Public Health Impact of Fortifying Wheat Flour with Iron

Iron Deficiency and Public Health
Iron deficiency is the most common micronutrient deficiency in the world [1]. It occurs when an individual has no usable iron stores remaining [2]. Iron deficiency during pregnancy is linked to an increased risk of hemorrhage, sepsis, maternal mortality, iron-deficiency anemia, perinatal mortality, and low birth weight [2]. Iron deficiency can cause impairment of physical and cognitive development in children, fatigue, reduced school or work performance and reduced immune status and ability to fight infections [1]. Reductions of cognitive and work performance of substantial portions of the population can have economic consequences for entire nations [3].

Why Fortify Flour with Iron?
Fortifying wheat flour can be a cost-effective way to reduce iron deficiency. It increases iron intake [4] without requiring consumers to modify behaviors. Wheat flour-based foods are widely consumed around the world [5], and the technology for flour fortification is well-established. The recurring cost of adding iron to wheat flour during milling is low at USD 0.62/metric ton of flour when ferrous sulfate is added as the iron compound to USD 2.00/metric ton when NaFeEDTA is added to flour [6].

Effectiveness of Flour Fortification Programs around the World
Adding iron to flour is an effective tool to improve the iron status of populations. In many countries, change in iron status, as reflected by serum ferritin, was measured before and after implementation of iron fortification of wheat flour (alone, or in combination with maize flour). Eleven sub-groups were analyzed (Figure) and nine reported an increase in serum ferritin levels after iron fortification began. The increase ranged from 3.8 mcg/L in Mongolian children [7] to 25 mcg/L in Fijian women [8]. The two studies that showed a decrease (from 2.10-5.50 mcg/L) in serum ferritin after fortification began were conducted in children 2-15 years of age in Uzbekistan [7] and in South African women [9]. The preponderance of the evidence from effectiveness trials is that iron fortification increases serum ferritin for all age groups and genders studied. All the studies had several limitations such as a lack of information on the coverage and intake of fortified flour.

References

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Figure. Mean or median serum ferritin levels (micrograms/liter) reported in studies that examined children, women of childbearing age, and men before and after implementation of iron fortification of wheat flour (alone or in combination with maize flour).

From left, the data were collected in the following countries:
- Tazhibayev 2008 [7]: Azerbaijan, Kazakhstan, Mongolia, Tajikistan, Uzbekistan
- Layrisse 2002 [10]: Venezuela
- Modjadji 2007 [9]: South Africa
- National food and Nutrition Centre 2012 [8]: Fiji
- Sadighi 2008 [11]: Iran
- Pouraram 2012 [12]: Iran


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