Ackatia-Armah R, McDonald CM, Doumbia S, Erhardt JG, Hamer DH, Brown KH. **Malian children with moderate acute malnutrition who are treated with lipid-based dietary supplements have greater weight gains and recovery rates than those treated with locally produced cereal-legume products: a community-based, cluster-randomized trial** Am J Clin Nutr 2015 ajcn.069807; First published online January 7, 2015

Introduction

In 2011, 33 million children under 5 years of age suffered from moderate acute malnutrition (MAM, defined as weight-for-age z-score (WAZ) <-2 and ≥3), which is associated with a 3-fold increased risk of mortality (1). Community-based screening and management of acute malnutrition (CMAM) has been promoted to facilitate access to services and increased program coverage (2). According to many national protocols, children with severe or moderate acute malnutrition should be treated with special milk-based formulas, ready-to-use lipid-based supplements, or other food blends, along with dietary counseling and appropriate medicines, either as inpatients or outpatients, depending on the severity of malnutrition and the presence or absence of complications (3). However, it remains to be determined, which nutritional supplement is the most efficacious for treatment of MAM.

This issue of NNA summarizes an article published in the *American Journal of Clinical Nutrition* which reported on the results of a cluster-randomized, community-based effectiveness trial comparing the impact of 4 different forms of dietary supplements among children with MAM (4). The primary objectives of the trial were to assess the impact of these dietary supplements on continued participation in the nutritional rehabilitation program and children's physical growth, rate of recovery and change in micronutrient status.

Methods

The study was conducted among young Malian children in the Dioila Health District, southeast of Bamako. Twelve of 20 health centers (Centres de Santé Communautaire, CSCom) and their surrounding villages were selected for participation. Potentially eligible children were identified during a baseline census, which was updated every other month. A total of 5 bimonthly community-based screening sessions were conducted to identify children aged 6-35 months with MAM. MAM was defined based on two sets of criteria: 1) WHO Growth Standards [WAZ <-2 and ≥-3 or mid-upper arm circumference (MUAC) <12.5 cm and ≥11.5 cm (5)]; and 2) the national norm used at the time of the study in Mali [weight-for-length z-score (WLZ) <80% and ≥70% of the National Center for Health Statistics median or MUAC <12.0 cm and ≥11.0 cm (6)]. All children meeting one of these criteria were referred to the CSCom for possible study enrollment. Children with written parental consent meeting the inclusion criteria were assigned to the intervention group based on CSCom. Each CSCom was randomly assigned to one of the 4 intervention groups after stratification. After the first 3 rounds of community-based screening sessions, each CSCom was re-assigned to another treatment group (i.e. partial crossover of treatment).

Children were treated following the Malian national policy for treatment of children with MAM (6). Briefly, children received a high-dose vitamin A supplement, if they had not received one in the previous 3 months; antihelminthic treatment; ambulatory treatment for malaria or other acute infections, as required; and 1 of 4 dietary supplements. Dietary supplements provided were: 1) ready-to-use lipid-based supplementary food (RUSF providing 92g per day, supplied by Nutriset SAS); 2) corn-soy blend "plus plus", a specifically formulated refined micronutrient-fortified cereal-legume-milk blend for children with MAM (CSB++ supplied by the World Food Programme); 3) a less-refined micronutrient-fortified cereal-legume blend (Misola supplied by Misola, Mali); 4) a less-refined cereal-legume milled flour mix (LMF), mixed with vitamin A-fortified vegetable oil, and a multiple micronutrient powder (MNP supplied by DSM). Misola and LMF were produced in Mali. The daily ration of each dietary supplement provided 500 kcal. More details on the dietary supplements are provided by Ackatia-Armah et al. (4).

At enrollment, children's weight, mid-upper arm circumference (MUAC), height and socio-economic and demographic characteristics were assessed. Follow up visits were scheduled after 1, 2, 3, 4, 6, 8, 10 and 12 weeks and children were reexamined, adherence to the treatment protocol was assessed and weight, MUAC and height were measured. Hemoglobin concentration was measured in capillary blood at baseline and after 12 weeks.

Results and Conclusions:

Among the 1264 enrolled children aged 6-35 months of age, 969 met the current WHO definition for MAM, 701 met the criteria used by the national program to identify children with MAM and 465 met both criteria. At enrollment, the children's mean WLZ was -2.24 ± 0.72, mean MUAC was 12.0 ± 0.5 cm and mean length-for-age z-score (LAZ) was -2.34 ± 1.35. There were no differences between groups, except for MUAC which was slightly lower in the RUSF group. Among all children enrolled, 93.3% of children (n=1175) completed the full 12 weeks of treatment and scheduled follow up visits. The decline in participation did not differ between intervention groups. Ninety-two percent of children returned packages during the follow up visits. The disappearance rate, which was used as a proxy for product consumption, was significantly greater for the RUSF group than for the other 3 groups ($P<0.001$).

Over the 12-week period, all children showed an increase in mean weight and length and adequate recovery for WLZ and MUAC, but not LAZ. When comparing the mean change in anthropometric measures, results were adjusted for cluster, household food security status, initial anthropometric value and month of enrollment. Mean change in weight was significantly greater in the RUSF group compared to the Misola and LMF group. However, RUSF was not significantly different from CSB++. The mean change in weight of the CSB++ group was significantly different only from the LMF group. The mean length gain was 2.8 ± 1.3 cm over 12 weeks and was significantly greater in the RUSF and CSB++ groups compared with the LMF group. Among all children enrolled, 4 children developed severe acute malnutrition (SAM) with complications and were hospitalized and 103 developed SAM without complications, but this did not differ between groups.

The RUSF group showed the highest rate of sustained recovery from MAM (73.1% for RUSF, 61.2%

for CSB++, 61.1% for Misola and 57.9% for LMF, p<0.0001), which was defined as WLZ>-2 and MUAC>12.5 cm for at least 2 follow up visits. The median time required for sustained recovery ranged from 5.9 to 9.7 weeks and was shortest in the RUSF group and significantly longer in the Misola and LMF groups (p<0.0001). Anemia prevalence was approximately 90% at enrollment, and remained high (>81%) in all four groups at the end of the study with no significant differences between groups. Children in all groups increased mean hemoglobin concentrations, but it was significantly higher in the RUSF group compared with the Misola group (p=0.015).

Program and Policy Implications:
This community-based intervention trial found that children in all 4 treatment groups increased their average body weight, MUAC and length during the 12 weeks of observation. Children who received RUSF gained significantly more weight, MUAC and length than children who received the locally produced cereal-legume mixtures (Misola or LMF). The results of children in the CSB++ group were intermediate between the RUSF group and the two cereal-legume groups. Three previous studies compared lipid-based ready-to-use therapeutic food (RUTF) or RUSF with conventional CSB and also found a slightly increased weight gain and recovery rate (7-9). In contrast, a recent study in Malawi (10) found no difference in recovery rate between children who received two different types of RUSF and the same CSB++ used in the present study.

The programmatic implications of the study by Ackatia-Armah *et al.* (4) are uncertain. Although children who receive RUSF were more likely to recover within the 12 weeks of observation, it is unclear whether this difference is worth the additional cost of the product compared with cereal-based products. The costs for food supplements per treatment considering the median recovery time and transportation costs was 15.69 USD for RUSF, 10.01 USD for CSB++, 12.79 USD for Misola and 11.54 USD for LMF. Thus, even with the shorter recovery period, the cost per child recovered were higher for RUSF.

NNA Editor's Comments*:
The effectiveness study by Ackatia-Armah *et al.* (4) provides relevant information on different supplementary products commonly used in the treatment of children with MAM. As the authors point out, the study does not, however, clarify which product would be most suitable in each setting and program managers of community-based management of acute malnutrition need to decide the most promising and suitable treatment regimen in view of current recovery rates and local availability and prices of dietary supplements.

*These comments have been added by the editorial team and are not part of the cited publication.

References:

1. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet 2013;382(9890):427-51. doi: 10.1016/S0140-6736(13)60937-X.
2. Collins S, Dent N, Binns P, Bahwere P, Sadler K, Hallam A. Management of severe acute

malnutrition in children. Lancet 2006;368(9551):1992-2000. doi: 10.1016/S0140-6736(06)69443-9.
3. Brown KH, Nyirandutiye DH, Jungjohann S. Management of children with acute malnutrition in resource-poor settings. Nature reviews 2009;5(11):597-603.
4. Ackatia-Armah R, McDonald C, Doumbia S, Erhardt J, Hamer D, Brown K. Malian children with moderate acute malnutrition who are treated with lipid-based dietary supplements have greater weight gains and recovery rates than those treated with locally produced cereal-legume products: a community-based, cluster-randomized trial Am J Clin Nutr 2015:ajcn.069807; First published online January 7, 2015.
5. World Health Organization. WHO 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.
6. Mali. Protocole national de la prise en charge de la malnutrition aigue. Bamako: Ministère de la Santé, Republique du Mali, 2007.
7. Matilsky DK, Maleta K, Castleman T, Manary MJ. Supplementary feeding with fortified spreads results in higher recovery rates than with a corn/soy blend in moderately wasted children. J Nutr 2009;139(4):773-8. doi: 10.3945/jn.108.104018.
8. Nackers F, Broillet F, Oumarou D, et al. Effectiveness of ready-to-use therapeutic food compared to a corn/soy-blend-based pre-mix for the treatment of childhood moderate acute malnutrition in Niger. J Trop Pediatr 2010;56(6):407-13. doi: 10.1093/tropej/fmq019.
9. Karakochuk C, van den Briel T, Stephens D, Zlotkin S. Treatment of moderate acute malnutrition with ready-to-use supplementary food results in higher overall recovery rates compared with a corn-soya blend in children in southern Ethiopia: an operations research trial. Am J Clin Nutr 2012;96(4):911-6. doi: 10.3945/ajcn.111.029744.
10. LaGrone LN, Trehan I, Meuli GJ, et al. A novel fortified blended flour, corn-soy blend "plus-plus," is not inferior to lipid-based ready-to-use supplementary foods for the treatment of moderate acute malnutrition in Malawian children. Am J Clin Nutr 2012;95(1):212-9. doi: 10.3945/ajcn.111.022525.

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