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RESEARCH ARTICLE

THE TREATMENT OUTCOME OF INFANTS LESS THAN 6 MONTHS OF AGE WITH UNCOMPLICATED SEVERE ACUTE MALNUTRITION (SAM) FED WITH SUPPLEMENTARY SUCKLING TECHNIQUE IN KHARTOUM, SUDAN

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Abstract

It is worth noting that 20 million children suffering from severe malnutrition are less than five years old, and 3.8 million of them are less than six months old. In Sudan the stunting rate was above 30 % that is classified by World Health Organization (WHO) as 'high '. The Supplementary Suckling Technique may seem easy in theory, but find it difficult to apply, as the method must be well explained to the mother and supported to succeed in using it. A prospective hospital-based study was done between January1st to December31st, 2020 among randomly selected infants less than 6 months of age with SAM following breastfeeding failure. Infants' anthropometric indices were daily measured and recorded. Supplementary suckling technique was used in the management with high or low protein-based milk formula as DF100 or F75. The outcome of these infants was recorded as cured, died, defaulter or in no recovery state. The male infants represented 22 (59.5%) of the total infants (37) with a male to female ratio of 1.47: 1. It was noticed that 18 (48.6%) of infants were in the age group 2-4 months, and 8 (21.6%) SAM infants in the age groups of > 4 and < 6 months while 11 (29.7%) SAM infants in the age groups of < 2 months. About 78.4% of SAM infants aged less or equal to 4 months. Improving breastfeeding practices effectively are needed. Severe acute malnutrition in infants less than 6 months can be managed successfully as inpatients with an adopted protocol. SAM infants less than 6 months of age with D F 100 and F 75 feeding using Supplementary Suckling Technique have shown improvement in their weight gain.

Keywords: Severe acute malnutrition (SAM), Infants supplementary suckling technique (SST), Political conflict Sudan.

Introduction

Globally, malnutrition is a significant cause of death and disease [1]. It constitutes 45% of the deaths of children under the age of five, and 6.7% represents acute malnutrition [2]. Malnutrition under the sixth month of age is considered uncommon. It is worth noting that 20 million children suffering from severe malnutrition are less than five years old, and 3.8 million of them are less than six months old [3]. SAM is defined by a very low weight-for-length < –3 Z-scores of the World Health Organization (WHO) Child Growth Standards Median or the presence of bilateral pitting oedema in infants who are less than 6 months of age.

In Sudan, it was found that more than two million children suffer from stunting, where the stunting rate was above 30%, which was classified by the World Health Organization as high and decreased to 24.9% in 2014 [1, 4].

Children under six months of age who suffer from severe malnutrition need hospitalization, follow-up, and appropriate therapeutic nutrition. The treatment protocols should reach the point of restoring full

breastfeeding to children [5]. Hospital treatment is of paramount importance in the community-based approach [6]. It is important to note that the treatment of malnutrition diseases in various countries of the world is carried out in outpatient clinics and community management for children between six months and five years [7,8].

Furthermore, it has also been documented that the introduction of the Mid Upper Arm Circumference (MUAC) as a screening tool to detect acute malnutrition in the community plays an important factor in this issue [9,10]. It is believed that malnutrition in children under six months is equal to children above that [11], but their treatment is incompatible with outpatient treatment [12].

Factors causing malnutrition in children under six months of age include low birth weight, persistent diarrhea, chronic disease, disability, and traditional feeding practices [13]. Although the general medical care for severely malnourished children under six months does not differ from that for children above that age, consideration must be given to access to effective breastfeeding by the mother [14].

Supplementary Suckling Technique for children under six months with severe malnutrition stimulates and maintains the continuity of breastfeeding for the child. This is a technique that may seem easy to put into theory, but may find it not feasible for application, as the method must be clearly, slowly and well explained to the mother and given continuous sufficient support to make a success in using it. Special therapeutic milk-based formula with high or low protein as DF100 or F75F75 and F100 contain all the essential Type 1 and Type 2 nutrients required to treat and correct the pathophysiological changes in a child with SAM.

Patients and Methods

This was a prospective hospital-based study among infants less than 6 months of age with severe acute malnutrition (SAM), following breastfeeding failure conducted during the period between January 1st, through December31st, 2020 in Sudan. This study was conducted in the Pediatric Department at Mohammed Al-Amin Emergency Hospital for children, Ibrahim Malek Hospital and Ahmed Qasem Hospital, Khartoum, Sudan which are tertiary referral hospitals, serving all referral cases from the neighboring provinces of Khartoum city.

In this study a total of 37 infants of both sexes were included. Inclusion criteria were infants less than 6 month of age with SAM due to failure of breastfeeding with SAM who were admitted for feeding in the treatment feeding centers (TFCs). SAM was diagnosed based on the definition of the updated WHO criteria for management of SAM in infants and young children [13]. These were weight-for-length less than –3 Z-score, or the presence of bilateral pitting oedema. In addition, it included all mothers who were unable to successful breastfeeding at admission due to failure of lactation owing to stress of political-conflict.

Infants with known underlying organic diseases as a cause of malnutrition or SAM, known congenital, chronic or metabolic disease were excluded. Moreover, an infant was excluded if presented with any serious clinical condition or medical complication, recent weight loss, ineffective feeding (attachment, positioning and suckling) directly observed for 15–20 min, any medical or social issue needing more detailed assessment or intensive support (e.g., disability, depression of the caregiver, or other adverse social circumstances) [15].

A validated questionnaire containing personal and clinical data was filled and labeled with a code number.

Study Technique:

All infants included in this study were assessed and evaluated clinically. Data of the main sociodemographic and clinical characteristics were recorded using a data collection sheet. The infants were weighed to the nearest decimal point on daily basis using a beam balance scale. Length was measured in the first instance and then followed for every five days by using a measuring board that was made locally. The dorsum of the lower limbs was pressed to confirm the presence of bilateral lower limb pitting edema.

Supplementary suckling technique (SST) was used in the management of SAM infants using supplementary feeding formulas Diluted F feeding (DF100), a milk formula with higher protein and energy content with cup for those presenting with no oedema. On the other hand, those with oedema were fed on feeding formula F75, a low-protein milk-based formula diet.

All mothers were counseled about breastfeeding attachment and positioning according to the WHO guidelines [16]. Mothers were then trained on the use of SST in TFC. Nasogastric tube size 8cm was used for feeding. The tip of the tube was cut about 1 cm and the tube end was put in a cup with supplementary diluted F100 or F75. The tube tip adhered to the nipple was put inside the angle of the infant's mouth during breastfeeding. The cup was initially put 5- 10 cm below the breast during breastfeeding, the milk from the cup was sucked up through the tube and was taken by the infant initially. Then the cup was gradually lowered to approximately 30 cm below the breast level so that the milk did not flow too quickly. The volume of F100D in the cup was slowly reduced when the infant showed weight gain for 2-3 days (at least 20g per day), was free from illness and breast milk flow was obvious. Then supplementary milk in the cup (F100D) was reduced by one third and the mother continued breastfeeding for 2 or 3 days. If the weight continued to rise, the amount of supplementary milk (F100 D) was reduced until the milk

was no longer needed and the infant showed gain in weight from exclusive breastfeeding without any supplementary milk. If the weight gain was not satisfactory when the volume of supplementary milk was decreased then the policy was to increase the volume to the previous level for the next 2 days, with a successive repeat trial.

All infants received an antibiotic course with amoxicillin. During the hospital stay four infants developed complications with signs of pneumonia and three had gastroenteritis and sepsis who were all then consequently transferred to the inpatient care and received all the essential required treatment but succumbed thereafter. An infant was considered fit for discharge, if he/she was gaining sufficient weight on isolated breastfeeding to be followed in the available nutritional units at the nearest health centers.

Outcome Variables:

The outcome variables signified that that infant was cured, died, defaulter or in non-recovery state. Cured indicated an infant who was gaining adequate weight on breastfeeding at the time of discharge. Infants who died were those transferred to inpatient care after the development of complications at TFC.

The standard indices of nutritional status of children were weight, length, weight-for-length Z score (WLZ) and weight-for-age Z score. Indicators were expressed as Z scores in standard deviation (SD) from the median of the reference population. The WHO Multicenter Growth Reference Study Group growth standards was the reference [17].

Ethical Approval:

The Federal Health Ministry in Sudan provided the ethical approval. Mothers agreed to participate in the study after signing an informed consent form.

Statistics Handling

The data collected and the variable results were entered into the computer, using SPSS® (Statistical Package for Social Science SPSS Version 24) software for windows. Test of normality (Shapiro-Wilk) was performed on the continuous data and parametric tests were used where the data were normally distributed otherwise nonparametric were used.

Continuous variables were expressed as mean (SD) when normally distributed or otherwise median interquartile range (IQR). The outcome was divided into cured (the infant was gaining weight) and not cured (defaulter, non-recovery or death) and a P value <0.05 was considered significant.

Results:

The total number of infants included in this study was 37. All infants were clinically wasted and their weight-for-length Z scores were <-3. The demographic and clinical characteristics are shown in table 1.

All infants, 37 (100.0%) who had no edema were fed on F100D. The higher proportion of the infants (31) with SAM showed a significant response to SST treatment accounting for 83.8% cure rate. The defaulters were 2 (5.4%) and 4 infants died denoting a case fatality rate of 10.8%.

Table 1: Demographic and clinical characteristics of SAM infants (n=37)

Variables	Frequency	%
Sex		
Male	22	59.5
Female	15	40.5
Age		
< 2 months	11	29.7
2 to 4 months	18	48.7
> 4 and < 6 months	8	21.6
Residence		
Urban	30	81.1
Rural	7	18.9
Mother's education		
Illiterate	9	24.3
Primary	16	43.2
Secondary	8	21.6
University	4	10.8
Father's occupation		
Mother's ocupation		
Water supply and electricity	28	75.7
Home displacement	3	8.1
Previous hospital admission	15	40.5
Vaccination		
Up-to-date	19	51.4
Partial	5	13.5
Not vaccinated	13	35.1
Symptoms and signs		
Pallor	36	97.3
Poor appetite	32	86.5
Normal appetite	0	00.0
Hungry	5	13.5
Diarrhea	21	56.8
Clinical pneumonia	13	35.1
Vomiting	15	40.5
Seizure	0	00.0
Edema on admission	0	00.0

Table No. 1 shows distribution of infants with SAM in relation to Gender. Male infants represented 59.5% (22) of the total infants (37) with a male predominance over female infants 40.5 % (15). The distribution of SAM infants according to age categories, where 18 (48.7%) of infants were in the age group 2-4 months, and 8 (21.6%) of the SAM infants were in the age groups of > 4 and < 6 months and only 11 (29.7%) SAM infants in the age groups of < 2 months.

About 78.4% of SAM infants aged less or equal to 4 months. The distribution of SAM infants in relation to social variables showed that in this study the primary school level of father's education represented 13 (35.1 %) while those who were Illiterate and secondary school comprised 7 (18.9 %) and 11(29.7) respectively. The level of their mother's education with illiteracy represented 9 (24.3 %) of them while those who were primary school constituted 16 (43.2%) of mothers. The private work of the father's occupation was documented in 29 (78.4 %) of them while the mother's occupation as housewife work comprised 34 (91.9 %) of them. Regarding marital status 35 (94.6 %) were married. The income per month of the families less than 100 US Dollars represented 15 (40.5 %). Only 3 (08.1) of SAM infants were displaced and 2 (5.4 %) were affected by war.

The most common clinical presentations were pallor in 45 (11.6%), poor appetite in 32, diarrhea 21

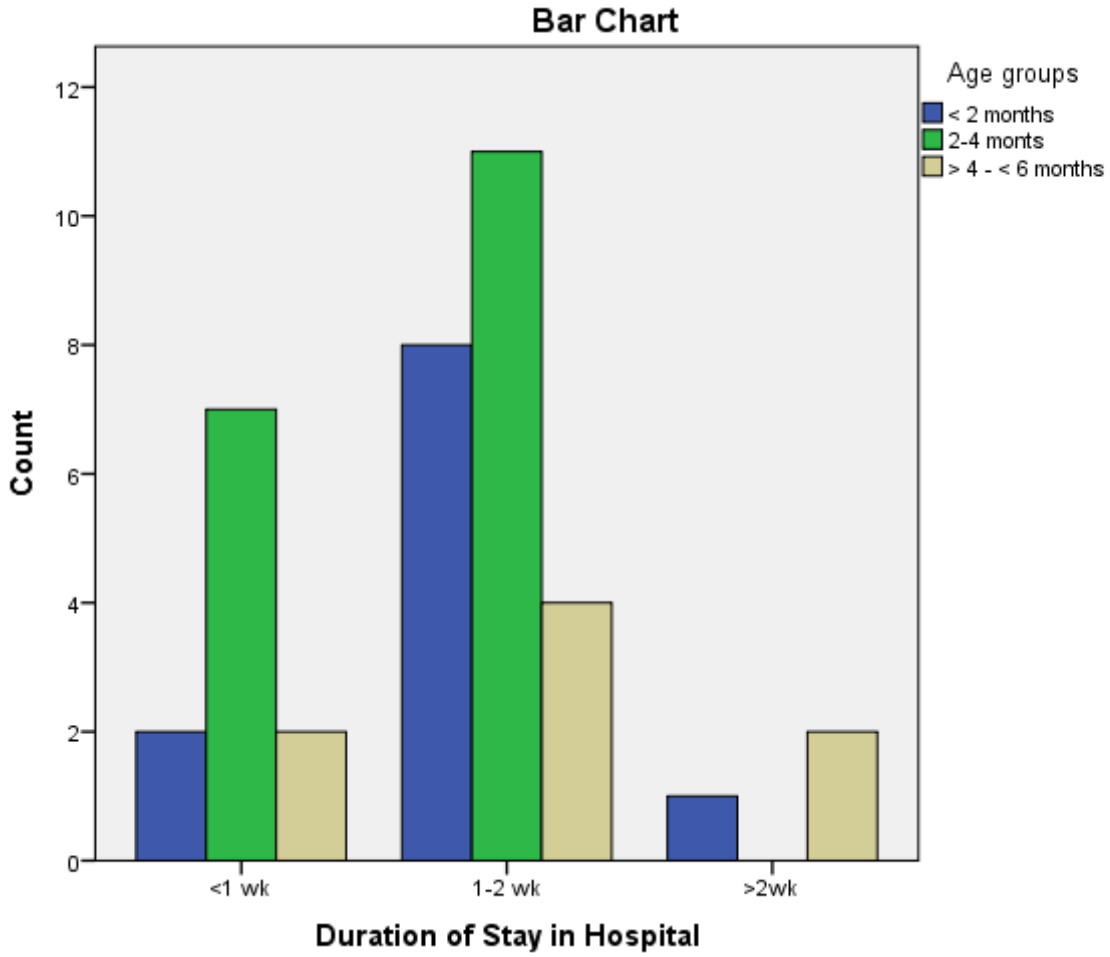

Fig. 1: The distribution of infants according to age group in relation to duration of Hospital stay.

Figure No. 1 shows distribution of infants with SAM less than 6 months according to age group in relation to duration of stay in hospital. It was noticed that 11 of 23 infants aged 2-4 months had duration of hospital stay between 1-2 weeks.

Discussion:

In Sudan, around one out of every three children are in need of humanitarian assistance. It is due to the fact of the back of growing food insecurity, which is an ongoing problem that has increased persistent malnutrition, water, health, and education crises for children across Sudan. Approximately three million children under 5 years of age in Sudan are acutely malnourished, of which those suffering from SAM account to 650,000 and around half of them will die without treatment. (UNICEF Sept 2022, children in Sudan are in the middle of a perfect storm of crisis. This study aimed to study the effectiveness of

Supplementary Suckling Technique in the management of severely acute malnourished infants of both sexes less than 6 months of age admitted to children Hospitals, Khartoum, Sudan.

Malnutrition has serious implication for health and health care costs. This study revealed that SAM infants less than 6 months of age with D F 100 feeding using SST have showed marked improvement.

In this study the sex difference revealed a male predominance with 59.5% of the total infants and the female infants (40.5%), that was comparable to the study of Oberlin O et al where more boys (63%) appeared than girls (37%) [18].

There was a high cure rate of infants with SAM feeding on SST with a relatively low case fatality rate of 10.8%. To the best of our knowledge, this is the first study conducted to assess the outcome of SST in infants with SAM in a hospital TFC in a country devastated by conflict. Especially SAM was the result of failure of lactation due to maternal stress in a population with a hazardous combination of factors, driven by conflict and economic decline. In addition to this, socioeconomic factor, poor nutrition, and mothers' knowledge and feeding practices led to increase in the prevalence of malnutrition.

The success rate of SST of SAM infants in this study was 80.6% whereas this was comparatively lower than the report of Singh *et al* with (72.7%) showing a higher failure rate, but their mortality rate was lower than this study. Although the cure rate in this study was higher than that of Singh *et al* with a higher failure rate but their mortality rate was lower [19].

In a similar report from Niger though with a larger sample, the infants had comparable clinical presentations on admission, comparable similar cure and fatality rate and a lower defaulter rate [20]. The conflict setting in this study's environment likely hindered similar outcomes when compared to stable communities as in Niger.

Concerning the educational level of parents, the illiterate mothers and fathers comprised 24.3% and 18.9% respectively, which was lower than that reported in Senegal of 64%, The occupation of the mothers includes housewives 91.9% that was comparably higher than the study of Gobre et al around 80.7%. [21]

Around 94.6% were married mothers that was comparable to the literature reports, [22] with monthly family income less than 100 US Dollars (40.5 %) which was lower than the study of Gobre et al. [22]

In all other studies employing SST as the main feeding procedure which were reviewed, it was quite difficult to find a comparable result due to the lack of literature reports in this aspect [15,16]. The noticeable response in young children was probably due to the relatively safe environment in the hospital and hence early production of breast milk. Re-lactation was found to be associated with the age of infants; where the relationship showed that the younger the age of the infant at the time of intervention the better was the re-lactation achievement [23].

Limitation of the study in a follow up the infants after discharge form therapeutic feeding center as they will continue follow up in Outpatient therapeutic center in the district with all due difficulties because of safety issues and displacement. Hence, no reliable information on relapses, readmissions and death therefore, limitation of short and long terms outcomes.

Conclusion:

Improving breastfeeding practices effectively are needed because most mothers although were aware of the important of the breastfeeding but they were unable to practice it well. Severe acute malnutrition in infants less than 6 months can be managed successfully as inpatients with an adopted protocol. Supplementary Suckling technique (SST) provides the SAM infant <6m with therapeutic milk in order to initiate rehabilitation and re-establish exclusive breastfeeding through stimulating re-lactation. SAM infants less than 6 months of age with D F 100 feeding using SST have been improved by their weight. Improving breastfeeding practices effectively are highly recommended

List of abbreviations:

- Acute severe malnutrition (SAM)
- Treatment feeding Centre (TFC)
- Supplementary sulking technique (SST)
- Weight-for-length z score (WLZ)

Declarations:

Ethics approval and consent to participate:

The Federal Health Ministry in Sudan provided ethical approval to this study. Mothers agreed to participate in the study after signing an informed consent form.

Consent for publication:

Not applicable

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests

Funding:

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Authors' contributions:

MSMB designed the study and collected the data and wrote the initial draft. IAB designed the study, participated in the writing of the initial draft and revised the draft. JAB analyzed and interpreted the data and wrote the initial draft. AMA designed the study and wrote the draft. All authors read and participated in the writing of the draft and approved the final manuscript.

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مقالة بحثية

نتائج العلاج للرضع الذين تقل أعمارهم عن 6 أشهر والذين يعانون من سوء التغذية الحاد الوخيم غير المصحوب بمضاعفات الذين يتغذون بتقنية الرضاعة التكميلية في الخرطوم، السودان

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المُلخّص

يعاني حوالي 3.8 مليون طفل دون سن 6 أشهر من سوء التغذية. في السودان، كان معدل التقزم أعلى من 30% المصنفة بناء على منظمة الصحة العالمية على أنها "عالية". تقنية المص التكميلي هي تقنية بسيطة من الناحية النظرية ولكنها عمليا تمثل تحديا لتنفيذها بشكل صحيح داخل وحدات التغذية العلاجية. يجب العمل بشكل وثيق مع الأمهات لإثبات ثقتهن في قدرتهن على تحسين إنتاج لبن الأم. تم إجراء دراسة مرتقبة قائمة على مستوى المستشفى في الفترة من 1 يناير إلى 31 ديسمبر 2020م بين الرضع المختارين عشوائياً الذين تقل أعمارهم عن 6 أشهر والذين يعانون من سوء التغذية الحاد الشديد بعد فشل الرضاعة الطبيعية. تم قياس مؤشرات الأنثروبومترية للرضع وتسجيلها يوميًا. تم استخدام تقنية المص التكميلي في العلاج باستخدام DF100 أو F75 وتم تسجيل النتيجة كشفاء، توفي، متخلف أو في حالة عدم استفادة. يمثل الذكور 22 (59.5%) من مجموع الرضع (37). لوحظ أن 18 (48.6%) من الرضع كانوا في الفئة العمرية 2-4 أشهر، وأن هؤلاء الرضع الذين يعانون من سوء التغذية الحاد الشديد في الفئات العمرية 4 >و <6 أشهر كانوا 8 (21.6%) و 11 (29.7%) من الرضّع الذين يعانون من سوء التغذية الحاد الشديد في الفئات العمرية أقل من شهرين. حوالي 78.4% من الأطفال الذين يعانون من سوء التغذية الحاد الشديد تقل أعمارهم عن 4 أشهر أو تساويهم. هناك حاجة إلى تحسين ممارسات الرضاعة الطبيعية بشكل فعال. يمكن علاج سوء التغذية الحاد الوخيم عند الرضع أقل من 6 أشهر بنجاح كمرضى داخليين باستخدام بروتوكول معتمد. تم تحسين وزن الرضع الذين يعانون من سوء تغذية حاد وتقل أعمارهم عن 6 أشهر ب D F 100 و75 F باستخدام تقنية المص التكميلي من خلال وزنهم.

الكلمات المفتاحية: سوء التغذية الحاد الوخيم، تقنية الرضاعة التكميلية للرضع، الصراع السياسي السودان.

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