

*East African Medical Journal Vol. 91 No. 1 January 2014*

## PREVALENCE OF ACUTE MALNUTRITION IN PRE-SCHOOL CHILDREN IN A RURAL AREA OF NORTHERN SUDAN

S. Mohamed, FRCPC, Department of Paediatrics, College of Medicine, King Saud University, Riyadh, Saudi Arabia, M. D. Hussein, M.D., Department of Paediatrics, Dongola Police Hospital, Dongola, Sudan

Request for reprints to: Dr S. Mohamed, Department of Paediatrics, College of Medicine, King Saud University, Riyadh, Saudi Arabia, e-mail: sararmohamed@hotmail.com

## PREVALENCE OF ACUTE MALNUTRITION IN PRE-SCHOOL CHILDREN IN A RURAL AREA OF NORTHERN SUDAN

S. MOHAMED and M. D. HUSSEIN

### ABSTRACT

**Objectives:** To determine the prevalence of acute malnutrition in pre-school children in Karma Albald village, Northern Sudan.

**Design:** Prospective observational study.

**Setting:** Four kindergartens in Karma Albald village, Northern Sudan.

**Subjects:** Pre-school children attending kindergartens in Karma Albald village (n = 163).

**Results:** Using the World Health Organization case definitions and weight-for-height growth chart, wasting was observed in 29 of 163 children (17.8%); nine children had severe wasting. Socio-economic data showed that 70 children (43%) were from large families (families with four or more children) and 40 were from 'poor' families; 21 fathers and 12 mothers had poor literacy. All of the risk factors associated with malnutrition that were studied (that is, economic status, family size, order of the child in the family, and other socio-economic indicators) did not reach statistical significance.

**Conclusions:** The prevalence of malnutrition was high in this cohort. Effective interventions are needed to tackle this major child health problem.

### INTRODUCTION

Growth assessment and monitoring is an important indicator of childhood wellbeing and an effective alert system for the early signs of malnutrition (1). Infant and child growth is assessed using various anthropometric measurements. This is based on comparing a child's measurement with population standards. The latest and most widely used standards for assessing the growth and development of children were released by the World Health Organization (WHO) in April 2006 (1,2). These standards define wasting, which indicates acute malnutrition, as weight-for-height  $<-2$  standard deviations (SD), and severe wasting if  $<-3$  SD (1,2). Malnutrition is due to insufficient intake of protein, energy, or both, and occasionally associated with recurrent or chronic infections (3). Children are at a high risk of malnutrition because of their high nutrient requirements to achieve appropriate growth. They are also more vulnerable to the complications of malnutrition.

World-wide, malnutrition is a leading cause of morbidity and mortality in children under five years of age, contributing to 13–66% of deaths in this age

group (4). Globally in 2012, about 51 million children aged less than five years old were wasted, and 17 million were severely wasted, giving a prevalence of almost 8% for wasting and just less than 3% for severe wasting (5). Furthermore, 71% of all severely wasted children were living in Asia and 28% were in Africa (5). Sudan is classified as a lower middle income country according to The World Bank's income classifications, which are based on estimates of gross national income per capita (6). In Sudan, malnutrition is a major health problem that contributes significantly to the deaths of children younger than five years (5,7-9). Although many hospital-based studies have addressed malnutrition in Sudanese children, community-based studies are limited. Therefore, we undertook a community-based cross-sectional study to determine the current prevalence of acute malnutrition in Karma Albalad, a stable rural area in Northern Sudan.

### MATERIALS AND METHODS

**Study area and population:** The current study was conducted in Karma Albalad (KA), a village in the northern region of Sudan. It is located on the east

bank of the River Nile, 60 km north to Dongola (the region's capital). According to a recent census, the population of the northern region of Sudan is 750,000, with the vast majority live in rural areas (8). About 10,000 people live in KA, 800 of who are aged one to five years; this is based on data from the Expanded Programme on Immunisation (EPI), Ministry of Health, Northern State (10). Most of the residents in KA are farmers; some are laborers, employees, or work abroad (7). The educational facilities in KA include four kindergartens, five mixed primary schools, and one secondary school for girls. There is a health centre in KA, which is run by a medical assistant. A hospital with paediatric facilities is located in the nearby village of Alborgeig. We selected KA as the study site because it is the largest and most populated village in the northern region. Furthermore, there are more kindergartens in the village compared to other localities, which tend to have between one and two. We assumed that KA would probably be the best representation of pre-school aged children in the region. In Sudan, pre-school education is not mandatory, however it is strongly recommended by the Ministry of Education. All kindergartens in KA are public with free admission for all children. The majority of parents utilise these facilities to prepare their children for formal school education.

*Study Design:* The current study used a cross-sectional design. All children between three and six years of age, who were attending the four kindergartens in KA on the day the study was conducted (8<sup>th</sup> of January 2010), were included in the study group. A written consent was taken from the local authority and the parents of the children who participated in the study. Parents with poor literacy were consented by research team members in the presence of a witness. The research team included the second author and two medical officers. The team members received training by the second author on the study methods. The second author also trained the kindergarten teachers about how to complete the questionnaire. The research team and teachers trained parents on how to fill in the questionnaire, and assisted parents who had difficulties with completing the questionnaire, including parents who were illiterate. Some parents completed the questionnaire at home, and then returned it. Children were excluded if their parents refused to participate in the study, or failed to complete the questionnaire. The questionnaire was designed by the two authors using the Arabic language, which is the language spoken by the local community. The questionnaire covered the demographic and socio-economic status of the families. The first part of the questionnaire included

demographic information about the child. The second part contained information on the parents (e.g. level of education, occupation, income). The education of parents was categorised as follow: poor literacy (illiterate), primary school level, secondary school, or post-secondary. Families who were receiving a regular allowance from the local government social authority were considered to be 'poor' families. The third part of the questionnaire covered the health status of the child, and the risk factors for wasting, including their history of chronic diseases. The final questionnaire was pilot-tested and validated. The children's weights were measured using a weighing scale (100g increments) and their standing height was measured using a stadiometer; all children were examined for the presence of bilateral pedal oedema. Weights and heights were plotted on the WHO's weight-for-height chart. Using this chart, wasting (as an indicator of acute malnutrition), was defined as a weight-for-height  $< -2$  SD, and severe wasting  $< -3$  SD. Furthermore, children with severe wasting, and those who had oedema, were classified as having severe acute malnutrition (SAM).

*Statistical Analysis:* Data were entered and analysed using SPSS version 17. Chi-square and student t-test were used for differences in proportions or means between groups. The difference between proportions was considered significant when the p-value was less than 0.05. Simple and multiple logistic regressions were used to identify risk factors for malnutrition, and odds ratios with 95% confidence intervals were reported.

## RESULTS

Out of 172 questionnaires that were given to parents (Figure 1), 163 were filled in and returned to the investigators (94.8% response rate). About half of the children who completed the study were females (82 children). Seventy children (43%) of the study group were from large families (families with four or more children); the rest were from small families (with less than four children). Furthermore, 40 children were from poor families (Table 1). Illiteracy was observed in 21 fathers and 12 mothers. The majority of fathers (77%) were farmers. Of all the participants, 29 (17.8%) had wasting, and nine were severely wasted (Table 2). None of the wasted children had oedema. All of the risk factors associated with malnutrition that were evaluated (that is, economic status, family size, order of the child in the family, and other related socio-economic indicators) were not found to be statistically significant (Table 3).

**Table 1***Characteristics of the study group: pre-school children in Karma Albalad, Northern State, Sudan (n = 163)*

Characteristic	No.	%
Sex		
Male	81	49.7
Female	82	50.3
Family characteristics		
Large family	70	43.0
Poor family	40	24.5
Illiterate mother	12	7.4
Child order		
First child	48	29.4
Last child	50	30.6

**Table 2***Prevalence of acute malnutrition (wasting) in the study group: pre-school children in Karma Albalad, Northern State, Sudan (n = 163)*

Variable	No.	(%)
No malnutrition	134	(82.2%)
Malnutrition	29	(17.8%)
Wasting	20 (12.3%)	
Severe wasting	09 (05.5%)	
Total	163	(100%)

**Table 3***Association of malnutrition with risk factors in the study group: Pre-school children in Karma Albalad, Northern State, Sudan (n = 163)*

Characteristic		Nutritional status		Odds ratio	P-value
		Malnourished (%)	Notmalnourished (%)		
Gender	Female	14 (48)	68 (52)	.058	.19
	Male	15 (52)	66 (49)		
Mother's Education	Illiterate	3 (10)	9 (7)	.423	.25
	Educated	26 (90)	125 (93)		
Family Size	Small	18 (62)	75 (56)	.365	.00
	Large	11 (38)	59 (44)		
Socio-economic Status	Poor	7 (24)	33 (25)	.003	.32
	Not poor	22 (76)	101 (75)		
Child Order	First	7 (24)	41 (31)	.179	.00
	Last	7 (24)	43 (32)		

## DISCUSSION

Malnutrition is a major child health problem worldwide and a leading cause of childhood morbidity and mortality, especially in developing countries (4-6). Children are more vulnerable to developing malnutrition because they are growing rapidly and are prone to infections. Furthermore, if the parents are not well informed, the amount of meat and/or protein-rich foods in the children's diet may be insufficient (4). To our knowledge, only a few community-based studies have investigated the prevalence of malnutrition in Sudanese children (8,9). Most of these studies addressed the issue of malnutrition during disasters, such as war, drought, famine or displacement. In view of the recent changes in the demography and socio-economic status of the Sudanese community, we decided to study the prevalence of malnutrition in children as an important determinant of wellbeing. The aim was to help health decision makers to plan health service provision. In the present study, we found that the prevalence of acute malnutrition (wasting) among pre-school children in Karma Albalad village was 17.8%. This is consistent with a 2009 report from the United Nations Children's Fund (UNICEF), which estimated wasting in Sudan at 16%, and severe wasting at 7% (6). Furthermore, a household survey conducted in Sudan during 2006 (7), reported a prevalence of acute malnutrition in pre-school children of 27%, with 10% of children having severe wasting (7). This is comparable with reports from other developing countries (4,11-18). In contrast, another study conducted in a displacement camp hosting families affected by disasters, reported a prevalence of malnutrition of 56.1% in children less than five years of age (9). It is obvious that the prevalence of malnutrition rises with increasing poverty, especially in unsettled communities (5). Therefore, a high prevalence of malnutrition in Sudan is not surprising because it is one of the poorest countries in the world (6). The recent Sudan poverty assessment report, prepared by both the World Bank and the Sudanese government, stated that 46.5% of the overall population was below the poverty line; the rate was higher (57.6%) among the rural population (6,19). This report presented detailed analysis of poverty, demography, livelihood, education level, and employment status.

The present study was conducted in a rural area, where the vast majority of parents were farmers with limited income and/or education. People who live in rural areas in Sudan constitute 86% of the total population (6,19). This rural community is homogenous and the majority of people are from same tribe, which explains the similarities in their social characteristics. When we analysed the possible risk factors associated with malnutrition, such as the mothers' education, family size, family income, and

other socio-economic indicators, none of these risks factors reached statistical significance. This could be explained by the fact that most rural families are extended and share the same culture. Consequently, the lifestyle, for example, how they dine, of these people is expected to be relatively similar despite any differences in social status. So, social factors may not have a significant impact on childhood nutrition compared with urban communities. Similarly, a study conducted in a displaced camp in Sudan, and other studies from Bangladesh, failed to find a relationship between maternal education and malnutrition (9,13); in contrast, other studies observed a significant impact (14,15). This contradiction may be influenced by the differences in the characteristics of the study population, as well as the quality and level of maternal education. Moreover, the impact of different educational systems on the perceptions and attitudes of local communities towards child health issues varies; these may not necessarily result in positive changes. We also investigated the role of gender on the prevalence of malnutrition and did not find that either sex was a risk factor for malnutrition. In contrast, some reports have found that male gender is a risk factor, while others have concluded that female gender is a risk factor (16-18). It appears that different social and cultural factors, rather than the gender itself, affects the nutritional status of children. This is apparent in communities where male gender is preferred and they gain advantage accordingly, including better quality nutrient intake and feeding practices.

According to the WHO classification, SAM is determined by the presence of oedema in a wasted child, or in the absence of oedema, a weight-for-height  $<-3$  SD. In the present study, one third of wasted children had SAM, which is comparable to previous studies (9,13-16). Identification of children with SAM is crucial as they have a highly elevated risk of death, exceeding, by nine-fold, those children with a weight-for-height above  $<-1$  SD (20). Furthermore, children with SAM are most likely to benefit from therapeutic feeding. Previous recommendations suggest that all children with SAM who are less than five years of age should be admitted to hospital; however, current local policies endorse outpatient care and community therapeutic nutritional interventions for these children (3,20). This approach decreases costs and allows guardians to keep their children at home. In addition, to improve therapeutic measures to control existing malnutrition, local authorities in our study area should implement effective interventions to prevent childhood malnutrition, as well as measures to improve the nutritional status of this rural community.

The limitations of this study include the relatively small number of participants, and the lack of a control group. Thus, in the future, a comprehensive

study is needed that has a wider scope and involves different parts of the country; this would be helpful for validating our findings and for identifying solutions.

In conclusion, the prevalence of malnutrition was high in this cohort. Therefore, effective interventions are needed to tackle this major child health problem.

#### REFERENCES

1. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr Suppl.* 2006;**450**:76–85.
2. WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. Geneva: World Health Organization; 2006.
3. Park SE, Kim S, Ouma C, Loha M, Wierzba TF, Beck NS. Community Management of Acute Malnutrition in the Developing World. *Pediatr Gastroenterol Hepatol Nutr.* 2012;**15**:210–219.
4. Bhutta ZA, Salam RA. Global nutrition epidemiology and trends. *Ann Nutr Metab.* 2012;**61** Suppl 1:19–27.
5. Joint Child Malnutrition, Levels & Trends in Child Malnutrition: UNICEF/WHO/The World Bank; 2012. Available from [http://www.who.int/nutgrowthdb/jme\\_unicef\\_who\\_wb.pdf](http://www.who.int/nutgrowthdb/jme_unicef_who_wb.pdf) (accessed on Nov 15, 2013).
6. A poverty profile for the Northern States of Sudan, Poverty Reduction and Economic Management Unit, African Region. The World Bank; 2011.
7. Ministry of Health. House-hold survey. Ministry of Health, Sudan; 2006.
8. Ministry of Health. Annual report. Ministry of Health, Sudan; 2008.
9. Mamoun N, Homedia S, Mabyou M, Hussan M, Muntasir HMA. Prevalence, types and risk factors for malnutrition in displaced Sudanese children. *Am J Infect Dis.* 2005;**1**:84–86.
10. Ministry of Health. Expanded Program on Immunization (EPI). Ministry of Health, Northern State, Sudan; 2008.
11. Centers for Disease Control and Prevention (CDC). Impact of new WHO growth standards on the prevalence of acute malnutrition and operations of feeding programs - Darfur, Sudan, 2005–2007. *Morb Mortal Wkly Rep.* 2009;**58**:591–594.
12. Alawadi A. Nutritional status of pre-school children in Alkuwait. *East Mediterr Health J.* 1996;**2**:386–395.
13. Henry FJ, Briend A, Fauveau V, Huttly SA, Yunus M, Chakraborty J. Gender and age differentials in risk factors for childhood malnutrition in Bangladesh. *Ann Epidemiol.* 1993;**3**:382–386.
14. Rikimaru T, Yartey JE, Taniguchi K, Kennedy DO, Nkrumah FK. Risk factors for the prevalence of malnutrition among urban children in Ghana. *J Nutr Sci Vitaminol (Tokyo).* 1998;**44**:391–407.
15. Rayhan I, Khan S. Factors causing malnutrition among under five children in Bangladesh. *Pak J Nutr.* 2006;**5**:558–562.
16. Phengxay M, Ali M, Yagyu F, Soulivanh P, Kuroiwa C, Ushijima H. Risk factors for protein-energy malnutrition in children under 5 years: study from Luangprabang province, Laos. *Pediatr Int.* 2007;**49**:260–265.
17. Veghari GR. Assessment of physical growth among the under 6 years children in rural area in Gorgan, Iran. *Pak J Nutr.* 2007;**6**:252–255.
18. Sanghvi U, Thankappan KR, Sarma PS, Sali N. Assessing potential risk factors for child malnutrition in rural Kerala, India. *J Trop Pediatr.* 2001;**47**:350–355.
19. United Nation Development Program of the United Nations. Human Development Report: The rise of the Sudan; human progress in a diverse world. New York: United Nations; 2013.
20. Patel MP, Sandige HL, Ndekha MJ, Briend A, Ashorn P, Manary MJ. Supplemental feeding with ready-to-use therapeutic food in Malawian children at risk of malnutrition. *J Health Popul Nutr.* 2005;**23**:351–357.