

ABSTRACT

In Sri Lanka, with regard to micronutrient deficiency among adolescents, only iron, iodine and vitamin A deficiencies have been identified and treated so far but studies elsewhere have shown that zinc and folate deficiencies could also be a matter of public health concern. Generally, intervention strategies to combat multiple micronutrient deficiencies include supplementation, fortification and dietary modification/ diversification.

This study was conducted to determine whether micronutrient deficiencies exist among adolescents and if so to ascertain the dietary intake of such nutrients in a selected adolescent population in Galle, Sri Lanka. Recognizing that micronutrient supplements can only help in the short-term, and long-term intervention should be based on food, we evaluated the Sri Lankan dietary staple, rice, as a potential vehicle for micronutrient fortification.

Of 945 adolescents (12-16 years) assessed, stunting, wasting and underweight were found in 18.4%, 31.2% and 36.4% respectively. Dietary intake of micronutrients (iron, zinc and folate) and their body storage levels were studied. Anaemia (defined as haemoglobin <120g/L; 54.8%), iron deficiency anaemia (defined as anaemia with serum ferritin <30 μ g/L; 33.9%), and the deficiencies of zinc (defined as serum zinc <9.95 μ mol/L; 54.6%) and folate (defined as serum folate <6.8nmol/L; 53.3%) were highly prevalent, and occurred concomitantly. For the first time in Sri Lanka a combined iron and zinc supplementation trial was carried out and the interaction between these two micronutrients were studied by a placebo-controlled trial. Both iron alone and combined supplementation were effective in reducing the degree of anaemia. Zinc deficiency improved in both the zinc only and combined supplementation groups and no interaction was observed.

A survey on the suitability of rice flour for micronutrient fortification showed that 39.3% buy rice flour from the market and 54.4% buy ready made food items based on rice flour. Based on this, rice flour was fortified with iron in the form of ferrous sulfate (FeSO₄); zinc in the form of zinc oxide (ZnO) at the fortificant level of 60mg per kilogram of rice flour. Folic acid was mixed to obtain 2 mg per kilogram whereas disodiumEDTA was added in 1:1 molar ratio with elemental iron as an enhancer to iron and zinc availability. Sensory characteristics (odour, acceptance, texture and taste) of meals made out of this flour were tested with a sample of consumers which confirmed that people accepted the fortified elements in rice flour.

The absorption of iron and zinc from fortified rice flour was studied using ⁵⁷Fe and ⁵⁸Fe stable isotopes for iron and ⁶⁷Zn and ⁷⁰Zn stable isotopes for zinc in a sample of children of 7-10 years who were randomized into four groups based on the type of fortification. The highest fractional absorption of iron was seen with FeSO₄+disodiumEDTA and ZnO

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(6.1%±4.4) and the lowest with FeSO₄ and ZnO (1.9%±1.1). The group who took FeSO₄ only absorbed 2.5%±1.5 of iron from the meal whereas the group who took FeSO₄ with disodiumEDTA had 3.5%±2.0 iron absorption. Fractional absorption of zinc was 13.5% ± 6.0 in the group who took FeSO₄+disodiumEDTA and with ZnO and 8.8%±2.0 in FeSO₄ and ZnO group. These results demonstrated a benefit in adding EDTA to improve both iron and zinc absorption.

The efficacy of this fortification and possible interaction between iron and zinc was assessed in same groups by giving 75 g of fortified rice flour according to their group allocation for a period of four weeks. This study showed that regular consumption of micronutrient-fortified rice flour for four weeks led to improvements in weight, height and status of iron, zinc and folate levels. We conclude that fortified rice flour can be used effectively to ameliorate micronutrient malnutrition in Sri Lanka.