

Maize porridge enriched with a micronutrient powder containing low-dose iron as NaFeEDTA, but not amaranth grain flour, reduces anemia and iron deficiency in Kenyan preschool children.

Macharia-Mutie CW, Moretti D, Van den Briel N, Omusundi AM, Mwangi AM, Kok FJ, Zimmermann MB, Brouwer ID. *J Nutrition* 142: 1756-1763, 2012.

Introduction

Interventions to increase iron intake through iron supplementation can have both beneficial and adverse outcomes. On the one hand, iron supplementation improves cognitive performance and immune function of iron deficient (ID) individuals or those with iron deficiency anemia (IDA). On the other hand, there is growing evidence that iron supplementation of non-ID persons can increase their risk and/or severity of infections, including malaria, diarrhea and possibly others (Ianotti, 2006). For these reasons, the World Health Organization has recommended that iron supplements should be provided only to individuals known to be ID, and measures to control malaria and other infections should be delivered simultaneously (WHO, 2007). This recommendation has also been extended to other forms of relatively high dose iron supplements, including micronutrient powders (MNP), under the assumption that it is large-dose, bolus administration of iron that imposes the greatest risk of adverse effects.

The dilemma for public health programs is that reliable, low-cost methods to screen individual children for iron deficiency are not yet available. However, it has been assumed that lower doses of iron, such as the amount delivered in fortified food, are likely to be safe. Therefore, the WHO has indicated that it is acceptable to provide lower doses of iron, such as the amount included in fortified food, without prior screening of iron status. The authors of the study selected for this month's NNA assessed the efficacy of two different (presumably safe) strategies for delivering food-based, supplemental iron to young Kenyan children consuming a maize-based porridge. Specifically, 279 children 12-59 months of age were randomly assigned to receive one of the following meals under supervision each day during a 16-week feeding period: 1) conventional (non-fermented) maize porridge with a phytate:iron ratio of 5:1; 2) the same porridge with added MNP containing low-dose NaFeEDTA (2.5 mg iron per serving), which is a relatively highly absorbable form of iron when consumed with high-phytate foods, along with 15 other micronutrients; or 3) a porridge composed of 70% unrefined amaranth flour (a rich source of iron, containing ~19 mg additional iron/meal) and 30% maize with a phytate:iron ratio of 3:1. Children who had not been dewormed in the three months prior to the study were given anti-helminthic treatment (Albendazole). Hemoglobin (Hb), plasma ferritin (pF), and soluble transferrin receptors (TfR) were measured at baseline and at the end of the intervention period.

Results and conclusions

Children in the three study groups were similar at baseline. Approximately 38% of the children were anemic initially (Hb<110 g/L), 31% were ID (pF<12 µg/L or TfR>8.3 mg/L), and 22% had IDA (i.e., they had both anemia and iron deficiency). Following the intervention, the prevalence of anemia, iron deficiency and IDA decreased in all three groups, possibly because of the anti-helminthic treatment that was given to the children in all groups before the study and the additional iron provided by the porridges. Relative to the maize porridge (control) group, children in the group that received MNP had a slightly greater increment in Hb and pF, and a slightly greater reduction in TfR. Likewise, the prevalence of anemia, iron deficiency and IDA was reduced more in the MNP group than in the control group. The

changes in these outcomes did not differ for the children in the amaranth porridge group compared with the control group. Interestingly, among children who were ID at baseline, those in the MNP group had a significant increase in Hb relative to the control group, but not pF. By contrast, among children who were not ID at baseline, those in the MNP group had a significant increase in pF relative to the control group, but not Hb. Children in the amaranth group did not respond differently from the control group, regardless of their initial iron status.

Program and Policy Implications

These results indicate that children can respond to 16 weeks of low-dose iron supplementation (2.5 mg iron/daily dose) by increasing their Hb and/or iron stores (depending on their initial iron status) when the supplemental iron is provided as NaFeEDTA in a multiple micronutrient MNP. Because of the study design, which did not include a comparison group that received low-dose iron in the same chemical form usually incorporated in MNP (i.e., micro-encapsulated ferrous fumarate), it is not possible to determine whether it was the form of iron (i.e., NaFeEDTA), the other micronutrients in the MNP, or the combination of these factors that may have been responsible for the positive results of the present study. By contrast with the increased iron status observed among children who received MNP, there was no significant difference in iron status indicators among children in the amaranth group compared with the control group during the 16-week period of observation, even though the children who consumed the amaranth-maize porridge received more iron than those in the MNP group. This may be due to the presence of phytate and/or other factors in unrefined amaranth grain that inhibit iron absorption. It is conceivable that a longer period of supplementation with high-iron grains may have yielded more positive results.

NNA Editors' comments*

These results suggest that MNPs containing a lower dose of iron than most of the currently used products can have a positive impact on iron status indicators. However, the present study was conducted in a population that had a fairly low prevalence of iron deficiency and IDA initially, compared with many African countries; so, it is not certain whether the same results would occur in populations where iron deficiency is more severe.

Although the authors initially justified the present study because of the need for low-dose, food-based forms of iron supplementation to reduce the prevalence of ID and IDA without imposing any risk of adverse effects of iron supplements among iron-replete individuals, the study design and sample size did not allow for assessment of adverse effects of the supplements. Thus, additional studies are still needed to address this concern. The current consensus of international agencies is that the proven benefits of MNP and similar products for reducing iron deficiency and IDA outweigh the possible risk of increased infections (WHO, 2011), although more research is needed to confirm this assumption as programs are being implemented.

References

1. Iannotti LL, Tielsch JM, Black MM, Black RE. Iron supplementation in early childhood: health benefits and risks. *Am J Clin Nutr* 84:1261-76, 2006.
2. World Health Organization. Conclusions and recommendations of the WHO consultation on prevention and control of iron deficiency in infants and young children in malaria endemic areas. *Food Nutr Bull* 28: S621-7, 2007.

3. World Health Organization. Guideline: Use of multiple micronutrient powders for home fortification of foods consumed by infants and children 6-23 months of age. WHO, Geneva. 2011.

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

Announcements and documents received this month:

1. The World Health Organization has published a new report on, "Priorities in the Assessment of Vitamin A and Iron Status in Populations." (Document available at: http://www.who.int/nutrition/publications/micronutrients/meetingreport_assessment_vitAandIron_status/en/index.html).
2. The US Centers for Disease Control has produced a new "Survey Toolkit for Nutritional Assessment," which was developed by CDC's International Micronutrient Malnutrition Prevention and Control Program (IMMPaCt) to provide epidemiological support to countries to assess and monitor the elimination of micronutrient malnutrition. These materials are available online at: <http://www.micronutrient.org/nutritiontoolkit/about.htm>
3. UNICEF has issued a new progress report entitled, "Committing to Child Survival: A Promise Renewed," which highlights some of the key nutrition strategies for reducing child mortality (See: <http://www.apromiserenewed.org/index.html>).
4. New resources for nutrition programs are available from the USAID-supported Food and Nutrition Technical Assistance Project (FANTA III). One example is a new BMI and BMI-for-Age Look-Up Tables for Children and Adolescents 5–18 Years of Age and BMI Look-Up Tables for Non-Pregnant, Non-Lactating Adults ≥ 19 Years of Age (2012), which are available in English, French, Spanish, and Portuguese. The FANTA III catalogue of publications and related resources can be found on the FANTA web site (www.fantaproject.org).

Nutrition News for Africa is a monthly electronic newsletter whose aim is to disseminate state-of-the-art research and policy papers to scientists, program planners, policy makers, and opinion leaders working in the field of public health nutrition in Africa. The newsletter is prepared as a collaborative effort of Helen Keller International (HKI) and the Program in International and Community Nutrition (PICN) of the University of California, Davis. HKI regional staff members and students and faculty members of the PICN identify and summarize relevant articles and policy statements from the scientific literature and international agency publications. We also encourage members of this network to suggest possible documents of interest and to provide feedback on the articles selected.

To subscribe, please click "[Subscribe here](#)"



Editorial Office:

Helen Keller International
Regional Office for Africa
11 Nord Foire Azur
PO Box 29.898
Dakar
Senegal