COMPARATIVE STUDY OF INPATIENT AND OUTPATIENT TREATMENTS FOR SEVERE ACUTE MALNORISED (SAM) CHILDREN AT ELOBEID SPECIALIZED PEDIATRIC HOSPITAL

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ABSTRACT

The study was conducted at Elobeid Specialized Pediatric Hospital, Elobeid, Sudan. The study aimed to make a comparison between the effects of inpatient and outpatient treatments for severely acute malnourished (SAM) children under five years of age. Eighty children were randomly selected and divided into two equal groups; 40 children were treated as inpatients with therapeutic milk, and the other 40 children were treated as outpatients with therapeutic foods. Data were collected using a questionnaire and anthropometric measurements, and then analyzed using SPSS version 16 with the t-test. Study results showed that the health conditions of 92.5% inpatients and 87.5% outpatients improved after taking the treatments, calculated t value 1.46, significance value 0.120, > (p = 0.05), therefore, there was no significant difference between both treated children. It was found that the appetites of 92.5% inpatients and all outpatients were recovered, where a calculated t value of 1.78, significance value 0.176, > (p=0.05); therefore, there were no significant differences between both treated children. There were 55% inpatients and 75% outpatients who reported improved physical activities one week after treatment, where calculated t value was 2.18, a significant value 0.00, < (p=0.05), there were significant differences in enhanced activity between both two treated children. The study findings recorded 0.41 and 2.00 cm MUAC of inpatients and outpatients, respectively, where calculated t value was 2.82, significant value 0.000, < (p=0.05). Body weight was 0.31 kg for inpatients and 1.35 kg for outpatients, where calculated t value was 1.23, significance 0.000, < (p=0.05). As additional meals, the study findings revealed that 55, 15, and 30% of outpatients' respondents took porridge with dried meat, starchy foods, and lentils and broad beans, respectively. It can be concluded that inpatients and outpatients' therapeutic treatment positively affected the nutritional and health status of children. The study recommended raising mothers' awareness about the factors leading to malnutrition and the benefits of therapeutic milk and therapeutic foods.

Keywords: Malnutrition, inpatient, outpatient, therapeutic foods, therapeutic milk, treatment.

الملخص

أجريت هذه الدراسة بمستشفى الأبيض التخصصي للأطفال بمدينة الابيض ـ السودان. هدفت الدراسة الى مقارنة أثر المعالجة الداخلية والخارجية لأطفال أقل من خمس سنوات مصابين بسوء التغذية. تم اختيار 80 طفلاً بطريقة عشوائية، 40 طفل تمت معالجتهم داخلياً بواسطة الألبان العلاجية و40 طفل تمت معالجتهم خارجياً بواسطة الوجبة العلاجية. لجمع البيانات الأولية تم إستخدام الإستبيان وبعض القياسات الجسمانية. تم تحليل البيانات بإستخدام برنامج الحزم الإحصائية للعلوم الإجتماعية النسخة

(16) بإستخدام إختبار ت بمستوى معنوية 5%. أظهرت نتائج الدراسة أن 92.5% من الأطفال المعالجين داخلياً و87.5% من المعالجين خارجياً قد تحسنت حالتهم الصحية بعد تناول الوجبتين وكانت قيمة ت المحسوبة 1.46 بدلالة معنوية 0.120، لذلك لم يكن هناك فرق معنوي في تحسن الصحة بين المعالجتين. تم إسترداد شهية 92.5 و100% من الأطفال المعالجين داخلياً وخارجياً، على التوالي وكانت قيمة ت المحسوبة 1.78 بدلالة معنوية 0.176 وبالتالي لم يكن هناك فرق معنوى في تحسين الشهية بين المعالجتين. هناك 55% و75% من الأطفال المعالجين داخلياً وخارجياً، على التوالي قد عُزز نشاطهم البدني بعد أسبوع واحد من العلاج حيث كانت قيمة ت المحسوبة 2.18 بدلالة معنوية 0.000 ودلالة على وجود فرق معنوي مظهراً أفضلية المعالجة الخارجية. أظهرت نتائج الدراسة أن الأطفال المعالجين داخلياً وخارجياً سجلوا محيط منتصف ذراع بلغ 0.41 سم و2.00 سم، على التوالي، وبلغت قيمة ت المحسوبة 2.82 بدلالة معنوية 0.000، ويدل على أن محيط أعلي الذراع في الأطفال المعالجين خارجياً. كان وزن الجسم 0.31 كجم و1.35 كجم لكل من الأطفال المعالجين داخلياً وخارجياً، على التوالي، وكانت ت المحسوبة 1.23 بدلالة معنوية 0.000 والوزن في حالة الأطفال المعالجين خارجياً كان معنوياً أعلى. وُجد أن الأطفال المعالجين خارجياً يتناولون وجبات إضافية مثل عصيدة مع ملاح وأطعمة نشوية وعدس وفول مصري حسب إفادة 55% و15% و30% من المستهدفين، على التوالي. خلصت الدراسة إلى أن كل المعالجتين تؤثر إيجاباً على الحالة الغذائية والصحية للأطفال دون سن الخامسة. توصي الدراسة بضرورة رفع مستوى وعي الأمهات عن مسببات وعوامل سوء التغذية وفوائد الألبان والوجبات العلاجية.

INTRODUCTION

Malnutrition is one of the most important underlying causes of child mortality in developing countries, particularly during the first 5 years of age (Pelletier *et al.*, 1995). According to Save the Children (2012), malnutrition is a broad term that refers to "all deviations from adequate and optimal nutritional status" resulting from specific nutrient deficiencies or diets based on inappropriate combinations or proportions of foods.

The UN Standing Committee on Nutrition identifies malnutrition as the single largest factor impacting the global disease burden (UNSCN, 2004). In 2013, malnutrition was the underlying cause of death for at least 3.1 million children, accounting for 45% of all deaths among children under the age of five and stunting growth among a further 165 million, according to a set of reports released ahead of a nutrition summit in London (Tran, 2013). Malnutrition increases an individual's susceptibility to disease by hindering the immune system, which increases vulnerability to infectious diseases such as TB, HIV, and hepatitis C (Semba, 2003, and Cegielski and McMurray, 2004).

It was estimated that the annual global cost of malnutrition from loss of productivity and healthcare expenditures was USD 3.5 trillion (FAO, 2013). Underweight is responsible for nearly 15% of the total daily losses in countries with high child mortality (World Bank, 2006). Studies of low-income Asian countries estimated that micronutrient deficiencies decrease adult productivity by 5-17% (Horton, 1999).

In 1974, the World Food Conference declared, "Every man, woman and child has the inalienable right to be free from hunger and malnutrition." (UNICEF, 2015). Since 1990, the number of malnourished individuals has fallen by 21% (FAO, 2015). Yet, from 2011 to 2013, one out of every eight people in the world, almost one billion people, was still not getting enough food for an active and healthy life (IFAD, WFP, and FAO, 2013). Most (98%) of these individuals lived in developing economic regions (FAO, WFP, and IFAD, 2012). Socially vulnerable groups such as children and childbearing women shoulder the largest burden of malnutrition (FAO, 2015).

Based upon the type of nutritional deficit, an individual is said to be acutely and/or chronically malnourished. Acute malnutrition is caused by a sudden decrease in food consumption that results in rapid weight loss and a physical inability to meet the energetic needs of the body (Save the Children, 2012).

Acute malnutrition is the most visible form of malnutrition and is typified by severe wasting (disproportional weight for height) and/or edema (the retention of fluid). Acute malnutrition can lead to reductions in age-appropriate growth, depressed immune functioning, fluid overload, heart failure, infection, and death. The prevalence of acute malnutrition within a displaced population is often used as an indicator of the severity of the humanitarian crisis. Chronic malnutrition is the result of inadequate nutrition over a long period of time and is not always as visible as acute malnutrition. It can begin in uterus with poor maternal nutrition and persist through inadequate feeding practices and suboptimal food quality. Frequent exposure to bacterial infections can further contribute. Chronic malnutrition most commonly manifests through physical stunting the term used to describe individuals whose weight and height may appear proportional but who are shorter and slighter than their full genetic potential. The severity of chronic and acute malnutrition is diagnosed using anthropometric measures. Those with moderate acute malnutrition (MAM) or moderate chronic malnutrition (MCM) are 2–3 standard deviations below the population's weight for age and height for weight averages. Similarly, those who are severely acutely malnourished (SAM) or severely chronically malnourished (SCM) are at least 3 standard deviations below the population's growth averages (Grantham-McGregor et al., 2007). The objective of this study was to compare between effects of inpatient and outpatient treatments of severe acute malnutrition (SAM) in children under five years of age attended at the Nutrition Center of Elobied Specialized Pediatrics Hospital.

MATERIALS AND METHODS

Study area

The study was carried out in the Nutrition Center of Elobied Specialized Pediatrics Hospital, Elobied, Sheikan Locality, North Kordofan State. North Kordofan State is located at a latitude of 12° 15 – 16° 32° N and longitude 27° – 32° E the area of the state is 19480 km^2, it is divided into 13 localities and consists of more than 35 administrative units. The total number of citizens is 3.03 million people according to the 2025 projection. The study used a cross-sectional interventional prospective descriptive hospital-based design.

***Sampling techniques*:** The study sample population was composed of children under five years of age (6 to 59 months); 80 children were randomly selected as the study sample using the following equation, according to Zaied *et al*. (2014).

$$N = \log (1 + \frac{\propto 2 * n}{\propto 2})$$

Where:

    N = size of the sample

    α = 0.01

    n = monthly target

The first group (40 children) was treated inpatient with therapeutic milk (F100 and F75), and the second group (40 children) was treated outpatient by therapeutic foods (ready-to-use therapeutic foods (RUTF).

Inclusion criteria: All children under 5 years of age (6-59 months) admitted as severe acute malnutrition and fulfilling the WHO criteria of severe wasting or edematous malnutrition in the hospital.

Exclusion criteria: Children more than 5 years old and parental refusal to participate in the study.

Data Collection

The study data were collected by questionnaire and some anthropometric measurements. The secondary data was collected from the reports, books, journals and previous studies.

Anthropometric Measurements

The basic anthropometric measurements used in this study were weight (kg) and MUAC (mid-upper arm circumference) in order to assess nutritional status of the malnourished children according to WHO standard.

Weight

Weight was measured to the nearest 0.1 kg using the regular clinical beam balance. The scale was checked and the mothers were asked to remove the shoes and heavy clothes of the child before taking the weights (Federal Ministry of Health, 2015).

MUAC

MUAC was measured using a 3 colored MUAC tape. MUAC less than 11.5cm (red color) indicates severe acute malnutrition. The child should be immediately referred for treatment. MUAC between 12.5 and 13.5 cm (yellow color) indicates moderate acute malnutrition. The child should be immediately referred for supplementation. MUAC over 13.5 cm (green color) indicates that the child is well nourished (Federal Ministry of Health, 2015).

Data Analysis

Statistical analysis: Data was analyzed by using Statistical Package for the Social Sciences (SPSS) software version 16 (percentages and frequencies). A t-test at 5% significance level was used.

RESULTS AND DISCUSSION

Therapeutic milk and therapeutic foods taken by children

As shown in Table 1, the results of the study reported that all children in both treatments drank and ate the same type of therapeutic milk (F 75 and F100) and therapeutic foods (RUTF), which were prescribed by the center. This showed the mothers' knowledge and awareness about the adoption of these treatments to improve the nutritional and health status of their children. Moreover, the results revealed that 87.5% of the inpatient children completed the prescribed milk, while 12.5% did not complete it. In the case of outpatients' children, 65% completed all prescribed milk, whereas 35% did not. These children who did not take the all prescribed amount of milk and therapeutic foods might be due to the children's negative response to the treatment at the beginning or to the less appetite at the start of the treatments. These might need more guidance and mentorship in therapeutic awareness. Nonetheless, some of them will probably improve after continuing the therapeutic feeding.

Additional meals taken by the children: The study findings, concerning the inpatients treatment, showed that no additional food was taken with the therapeutic milk (F75 and F100) whereas in the outpatients' treatment the additional meals were taken with the therapeutic foods (RUTF) i.e. fermented bread porridge (*asida*) with meat cookery (*molah*) (55%), starch (15%), lentils and broad beans (30%) (Table 2). This indicated that the nutrition staff in the inpatient treatment follow-up gave advice to the mothers not to introduce additional foods during the therapeutic treatment period.

Table 1: Therapeutic milk and therapeutic foods taken by children

	Therapeutic milk		Therapeutic foods	
Variable	Inpatient (SC)		Outpatient (OTP)	
	Frequency	%	Frequency	%
Taken	40	100	40	100
Not taken	0	0	0	0
Total	40	**100.0**	40	**100.0**
Completed	35	87.5		
Not completed	5	12.5	26	65.0
Total	40	**100.0**	14	35.0

Table 2: Additional meals taken by children and their types

	Additional meals			
Variable	Inpatient (SC)		Outpatient (OTP)	
	Frequency	(%)	Frequency	(%)
Taken	0	0	40	100
Not taken	40	100	0	0
Total	40	100.0	40	100.0
Types of meals				
Fermented bread with meat porridge	0	0	22	55.0
Starch	0	0	6	15.0
Lentils and broad beans	0	0	12	30.0
Total			40	**100.0**

Continuing treatments: As shown in Table 3, for both treatments, the study outcome reported that therapeutic milk (F75 and F100) and therapeutic foods (RUTF) were not stopped throughout the course of the treatments. This indicated the awareness of mothers on the importance of continuing treatment for the rapid cure of the child, for improving his health.

Children's status after treatments: The results of the study, for the inpatient children, revealed that 92.5% of them had improved health conditions was improved after taking the therapeutic milk (F75 and F100). In the case of outpatient ones, 87.5% their health condition improved after taking the therapeutic foods (RUTF) (Table 4). From these results, it's clear that the therapeutic milk and foods were important in improving the health of children under study as well as curing them. Statistical analysis revealed that the calculated t value was 1.46, with a significance value of $P \leq 0.120$. Therefore, there was no significant difference in health improvement between inpatients and outpatients treated children.

Table 3: Continuing treatments

	Inpatient (SC)		Outpatient (OTP)	
Variable	Frequency	(%)	Frequency	(%)
Continued	0	0	0	0
Not Continued	40	100	40	100
Total	40	100.0	40	100.0

Children's appetite status during treatments: As shown in Table 5, among inpatient children, the study findings showed that 92.5% of children showed improved appetites. Concerning the outpatient children, all of them manifested improved appetites during the treatment period. Calculated t value was 1.78, with a significant value of P≤0.176.

Table 4: Children's status after the treatments

	Inpatient (SC)		Outpatient (OTP)	
Variable	Frequency	(%)	Frequency	(%)
Improved	37	92.5	35	87.5
Not Improved	3	7.5	5	12.5
Total	40	**100.0**	40	**100.0**

Therefore, there was no significant difference in appetite between inpatients and outpatients treated children. These results confirmed that outpatient children benefit from living with their families, which might increase their appetite more than staying in centers due to psychological and social reasons. Furthermore, they have had no medical complications. Abdelgader and Ahmed (2019) from their work in *Elnohoud* Educational hospital, West Kordofan State, reported that 97% of children restored their normal appetite after one week of treatment; whereas the rest of them had a good appetite at the end of the third week prior to admission.

Children's physical activities after one week of treatment: As shown in Table 6, for inpatient children, the study results revealed that 55% of them their physical practices were improved after one week of the treatment. In turn, 75% of the outpatients' children had improved their physical practices after one week of the treatment. These results indicated the effectiveness of both treatments. Abdelgader and Ahmed (2019) indicated that 10% of patients' children demonstrated poor playing activities at admission, but all of them improved to excellent behavioral conditions (smile and play on mattress) after one dose of the treatments.

Children's capabilities to do their duties alone: After one month of treatment, all children, whether they were inpatients or outpatients, were able to do their duties without the help of any person

(Table 7). These findings might be attributed to the effective influence of the treatments in enhancing their energy due to the calories released by food assimilation.

Table 5: Children's appetite during the treatments

	Inpatient (SC)		Outpatient (OTP)	
Variable	Frequency	(%)	Frequency	(%)
Improved	37	92.5	40	100
Not Improved	3	7.5	0	0
Total	40	**100.0**	40	**100.0**

Table 6: Children's physical status after one week of treatment

	Inpatient (SC)		Outpatient (OTP)	
Variable	Frequency	(%)	Frequency	(%)
Improved	22	55.0	30	75.0
Not Improved	18	45.0	10	25.0
Total	40	**100.0**	40	**100.0**

Children's exit and recovery: The recovery of inpatient children took one week, two week, and more than two weeks with percentages of 35%, 47.5% and 17.5% respectively, in the same manner outpatient children needed longer time, 1 month, two months and more than two months to recover from the malnutrition with the percentages of 30, 55 and 15%, respectively (Table, 8). The recommended staying period in case of inpatient treatment is 21 days, whereas for the outpatient treatment could be four months. The present results indicated that the period of staying of most of the children treated well before the recommended period due to the good influence of the treatments.

Anthropometric Measurements

Gaining MUAC after treatments: The average MUAC gained by inpatient children was 0.41 cm, and that of outpatients was 2.00 cm (Table 9). Statistical analysis showed that, calculated t value was 2.82, with a significant value of $P \leq 0.00$. Therefore, there was a significant difference between the two treatments in MUAC gained. Normally, the MUAC measurements give an idea about the progress of a child's growth. Moreover, the results supported the hypothesis that outpatient treatment is more effective than inpatient treatment. Some of the children faced some difficulties in the measurements of MUAC due to the symptoms of edema that they suffered.

Table 7: Children's capabilities to do their duties alone

	Inpatient (SC)		Outpatient (OTP)	
Variable	Frequency	(%)	Frequency	(%)
Improved	40	100	40	100
Not Improved	0	0	0	0
Total	40	100.0	40	100.0

Table 8: Children's exit and recovery

	Inpatient (SC)*			Outpatient (OTP)*	
Variable	Frequency	(%)	Variable	Frequency	(%)
One week	14	35.0	1 month	12	30.0
two weeks	19	47.5	2 months	22	55.0
>2 weeks	7	17.5	>2 months	6	15.0
Total	40	**100.0**	Total	40	**100.0**

Table 9: Gaining MUAC and weight of children after treatment

Parameter	Treatment	
	Inpatient (SC)	Outpatient (OTP)
MUAC (cm)	0.41(±0.69)[b]	2.00(±1.39)[a]
Weight (kg)	0.31(±1.97)[b]	1.35 (±1.02)[a]

Means (±std)
Different letters indicated highly significant differences between means (P≤0.001).

Gaining body weight after treatments: The average body weight gained by inpatient children was 0.31 kg, and that of outpatients was 1.35 kg (Table 9). Statistical analysis revealed that, calculated t value was 1.23, with a significance value of P≤0.00. Therefore, there was a significant difference between the treatments in weight gained. The measurement of child weight indicated the progress in child growth as well as the health improvement. Some of the children who suffered from edema had their weight not increase after the treatments.

Conclusions and Recommendations

Conclusions

According to the results obtained by the present study, it can be concluded that the total number of children (6 to 59 months old) was 80, half of them were inpatients, and the others were outpatients. The inpatients' children came from different localities in the greater Kordofan region, while the outpatients' ones came from only two localities in North Kordofan State. The study findings

revealed that therapeutic milk (F75 and F100) and therapeutic foods (RUTF) were not stopped throughout the course of the treatments. The results of the study, for the inpatients' and outpatients' children, revealed that most of them improved after taking the therapeutic milk and therapeutic foods, respectively. Most of inpatients' and all outpatients' children their appetites were improved. Concerning the physical activities, nearly half of inpatient children and three-quarters of the outpatient children improved after one week. Nearly half of inpatients' and half outpatients' children took two weeks and two months to recover.

Recommendations

Based on study results and focused on ways for the effect of the treatments among acute malnutrition children of age (6 to 59 months), the study recommended that further investigations on malnutrition problems of the affected children concerning other states and localities should be adopted, it might be better for the research to analyze chemically outpatient's meals and study of the effect of micronutrients in the designed meals in the recovery of malnutrition problems. The study also recommended that raising mothers' awareness about the factors leading to malnutrition, providing training opportunities for the most vulnerable families, focusing efforts on increasing nutrition services, and additional centers for inpatient treatment (SC) should be considered.

Ethics Statement

The authors affirm that this paper is their original work and has not been previously published or submitted elsewhere. It accurately acknowledges the meaningful contributions of all co-authors, fully discloses all sources used, and reflects the personal and active involvement of each author, who collectively accept public responsibility for its content.

Conflicts of Interest

The authors declare no conflicts of interest.

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