Nutrition News for Africa

Abstract - June 15, 2007

An article entitled "Efficacy of iron-fortified whole maize flour on iron status of schoolchildren in Kenya : a randomized controlled trial" was published by Andang'o et al. in The Lancet 2007;369:1799-806.

Introduction

Fortification of staple cereal flours could be a cost-effective, sustainable way to improve iron status in developing countries. In sub-Saharan Africa, Nigeria and South Africa have made flour fortification with iron mandatory, and countries such as Cape Verde , Côte d'Ivoire , Guinea , Ghana , and Kenya are planning flour-fortification programs. An authoritative review by Hurrel and colleagues concluded that electrolytic iron is the only form of elemental iron that can be recommended as an iron fortificant in cereal fl ours. However, its bioavailability is questionable because it can bind to phytates in cereals, and in developing countries the typical diet includes whole grain flour, which has a much higher phytate content than low-extraction white flour. In such cases, NaFeEDTA might be a better fortificant. This study aimed to assess the effect of consumption of whole maize flour fortified with high and low doses of NaFeEDTA, and with electrolytic iron, on children.

Methods

The study was based at four schools in Marafa, in Malindi district of Kenya. Fieldwork took place between May and November 2004. Children who were enrolled in nursery and the first year of primary school were selected for the study. Inclusion criteria included age 3–8 years. The fortification vehicle consisted of *uji*, a porridge of maize flour cooked in water and sweetened with sugar. The target daily intake was 700 mL *uji* (containing 100 g flour) for children aged 3–5 years and 1000 mL *uji*(containing 150 g flour) for children aged 6–8 years. The children were divided into four groups. The porridge for one group was made from unfortified whole maize flour; for the other three groups it was fortified with either high-dose NaFeEDTA (56 mg/kg), low-dose NaFeEDTA (28 mg/kg), or electrolytic iron (56 mg/kg). The estimate was that the addition of iron at a low dose of 28 mg/kg fl our and a high dose of 56 mg/kg flour would provide 20% and 40%, respectively, of the daily iron requirements for children aged 3–5 years and 18% and 36%, respectively, of the requirements for children aged 6–8 years. Flour types could not be visually distinguished, even in the cooked product. Children consumed*uji* in graduated mugs, at school, 5 days a week for 5 months. The primary outcome was iron-deficiency anemia. Secondary outcomes were iron deficiency anemia; and difference in hemoglobin concentration and plasma concentrations of ferritin and soluble transferrin receptor in the two treatment groups.

Results

A total of 505 children completed the study. At baseline, hemoglobin concentrations were highest in the placebo group. Almost half the children (49%) had current or recent malaria infection. The prevalence of iron-deficiency anemia in children who consumed flour fortified with high-dose NaFeEDTA was almost 90% lower than in controls. Iron-deficiency anemia did not change in the group assigned flour fortified with electrolytic iron.

Discussion

Consumption of whole maize flour fortified with high-dose NaFeEDTA reduced iron-deficiency anemia, iron deficiency, and anemia in Kenyan children. The study findings show that low-dose NaFeEDTA conferred protection against iron deficiency, but not against iron-deficiency anemia or anemia. Electrolytic iron did not confer protection against any of these disorders. Consumption of both high-dose and low-dose NaFeEDTA improved the iron status of children. Treatment effects were most pronounced in children who had iron deficiency and iron-deficiency anemia at baseline . Malaria could have affected some of the study findings. The authors conclude that fortification of whole maize flour with electrolytic iron does not improve iron status, at least in the concentration and form used in this study. The authors think that continued intervention beyond 5 months would eventually have led to an even greater discrepancy between the treatment effects associated with NaFeEDTA and electrolytic iron. The authors recommend that the safety of NaFeEDTA at the doses used in this trial be confirmed.