosed by a weight-for-length (or height) below -3 SD of the WHO Child Growth Standards. In children ages 6-59 months, (mo.) a mid-upper arm circumference <115 mm also denotes extreme thinness: a color-banded tape is a convenient way of screening children in need of treatment. Bilateral edema is diagnosed by grasping both feet, placing a thumb on top of each, and pressing gently but firmly for 10 seconds. A pit (dent) remaining under each thumb indicates bilateral edema [4].

Exclusion criteria: We have excluded children with a history of previous neurological deficit, any hepatic, renal or metabolic disorders, congenital malformation and congenital heart disease.

Selection of controls:

Controls were children without SAM but had other health issues with match-able age and sex were enrolled in the study as controls.

A structured interviewer administered a questionnaire which was adapted from the review of different literatures was used to collect data related to the objectives of the study. The questionnaire covered a range of topics including socio-economic and demographic factors. Frequencies of various comorbid conditions in

study population were recorded. The outcomes were classified into cure, discharge against medical advice (DAMA) and death that were obtained.

Ethical approval:

The research protocol and the questionnaires were conducted according to the principles of the Declaration of Helsinki, as well as reviewed and approved by the Ethical Research Committee of Hadhramout University College of Medicine (HUCOM). Verbal consents were also taken from the parents and caregivers of children involved in the study.

Statistical methods:

The data were processed and analyzed using the Statistical Package for Social Sciences version 17 (SPSS Inc., Chicago, IL, USA. A Multivariate logistic regression test was used to determine the risk factors associated with SAM. p-value <0.05 was considered significant, and the confidence interval was set at 95%.

Results:

To determine the association between cases and controls and independent variables, multiple logistic regression analysis was performed.

Table 1: Socio-demographic risk factors related to SAM

Variables	Cases	Control	OR*	(CI** 95%)	P-value
Sex					
Male (Ref)	48(48%)	52(52%)	1.0		
Female	52(52%)	48(48%)	1.17	0.67 - 2.04	0.57
Age					
25 -59months(Ref)	29(29%)	55(55%)	1.0		
6 -24 months	71(71%)	45(45%)	2.99	1.66 - 5.36	0.0002
Place of residence					
Urban (Ref)	38(38%)	53 (53%)	1.0		
Rural	62(62%)	47 (47%)	1.83	1.04 - 3.23	0.03
Socioeconomic status					
High (Ref)	13(13%)	20(20%)	1.0		
medium	32(32%)	44(44%)	1.11	0.49 - 2.57	1.04 -
low	55(55%)	36(36%)	2.35	5.30	0.79
Family size					
< 3 (Ref)	18(18%)	27(27%)	1.0		
3-5	33(33%)	43(43%)	1.15	0.54 - 2.43	0.71
>5	49(49%)	30(30%)	2.45	1.15 - 5.18	0.01
Education level of mother					
University (Ref)	11(11%)	19(19%)	1.0		
Secondary school	24(24%)	30(30%)	1.38	0.55 -3.45	0.58 -
Primary school	26(26%)	31(31%)	1.44	3.58	1.34 - 8.43
Illiterate	39(39%)	20(20%)	3.36		0.001

Education level of father					
University (Ref)	12(12%)	14(14%)	1.0		
Secondary school	38(38%)	36(36%)	1.23	0.93	0.50 - 3.01
Primary school	28(28%)	35(35%)	1.71		0.37 - 2.33
Illiterate	22(22%)	15(15%)			0.62 - 4.71
Vaccination					
Yes (Ref)	22(22%)	91(91%)	1.0		
No	78(78%)	9(9%)	35.85		15.59 - 82.41

* OR: Odds Ratio

** CI: Confidence Interval

Ref. = reference category

As shown in Table 1 children aged 6-24 months were about three times more likely to be suffered of SAM than children aged 25-59 months (OR=2.99 CI 95% 1.66 -5.36. Children living in rural areas, low-income families, and families with more than 5 people from the same family were more likely to have SAM than those children living in urban areas, in high-income families, and less than 3 people in the same family (OR=1.83 CI 95% 1.04-3.23, OR= 2.35

CI 95% 1.04 -5.30 and OR=2.45 CI 95% 1.15-5.18) respectively.

Regression analysis also identified significant association between mother illiteracy and SAM. Children of illiterate mothers were more likely to have SAM compared to children of literate mothers (OR = 3.36, 95% CI: 1.34-8.43). SAM was also significantly more prevalent among non-vaccinated children (OR=35.85 CI 95% 15.59 -82.41).

Table 2: Nutritional practice of the cases and controls

Variables	Cases	Control	OR*	(CI** 95%)	p- value
Exclusive breast-feeding					
At 6 months(Ref)	29(29%)	40(40%)	1.0		
< 6	45(45%)	32(32%)	1.94	1.00 - 3.75	0.04
> 6	26(26%)	28(28%)	1.28	0.62 - 2.62	0.49
Initiation of complementary foods***					
At 6 months(Ref)	43(43%)	55(55%)	1.0		
< 6	34(34%)	20(20%)	2.17	1.10 - 4.29	0.02
> 6	23(23%)	25(25%)	1.17	0.58 - 2.35	0.64
Bottle feeding****					
No(Ref)	41(41%)	65(65%)	1.0		
Yes	59(59%)	35(35%)	2.67	1.50 - 4.73	0.001
Prelacteal feed*****					
No (Ref)	73(73%)	77(77%)	1.0		
Yes	27(27%)	23(23%)	1.23	0.65 - 2.35	0.51

* OR: Odds Ratio

** CI: Confidence Interval

Ref. = reference category

Complementary foods are foods other than breast milk or infant formula (liquids, semisolids, and solids) introduced to an infant to provide nutrients. *Bottle feeding at the time of interview.

*****Prelacteal feed is any food except mother's milk provided to a newborn before initiating breastfeeding.

As shown in Table 2 children with exclusive breast feeding less than 6 months, initiation of complementary feeding before 6 months (p-value=0.02) and on bottle feeding were more likely to have SAM than those children with

exclusive breast feeding at 6 months, initiation of complementary feeding at 6 months and non on bottle feeding (OR=1.94 CI 95% 1.00 - 3.75, OR= 2.17 CI 95% 1.10 - 4.29 and OR=2.67 CI 95% 1.50 - 4.73) respectively.

Table 3: Comorbidities risk factors associated with SAM

Variables	Cases	Control	OR*	(CI** 95%)	p- value
Diarrhea					
No (Ref)	39 (39%)	82 (82%)	1.0		
Yes	61(61%)	18 (18%)	7.12	3.72 - 13.64	0.0001
Pneumonia					
No (Ref)	57(57%)	89 (89%)	1.0		
Yes	43(43%)	11 (11%)	6.10	2.90 - 12.80	0.0001
Anemia					
No (Ref)	61(61%)	85(85%)	1.0		
Yes	39(39%)	15(15%)	3.62	1.83 - 7.15	0.0002
Urinary tract infection					
No (Ref)	89(89%)	98(98%)	1.0		
Yes	11(11%)	2(2%)	6.05	1.31 - 28.07	0.02
Sepsis					
No (Ref)	97(97%)	100 (100%)	1.0		
Yes	3(3%)	0 (00%)	7.21	0.36 - 141.53	0.193
Skin rash					
No (Ref)	92(92%)	98(98%)	1.0		
Yes	8(8%)	2(2%)	4.26	0.88 - 20.59	0.07
Hypothermia (Temp < 35 °C)					
No (Ref)	95(95%)	100(100%)	1.0		
Yes	5(5%)	0(00%)	11.57	0.63 - 212.20	0.09

* OR: Odds Ratio

** CI: Confidence Interval

Ref. = reference category

As shown in Table 3 children with SAM more likely to developed diarrhea, pneumonia, anemia and urinary tract infection compared to control children (OR=7.12 CI 95% 3.72 - 13.64, OR=

6.10 CI 95% 2.90 - 12.80, OR=3.62 CI 95% 1.83 - 7.15 and OR=6.05 CI 95% 1.30 - 28.07) respectively.

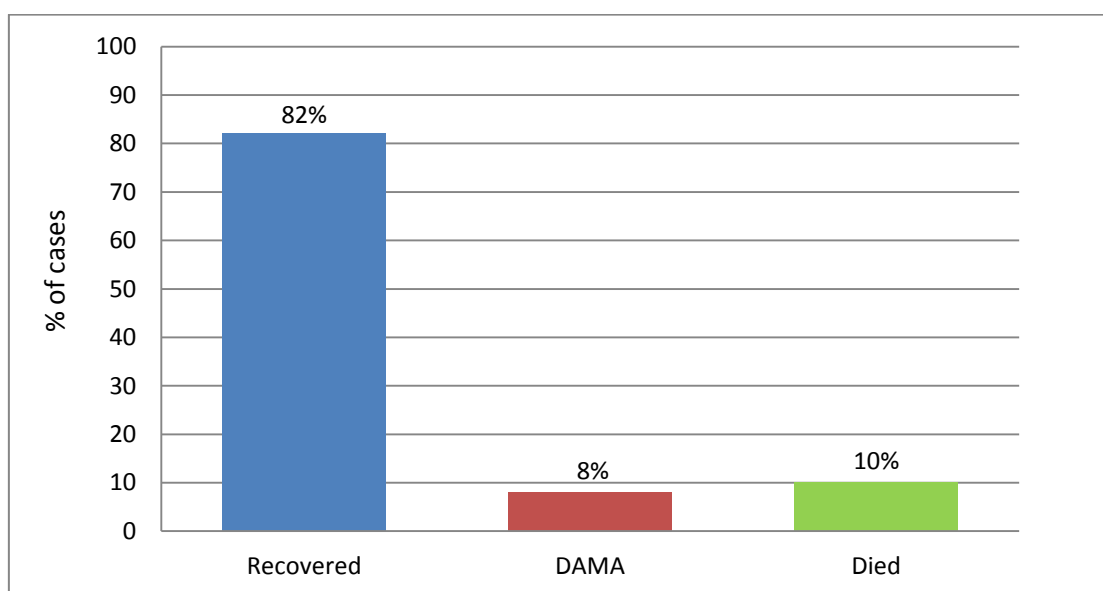
**Figure 1: Outcome of children admitted with SAM**

Figure 1, shows outcome of children admitted with SAM. The majority 82 (82%) of the study population recovered and were discharged from

the hospital, while 8 (8%) were discharged against medical advice and 10 (10%) died.

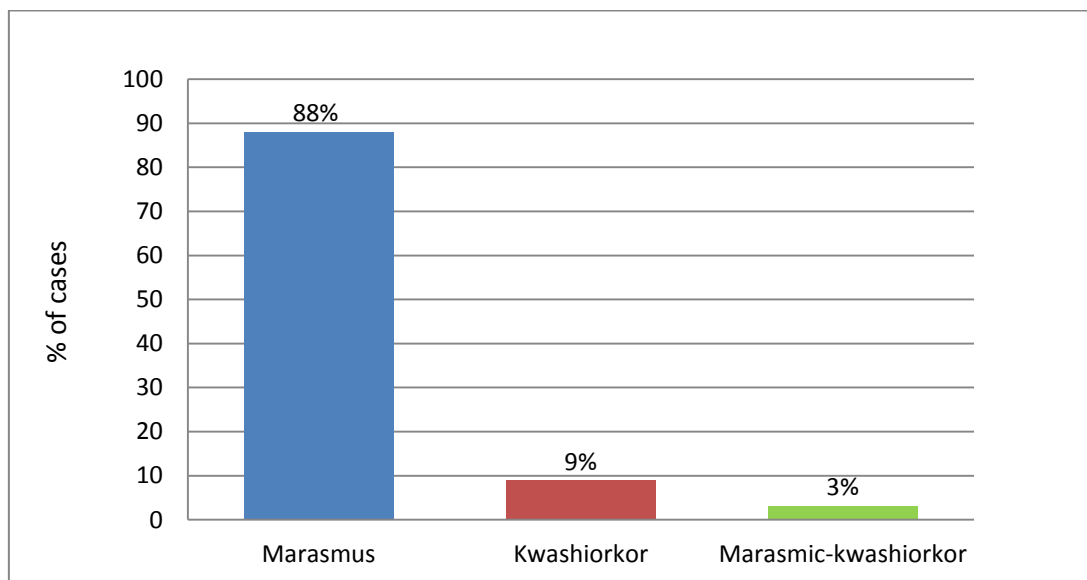


Figure 2: Percentage of cases with SAM

Figure 2, shows percentage of cases with SAM. Among 100 admitted children with SAM, 88 (88%) had marasmus, 9 (9%) had kwashiorkor and 3 (3%) had marasmic-kwashiorkor.

Discussion:

Children with severe acute malnutrition (SAM) have had a diet insufficient in energy and nutrients relative to their need [4]. In this study, more than two third of the malnourished children were in the 6 months to 24 months age group and this found to be a strong risk factor for SAM. This is in agreement with the results of other studies [1,7,24,35]. The high vulnerability of this age group to severe acute malnutrition is because infants sometimes wean early because of the new pregnancy, which causes the mother to stop breastfeeding the first child. After that, children are often weaned to solid food and are unable to eat large quantities of adequate food. This in turn can lead to malabsorption, diarrhea and later malnutrition. In addition, rapid growth occurs in the first and second years of life and also increases the requirements of the substrates for energy and tissue building, thus the lack of protein, energy and other micronutrients in these years leads to malnutrition [14].

Our study also detected that those residing in rural areas were significantly risk of exposure to SAM. Which is similar to other studies [1,5]. This may be due to different factors, including

improper antenatal care and birthing care, lower socioeconomic conditions and poor hygiene.

We observed in our present study significant association between low-income families and SAM. This is similar to other studies [1,5,30,34,35]. which may be due to the fact that poor families have low purchasing power for adequate nutritious food [20].

The other risk factor is family person >5, which increases susceptibility to SAM. The effect of a large family size has been implicated as a risk factor for severe malnutrition in different studies as well [8,25,30,37]. The increase in the number of children in the family is a heavy burden on household resources especially on food and finances reducing as well as the time and quality of care received by children [37]. The maternal illiteracy is found to be associated with a higher risk of SAM, which is similar to other studies [1,24,33]. The number of malnourished children decreased as the literacy status of mothers improved because better education makes the mother aware of the importance of immunization, breast feeding, family planning and birth spacing, hygiene and a balance diet [13].

Children who were not vaccinated at all were at risk for SAM, which in agreement with other studies [5,18,25]. Vaccination is a cornerstone of child health interventions to reduce morbidity and mortality in developing countries.

Furthermore, vaccination is likely to be one of the key tools within a multi-sectoral package of interventions aimed at preventing malnutrition in early life [31].

In the present study, exclusive breastfeeding less than 6 months was considered a significant risk factor for developing SAM. These are similar to what has been noted in previous studies [26,29,30]. Benefits of exclusive breastfeeding have been widely acknowledged. They are known to promote sensory and cognitive development, and protect the infant against infectious and chronic diseases. Exclusive breast feeding reduces infant mortality due to common childhood illnesses such as diarrhea or pneumonia, and provides immunoglobulins which helps in a quicker recovery during illness [20]. The American Academy of Pediatrics (AAP) and WHO, and European Society for Pediatric Gastroenterology, Hepatology, and Nutrition Committee on Nutrition all recommend exclusive breastfeeding for the first 6 months. Similar data on the benefits of the exclusive use of formula for 6 months have not been published [23].

The kind of food which the child had received before 6 months of age was also significantly associated with the risk of SAM. Children who received complementary food before 6 months of age were at higher risk of SAM. Similar results were reported in other studies such as, Indiq Nigerian, Nepal, and Chad [21,29,30,32]. A study done in China showed that the introduction of other diet before the age of six months increased the prevalence of pneumonia and diarrhea disease [36]. A study in Kenya showed an increased risk of being underweight when complementary food was started early [11]. The use of complementary feed before the age of six months may lead to reducing breast milk consumption and use an inappropriate food that lead to food intolerance and later lead to chronic diarrhea, which further contributes to weight loss and malnutrition.

Bottle feeding was an independent determinant for SAM in this study, which was consistent with the findings of hospital based case-control studies in Ethiopia and India [3,25]. The reason might be poor hygiene associated with the bottle or inappropriate preparation of the formula, leading to diarrhea and other diseases [30].

The present study found that, the risk of having SAM was greater in children who had suffered

other clinical conditions such as diarrhea, followed by pneumonia, anemia, and urinary tract infection. These findings were comparable to those reported by other investigators [16,19,27]. Malnutrition adversely affects the immune status of children and makes them more vulnerable to infections. In severely malnourished patients, both acquired immunity i.e. lymphocyte functions as well as innate host defence mechanisms i.e., macrophages and granulocytes are affected. Diminished immune functions render undernourished patients more susceptible to infections [14].

Among the 100 admitted children with SAM, 88% had Marasmus, 9% had kwashiorkor and 3% had Marasmic- kwashiorkor. This is in agreement with the results of other studies [1,6,15,20]. The greater percentage of the diet in Al-Mukalla and the other areas of Hadhramout governorate are mainly based in rice and bread which is made from carbohydrate. People cannot afford to buy foods rich in protein as fish and meat which is very expensive throughout the year due to war conditions and currency collapse. This study revealed that 10% children died during the follow-up period. This result is in line with the study conducted in Sudan and Malawi (9.3% and 8.7%), respectively [20,28]. But lower as compared to studies conducted in Cameroon (15%) and India (16.6%), respectively [13,21]. The death rate in this study was also found to be much higher from the result reported from Ghana in which the death rate was zero percent [33] and (3.8%) in North Ethiopia [19]. The difference can be due to differences in management team and supplies, patient load, patient clinical profile and a difference in following management protocol [19].

Conclusion:

Younger children aged less than two years accounted for most of the admissions in this study. There is a need therefore to strengthen the infant feeding practices by promoting exclusive breastfeeding for the first 6 months of life. followed by appropriate weaning with continued breast feeding till second year of life. As well as, information, education and communication to parents on the causes and prevention means of this condition must be strengthened by medical staff to reduce morbidity and mortality related to malnutrition.

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عوامل الخطورة، الأمراض المصاحبة، والنتائج عند الأطفال المصابين بسوء التغذية الحاد الوخيم بمستشفى المكلا للأمومة والطفولة - حضرموت - اليمن

صالح عوض بحول مازن أحمد جواس

فائزة سالمين ناجي

الملخص

يعد سوء التغذية الحاد الوخيم إحدى المشاكل الصحية الكبرى باليمن وقد استهدفت هذه الدراسة تحديد عوامل الخطورة، الأمراض المصاحبة، والنتائج عند الأطفال المصابين بسوء التغذية الحاد الوخيم. أجريت هذه الدراسة لحالات وشواهد (100 من الحالات و 100 من الشواهد) على الأطفال المصابين بسوء التغذية الحاد الوخيم المرقدين بقسم التغذية بمستشفى المكلا للأمومة والطفولة والذين تتراوح أعمارهم من ستة أشهر إلى خمس سنوات في الفترة ما بين سبتمبر 2018 إلى أغسطس 2019. أظهرت النتائج أن عوامل الخطورة المصاحبة لسوء التغذية الحاد الوخيم كالتالي: أعمار الأطفال من 6 أشهر إلى 24 شهراً، المقيمين في المناطق الريفية في العائلات ذات الدخل المنخفض. الأسر التي عدد أطفالها أكثر من خمسة أفراد وأمهاتهم غير متعلمات. كما أظهرت الدراسة أن سوء التغذية الحاد الوخيم أكثر حدوثاً بين الأطفال الذين يرضعون رضاعة حصرية لأقل من 6 شهور. تعطى لهم التغذية التكميلية قبل 6 أشهر، يرضعون من الزجاجاة وغير المطعمين. إن من أهم الأمراض المرتبطة بأمراض سوء التغذية الحاد الوخيم هي الإسهالات والتهاب الصدر. وجد أن من أصل مائة حالة إصابة بسوء التغذية الحاد الوخيم 88% حالة إصابة بمرض الهزال، و 9% حالة إصابة بمرض الكواشيوركور، و 3% حالة إصابة بهزال الكواشيوركور. أغلبية المرضى (82%) تم شفاؤهم، بينما خرج (8%) من غير إكمال خطة العلاج وتوفي (10%) في أثناء فترة الترقيد في المستشفى. الأطفال الصغار الذين تتراوح أعمارهم أقل من سنتين كانوا أغلبية المصابين بسوء التغذية الحاد الوخيم في هذه الدراسة هناك حاجة إلى تقوية ممارسات تغذية الأطفال الرضع من خلال تشجيع الرضاعة الطبيعية الخالصة لستة الشهور الأولى من أعمارهم واتباعها بالأغذية التكميلية مع مواصلة الرضاعة الطبيعية إلى سنتين من حياتهم.

الكلمات المفتاحية: سوء التغذية الحاد الوخيم. عوامل الخطورة، الأمراض المصاحبة، النتائج. الأطفال أقل من خمس سنوات. مستشفى المكلا للأمومة والطفولة.