Enrichment of iron and folic acid: The real need and the dangers of this initiative

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The article "Considerations on the food fortification policy in Brazil"[1] published in this issue of the *Revista Brasileira de Hematologia e Hemoterapia* (*Journal of Hematology and Hemotherapy*) questions whether the mandate to enrich food will or will not worsen the health of individuals that suffer from iron excess-related conditions. Another aspect questioned by this article is whether there is, or there is no danger of an iron and folic acid enriched diet triggering irreversible neurological lesions in vitamin B2-deficient individuals who do not present with anemia.

An inadequate folate (folic acid) intake results in megaloblastic anemia and neural tube defects. Neural tube defects are fatal, although preventable if a woman consumes enough folic acid before getting pregnant and at the beginning of pregnancy.

Iron deficiency, which mainly results from low bioavailability of iron and insufficient iron in the diet to meet the individual's nutritional needs, causes anemia; this is a global public health issue affecting populations of all social classes and is one of the major factors related to low weight at birth, cognitive deficits in children and maternal mortality.

According to World Health Organization (WHO) data, it is estimated that anemia affects 1620 million people worldwide, that is, 24.8% of the population. The highest prevalence is among pre-school children (47.4%), followed by pregnant women (41.8%) and childbearing-age woman (30.2%).[2] Neural tube defects, on the other hand, affect more than 300,000 children a year, globally.[3]

Among the strategies advocated by the WHO to control iron deficiency anemia, and recommended to ensure a balanced, healthy diet, fortification of food is recognized as the best approach.[4] Additionally this has the best cost effective ratio over medium to long terms.

Vellozo & Fisberg[5] believe that the efficacy of preventing anemia using enriched food has proven to be adequate in disease-prevention programs in several countries; however, they highlight that most of the studies are local and age groups are restricted, thus limiting the representativeness of the sample.

With the aim of increasing the availability of iron and folic acid-enriched foods to the Brazilian population, and thus reducing the prevalence of anemia and neural tube defects in Brazil, the Ministry of Health, as of June 18 2004, made the addition of iron (30% daily recommended intake or 4.2 mg/100 g) and folic acid (70% daily recommended intake or 150 µg/100g) to maize and wheat flours mandatory.[6]

Few studies evaluating the efficacy or the effectiveness of iron-enriched foods have been published in Brazil. Some review studies make it clear that there are few data supporting the hypothesis that increasing iron intake with some fortified foods (mass or targeted fortification) improves iron nutritional status. Therefore, although desired, the efficacy and effectiveness of iron-enriched foods on the prevalence of anemia in the population is yet to be shown.

Because fortification programs reach all population groups, there is the concern that individuals who already consume iron within the recommended amounts and that have full body storages may consume more mineral than that recommended in the Dietary Reference Intake leading to side effects. There are few publications addressing moderate overloads of this mineral in healthy individuals.

The maize and wheat flour iron fortification program must monitor the Brazilian population as a whole and not only those groups that are susceptible to iron-deficiency anemia. Some studies conducted in European countries, in populations without hereditary hemochromatosis, showed a positive correlation between the high body iron storage and some types of cancer, mainly in individuals aged 45 and above, showing a long-term deleterious effect of an excessive iron intake. Brazil offers a contrast where, on one hand, there is high prevalence of iron deficiency anemia and, on the other hand, there are population groups that consume large amounts of foods with high iron availability such as red meat. Nevertheless, we still do not have data on the prevalence of hereditary hemochromatosis in the Brazilian population. Therefore, it is necessary to screen the

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population. Additionally, there are no national data on the modification of iron status and the prevalence of neonatal malformations after iron and folic acid fortification.

Enrichment with folic acid is an incontestable intervention in primary prevention, with the positive impact in the prevention of neural tube defects already proven in several countries. This public health intervention is efficacious and safe. However, as with iron, there are only a few studies evaluating its efficacy and effectiveness, since the most prevalent at risk population, under 3-year-old children, benefit more with the iron in infant formulas.

Folic acid may prevent 50%-70% of the neural tube defects that are not caused by severe congenital defects such as malformation of the baby's spinal cord and brain. Women need folic acid before becoming pregnant and in the first stages of pregnancy in order to reduce the occurrence of disabling or fatal congenital defects.[3]

Despite the decrease in the numbers of babies born with neural tube defects, some research questions whether or not the overconsumption of folic acid leads to undesirable consequences such as the development or evolution of cancer or irreversible neurological lesions in vitamin B12-deficient patients without anemia.

The Medical Institutes of the National Science Academy both in the USA and in Canada, the European Union Scientific Committee on Food (SCF), and the Supreme Council of Public Hygiene of France concluded that the maximum daily folic acid intake is 1000 micrograms.[7] The level of folic acid added to wheat flours (150 µg/100 g) will not likely lead to a folate intake above the tolerable levels of 1000 µg per day.

A daily intake higher than 1000 micrograms is excessive in the case of medical supplementation but not for the consumption of enriched foods. There is no evidence of side effects from the intake of folic acid through enriched foods at the levels recommended to prevent damage such as for neural tube deficiency and in vitamin B12 deficiency without anemia. Folate has been associated with protection against some types of cancer, but further investigations are necessary to verify whether people who take high supplement doses, present higher risks of developing cancer.

Children of between 1 and 9 years old should not ingest more than 40 mg a day of iron, whereas for those aged 19 to 70 years old the intake should not exceed 45 mg of iron a day. Regarding folic acid, children from 1 to 3 years old should not consume more than 300 mcg a day and for those with ages ranging from 19 to 70 years old the maximum is 1000 mcg a day.

The conclusion is that the intake of folic acid from normal sources, even taking into account "mandatory fortification", is not associated with severe damage, including carcinogenic effects.[8] The same is true for iron. However there is a need for population studies to identify the prevalence of iron overload diseases in Brazil.

Even with the very few published studies, the efficiency of fortification to correct, eradicate, or prevent specific diseases caused by nutrient deficiencies is highly recognized. Nevertheless, there is the need to pursue new, more efficient, and more adequate ways of fortification. This subject still needs to be discussed in academic, governmental, and institutional settings.

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