# Inflammation and moderate acute malnutrition in children: a cross-sectional study in Burkina Faso

## Summary of conference abstract[i]

A Treatfood project research site, Province du Passoré, Burkina Faso

By Bernardette Cichon

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The treatFOOD project[1] is a collaboration between ALIMA, MSF-Denmark and the University of . It was funded by DANIDA, MSF-Denmark, MSF-Norway, WFP, USAID, ECHO and Arvid Nilsson's Foundation.

Video footage of the conference presentation is available at: ***http://bit.ly/2jYbWC5***

### Location: *Burkina Faso*

**What we know:** The role of morbidity in moderate acute malnutrition (MAM) is not well understood.

**What this article adds:** An observational study in Burkina Faso, using baseline data from a randomised controlled trial, described morbidity and inflammation in children with MAM. Almost 90% of children with MAM in this setting had an infection and/or inflammation. Maternal history reported a 38% infection rate in the previous two weeks; 71.8% were ill on the day of visit. Most prevalent diagnosed illnesses were malaria (40.2%), lower respiratory tract infections (23.2%), and upper respiratory tract infections (14.6%); fever was common. A total of 10.7% and 46.5% of asymptomatic children had elevated acute phase proteins (CRP and AGP, respectively), suggesting sub-clinical infection. This was largely unexplained by maternal reports and clinical examination. More emphasis on identification and treatment of infections as part of MAM treatment and investigation into how this affects nutritional status and recovery is needed.

## Background

Morbidity plays an important role in the development of and recovery from malnutrition. Morbidity in children with moderate acute malnutrition (MAM) has not been described in detail and it is unclear how morbidity compares to serum levels of acute phase proteins (APPs) which indicate systemic inflammation that can impede response to therapeutic nutritional interventions. The objective of this study was to describe morbidity and inflammation in children with MAM and to assess to what extent maternally reported and clinically diagnosed morbidity explains the variation in APPs.

## Methods

The data for this observational study were baseline data collected as part the treatFOOD trial, a randomised controlled trial testing effectiveness of food supplements for treatment of MAM, carried out in the Passoré Province, Northern Region, Burkina Faso. Children aged 6-23 months with MAM, resident in the catchment area and whose parents/guardians consented to participate, were included. Recruitment took place from September 2013 until August 2014.

Socio-demographic, anthropometric and morbidity data were collected by trained staff. Morbidity data collection included a patient history based on 14-day maternal recall of symptoms and a physical examination carried out by study nurses. Venous blood (2.5 ml) collected from the arm was used for diagnosis of malaria, using a rapid diagnostic test (RDT), and to measure serum concentrations of C-reactive protein (CRP) and α1-acid glycoprotein (AGP). Fever was defined as an axillary temperature > 37.5 °C. Upper and lower respiratory tract infections were diagnosed by experienced nurses based on an adapted version of the Integrated Management of Childhood Illnesses (IMCI) guidelines. Diarrhoea was defined as three or more loose, watery stools per day based on information provided by the mother. The thresholds used for defining elevated APP levels were CRP >10mg/l and AGP >1g/l. Multivariate ANCOVA models were used to explore the associations between morbidity and CRP as well as AGP. These models were also used to determine to what extent morbidity explains variation in APPs.

## Results

A total of 1,609 children were enrolled in the study. Over half (54.6%) of participants were female. Prevalence of stunting (height-for-age <-2 z score) was 37.7%. The mean (SD) age was 12.3 (4.8) months.

Mothers reported illnesses in the two-week period prior to admission in 38% of children. Furthermore, 71.8% of children were ill on the day of the visit according to the physical examination by the study nurse. The most prevalent illnesses diagnosed by the nurse were malaria based on positive RDT (40.2%), lower respiratory tract infections (23.2%) and upper respiratory tract infections (14.6%). Fever was also common (17.7%). Almost a quarter (24.2%) and two thirds (66.4%) of children had serum CRP >10 mg/l and serum AGP >1 g/l, respectively.

Positive malaria RDTs were more common among children admitted based on mid-upper-arm circumference (MUAC) only than children admitted based on weight-for-height z score (WHZ) only, after adjustment for age and sex (38% vs 26%, p<0.001). More children had lower respiratory tract infection if they were admitted based on WHZ only compared to MUAC only, after adjustment for age and sex (29% vs 21%, p=0.006). There were no associations between other symp-

[1] See www.treatfood.org

[i] Presented at the ACF research conference, November 9, 2016. Published research: B Cichon, F Fabiansen, CW Yaméogo, MJH Rytter, C Ritz, A Briend, VB Christensen, KF Michaelsen, R Oummani, S Filteau, P Ashorn, S Sheperd and H Friis. Children with moderate acute malnutrition have inflammation not explained by maternal reports of illness and clinical symptoms: a cross-sectional study in Burkina Faso. BMC Nutr. 2016;2:10.1186/s40795-016-0096-0.

toms, illnesses and APP levels and admission categories. A total of 10.7% (n=36) and 46.5% (n=157) of asymptomatic children had a CRP >10 mg/l and AGP >1 g/l, respectively. Only 19% of children had normal CRP and 12% had normal AGP in the absence of symptoms.

History of fever as well as nurse-documented fever, malaria, respiratory tract infections and skin infections were associated with higher levels of both APPs. History of cough and diarrhoea at the inclusion visit was associated with higher AGP only. Overall, morbidity data only explained a small amount of the variation in APP levels (adjusted R2 below 0.2 in all tested models).

## Lessons learned

This cross-sectional study has shown that almost 90% of children with MAM in this setting had an infection and/or inflammation. MAM treatment protocols usually only provide for supplementary food and routine medication such as deworming, vitamin A and iron and folic acid supplements. These results indicate a possible need for more emphasis on identification and treatment of infections as part of MAM treatment.

Furthermore, elevated APP levels in children without identified symptoms are not uncommon and morbidity data explained only a small proportion of the variation, as demonstrated by the adjusted R2 which was <0.2 in all models, both indicating a presence of sub-clinical inflammation. It is unclear what causes this sub-clinical inflammation and whether it affects nutritional status and response to treatment. Possible explanations for the sub-clinical inflammation cited by the authors include missed infections; the fact that APPs can rise during the incubation phase of a disease before clinical symptoms become apparent or remain elevated during convalescence; and the presence of other conditions such as environmental enteric dysfunction (EED); recent vaccinations; cooking with biomass fuels; and exposure to toxins that may elicit an acute-phase response.

## Conclusion

Morbidity among children with MAM in this setting is common but maternal reports and clinical examination explained only a small proportion of the variation in APPs, indicating a presence of sub-clinical inflammation. Further research is needed into the causes of this sub-clinical inflammation, as it could affect nutritional status and success of MAM treatment.

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# Upcoming research shared at ACF research conference

**At the ACF research conference, November 6th, 2016, experiences were shared from a number of studies where final results will be made available in 2017. A snapshot of what to expect, video footage of the conference presentations and contacts for the studies, are included below.**

## The PROMIS project: integrating the prevention of child undernutrition into community-based management of acute malnutrition programmes in Senegal, Mali and Burkina Faso

Innovative Approaches for the Prevention of Undernutrition (PROMIS) is a three-year (2014-16) project funded by Global Affairs Canada that seeks to prevent and improve the treatment coverage of acute in children in Burkina Faso, Mali, and Senegal. The intervention is implemented Helen Keller International and evaluated by the International Food Policy Research Institute (IFPRI) using mixed study designs. The PROMIS project looks to improve performance and beneficiary coverage of current community-based management of acute malnutrition (CMAM) programmes by integrating a package of preventive measures into child acute malnutrition (AM) screening offered by different delivery platforms. Impacts on child AM prevalence and incidence are hypothesised. In Mali and Burkina Faso, the programme's impact is assessed using a cluster randomised controlled design, while in Senegal, a smaller study assesses the programme's feasibility in a peri-urban setting.

In Mali, the delivery platform consists of monthly community health volunteers-led village gatherings of caregivers with children 6-23 months of age to screen children for AM and to deliver the enhanced preventive package (strengthened Behaviour Change Communication (BCC) on nutrition and health, and a small quantity of lipid-based nutrient supplement (SQ-LNS)). The comparison group receives monthly village-based group BCC and screening for child AM. In Burkina Faso, well-baby consultations (WBC) in health centres is the primary platform to offer monthly screening for AM among infants starting at birth. Caregivers of infants from 0-6 months allocated to the intervention group that participate in WBC receive strengthened BCC on nutrition and health after regular child AM screening. From the age of six months onwards, the provision of preventive SQ-LNS is added. The comparison group receives unspecific BCC as prescribed by the national policy. In Senegal, community health workers trained by local NGOs organise group BCC, screen children for AM and distribute SQ-LNS to caregivers of children 6-23 months of age.

In Mali and Burkina Faso, the programme's impact is assessed by two study designs. A baseline-endline comparison study assesses the programme's impact on the prevalence of acute malnutrition, whereas a longitudinal study with monthly follow-up measurements during 18 months evaluates the preventive impact on the incidence of child AM. A mixed methods process evaluation assesses the programme's impact pathways and feasibility. Finally, a cost-effectiveness study will provide insight into the economic dimension of this integrated programme. Results will be available at the end of 2017 and throughout 2018.

Video footage of the conference presentation is available at: **http://bit.ly/2k8Zodl**

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