

## **Micronutrient fortification to improve growth and health of maternally HIV-unexposed and exposed Zambian infants: a randomised, controlled trial**

The Chilenje Infant Growth, Nutrition, and Infection (CIGNIS) Study Team. PLoS One 2010; 5: 1-12.

### **Introduction**

In this issue of Nutrition News for Africa (NNA) we report on the results of a community-based randomized intervention trial, which was designed to assess the effects of fortifying a local complementary food mixture with multiple micronutrients (MMN) on young Zambian children's stunting prevalence, growth velocity and incidence of severe infections requiring hospitalization. The study was conducted in the context of a high endemic prevalence of maternal HIV infection in Lusaka, Zambia; and the results have important implications for infant feeding in the context of HIV.

### **Methods**

The study compared the effects of providing a locally [processed food mixture, with or without MMN fortification, among young children of HIV-infected and HIV-non-infected women during the period 6-18 months post-partum. The conventional food mixture was fortified with small amounts of vitamin A, thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12, iron and zinc to simulate the amounts of these MNs proposed for a national maize mass fortification program. By contrast, the fortified mixture was designed to meet the MN needs of breast fed children 9-11 months of age receiving low amounts of breast milk, and it contained the following additional amounts of the respective nutrients per kg flour: vitamin A, 5.85 mg RE; vitamin C, 2.0 g; vitamin D, 0.1 mg; thiamin, 9 mg; riboflavin, 9.6 mg; niacin, 127 mg; pyridoxine, 7 mg; folate, 1.6 mg; vitamin B12, 6.5 µg; pantothenic acid, 40.3 mg; magnesium, 943 mg; iron, 243.5 mg; zinc, 190.2 mg; copper, 3.2 mg; manganese, 12 mg; selenium, 0.2 mg; calcium, 6.8 g; and phosphorous, 5.3 g. The food mixture was distributed as a composite flour prepared from maize, beans, groundnuts and bambara nuts, with a total of 16% of energy as protein. Families were provided with 4 kg flour/month, and were instructed to add 250 ml water to each 30 g portion of the dry mixture to achieve a final energy density of 0.76 kcal/g.

Information was collected on household socio-economic status (SES) and maternal HIV status at baseline. The children's consumption of the assigned food product, body weight and morbidity history was assessed monthly, and child length was measured quarterly. Indicators of iron status (hemoglobin, Hb; serum ferritin, sF; and serum transferrin receptors, sTfR) were measured at baseline and 18 months of age, and child HIV status was also assessed at 18 months.

### **Results and Conclusions**

A total of 743 infants were enrolled in the study, and 576 (78%) completed the examinations at 18 months. 91% of the mothers had been tested for HIV status antenatally; of those tested, 23% were HIV-positive. The study groups were similar at baseline with regard to household SES, maternal HIV status, maternal and child nutritional status indicators, and child breastfeeding practices. The children reportedly consumed ~19 g flour/d (dry weight) at 7 months of age and ~25 g flour/d at 11-17 months; these amounts did not differ by study group.

Children of HIV-positive mothers were ~80% more likely to be stunted at 18 months (29% versus 18%, respectively,  $p < 0.03$ ). Overall, there were no significant differences in the prevalence of stunting or mean length-

for-age Z score (LAZ) at 18 months by treatment group, and these results did not change when they were stratified by maternal HIV status. However, among the subset of children of HIV-positive mothers who were breast fed <6 months, there was a significantly lower prevalence of stunting at 18 months and higher (albeit negative) mean LAZ among those who received the MMN-fortified porridge. Children who received the MMN-fortified porridge had a greater increase in Hb and sF, and a lower increase in sTfR than those who received the control diet, regardless of maternal HIV status. There were no differences in the number of child deaths or hospital referrals by treatment group, although children who received the MMN-fortified porridge tended to have fewer hospital referrals for malaria and more for pneumonia than those in the control group.

The authors concluded that provision of MMN-rich fortified flour from 6-18 months increased children's iron status and Hb concentration and enhanced linear among the subset of children of HIV-positive mothers who stopped breast feeding before 6 months.

### **Program and Policy Implications**

The prevalence of stunting at 18 months of age (18-29%) was moderately elevated among these urban Zambian children, especially among the children of HIV-positive mothers. Notably, the prevalence of stunting in both subgroups combined was only about half of that previously observed in children of the same communities prior to the start of the study. This suggests that provision of the complementary food and/or the specialized attention offered by the research project reduced stunting prevalence, regardless of whether or not additional MNs were included in the food. However, the inclusion of additional MNs in the complementary food enhanced iron status overall, and increased growth of children of HIV-positive women who stopped breast feeding prior to six months post-partum.

Recently revised feeding guidelines for non-HIV-infected infants of HIV-positive mothers indicate that the mothers or infants should receive anti-retroviral therapy and the infants should be exclusively breast fed for six months and breast feeding should be continued until at least 12 months (WHO, 2010). Complementary foods should be introduced at six months, and breast feeding should be discontinued only if acceptable, feasible, affordable, sustainable and safe (AFASS) feeding options can be provided. However, uncertainty exists about what constitutes AFASS feeding options, and the present study suggests that home-available or processed complementary foods should contain a full complement of MNs to ensure adequate MN status and physical growth of infants of HIV-positive mothers.

### **NNA Editors' comments\***

This was a well designed intervention trial carried out using a processed complementary food in an urban population with a moderately elevated prevalence of stunting. Additional studies are needed in rural areas with a higher prevalence of stunting, and in populations using home-available (rather than processed) complementary foods provided with or without point-of-use fortification (such as with MN powders or lipid-based MN supplements) to determine whether similar conclusions would be appropriate in those settings and under those study conditions.

### **References**

World Health Organization. Guidelines on HIV and infant feeding 2010. Principles and recommendations for infant feeding in the context of HIV and a summary of evidence. WHO, Geneva, 2010

\* Note that the Editors' comments and discussion of program and policy implications have been added by the editorial team and are not part of the cited publication.



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